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NUMS RAWALPINDI

NUMS 2026 Official Solved Paper

Official Annual Full-Length Practice Examination (FLP) · Complete Solved Paper

📍 Official Admitting Board: National University of Medical Sciences 📄 Archive Code: BEAMBE-FLP-NUMS-2026 ⌚ Duration: 150 Minutes (2h 30m)

150

TOTAL QUESTIONS

150m

OFFICIAL DURATION

+1 / 0.00

ZERO NEGATIVE MARKING

150

MAXIMUM MARKS

📄 EXAMINATION BLUEPRINT & SUBJECT WEIGHTAGE

Biology**55 MCQs**

36.7% weight

Chemistry**40 MCQs**

26.7% weight

Physics**40 MCQs**

26.7% weight

English**15 MCQs**

10.0% weight

BIO SECTION: BIOLOGY

Questions 1 to 55 (55 MCQs)

Q1. BIO

Identify the type of glycoprotein, responsible for cell fusion process in HIV cycle:

- (A) gp 40
- (B) gp 41
- (C) gp 120
- (D) gp 121

Q2. BIO

Which of the following enzymes converts mRNA to complementary DNA (cDNA)?

- (A) Integrase
- (B) Reverse transcriptase
- (C) Protease
- (D) DNAase

Q3. BIO

Edward Jenner used material removed from the lesion on the hand of milkmaid and vaccinated a boy suffering from which of the following disease?

- (A) Small pox
- (B) Chicken pox
- (C) Cow pox
- (D) Measles

Q4. BIO

Adenovirus are classified as:

- (A) Helical capsid
- (B) Polyhedral capsid
- (C) Enveloped virus
- (D) Coupler capsid

Q5. BIO

If a person is doing strenuous exercise, how many ATPs are produced by cellular respiration?

- (A) 2 ATPs
- (B) 3 ATPs
- (C) 4 ATPs
- (D) 6 ATPs

Q6. BIO

The end product of non-cyclic electron pathway is:

- (A) ATP and NADPH
- (B) ATP
- (C) FADH₂
- (D) NAOPH₂

Q7. BIO

Pyruvic acid is converted into acetaldehyde through which step?

- (A) Decarboxylation
- (B) Oxidation
- (C) Addition of coenzyme A
- (D) Reduction

Q8. BIO

Choose the correct sequence of electron carrier in respiratory ETC:

- (A) Coenzyme Q → cytochrome a → cytochrome a₃ → cytochrome b → cytochrome c
- (B) Coenzyme Q → cytochrome b → cytochrome c → cytochrome a → cytochrome a₃
- (C) cytochrome a → cytochrome a₃ → cytochrome b → cytochrome c → coenzyme Q
- (D) Cytochrome b → cytochrome c → coenzyme Q → cytochrome a → cytochrome a₃

Q9. BIO

Pumping movement of protons occur from:

- (A) Outer membrane and inner membrane
- (B) Matrix of mitochondria and mitochondrial intermembrane space
- (C) Inner membrane and cisternae
- (D) Inner membrane and intermembrane space

Q10. BIO

Net product of Krebs cycle is:

- (A) 2CO₂, 3ATP, 6NADH, 2FADH
- (B) 4CO₂, 3NADH, 6ATP, 3FADH
- (C) 4CO₂, 2ATP, 6NADH, 2FADH₂
- (D) CO₂, NADH, FADH

Q11. BIO

The electron carrier of mitochondria are found in:

- (A) Outer mitochondrial membrane
- (B) Stroma
- (C) Intermembrane space
- (D) Inner mitochondrial membrane

Q12. BIO

Which one of the following is a monosaccharide?

- (A) Sucrose
- (B) Maltose
- (C) Lactose
- (D) Fructose

Q13. BIO

What is percentage of water in brain cells?

- (A) 20%
- (B) 70%
- (C) 85%
- (D) 30%

Q14. BIO

Proportion of carbohydrate in bacterial and mammalian cell is:

- (A) 2%, 4%
- (B) 3%, 4%
- (C) 4%, 2%
- (D) 3%, 2%

Q15. BIO

Water has very high heat capacity due to its:

- (A) High polarity
- (B) Hydrogen bonding
- (C) High heat of vaporization
- (D) Ionization

Q16. BIO

Which one of the following biomolecule is involved in the transport of oxygen?

- (A) Protein
- (B) Fats
- (C) Carbohydrate
- (D) Nucleic acid

Q17. BIO

Which is the second most abundant organic molecule on earth?

- (A) Starch
- (B) Glycogen
- (C) Cellulose
- (D) Chitin

Q18. BIO

Glycerol reacts with fatty acids to produce:

- (A) Phospholipids
- (B) Terpenes
- (C) Acyl glycerol
- (D) Steroids

Q19. BIO

During cell wall formation absence of magnesium results in:

- (A) Lack of primary cell wall
- (B) Lack of secondary cell wall
- (C) Lack of middle lamella
- (D) No effect on cell wall formation

Q20. BIO

Identify the mismatch in the following:

- (A) Mitochondria - cellular respiration
- (B) Endoplasmic reticulum - detoxification
- (C) Mitochondria - deamination
- (D) Lysosome - autophagy

Q21. BIO

Which organelle will increase in number, in muscles of athlete?

- (A) Mitochondria
- (B) Ribosome
- (C) Golgi apparatus
- (D) Lysosome

Q22. BIO

In secretory cells which pathway is followed for the transport of material?

- (A) Golgi complex → RER → SER
- (B) RER → golgi complex → SER
- (C) RER → SER → golgi complex
- (D) SER → golgi complex → RER

Q23. BIO

How many number of chromosomes are present in onion?

- (A) 16
- (B) 8
- (C) 14
- (D) 26

Q24. BIO

A cell is treated with a toxin that disrupts Golgi apparatus. Which function is affected?

- (A) Lipid metabolism
- (B) Protein modification
- (C) Chromosome separation during cell division
- (D) ATP production

Q25. BIO

Where modification and packaging occur in secretory cells?

- (A) Golgi apparatus
- (B) Mitochondria
- (C) Endoplasmic reticulum
- (D) Nucleus

Q26. BIO

A person continuously faces water imbalance in body due to damage of which part of the brain?

- (A) Amygdala
- (B) Thalamus
- (C) Medulla
- (D) Hypothalamus

Q27. BIO

Which part of brain is activated to release excess CO₂ from body produced during strenuous exercise?

- (A) Pons
- (B) Medulla
- (C) Cerebellum
- (D) Cerebrum

Q28. BIO

The cerebrospinal fluid (CSF) is present between:

- (A) Dura matter & arachnoid matter
- (B) Arachnoid matter & Pia matter
- (C) Dura matter & Pia matter
- (D) Arachnoid matter & Dura matter

Q29. BIO

What is the role of growth hormone after adolescence?

- (A) Promotes protein synthesis
- (B) Inhibits protein synthesis
- (C) Decreases amino acid uptake
- (D) Inhibits cell division

Q30. BIO

Which of the following is correct function of calcitonin?

- (A) Resorption of calcium in bone matrix
- (B) Inhibits Ca^{+2} absorption by intestine
- (C) Increase reabsorption by kidneys
- (D) Increase blood calcium level

Q31. BIO

What is secreted when the levels of blood glucose get too low?

- (A) Calcitonin
- (B) Glucagon
- (C) Insulin
- (D) Corticoid hormones

Q32. BIO

Pathway followed by nerve impulse during reflex action is:

- (A) Interneuron → synapse → dendrites → cell body of motor neuron
- (B) Interneuron → dendrite → synapse → cell body of motor neuron
- (C) Interneuron → synapse → cell body of neuron
- (D) Interneuron → dendrites → cell body of neuron

Q33. BIO

Identify the animals having both mammalian and reptilian features:

- (A) Mice
- (B) Spiny ant eater
- (C) Opossum
- (D) Bat

Q34. BIO

An enzyme which requires a cofactor to become active is called:

- (A) Apoenzyme
- (B) Holoenzyme
- (C) Prosthetic group
- (D) Co-enzyme

Q35. BIO

Which statement best describes competitive inhibitors?

- (A) Denature enzyme permanently
- (B) Used as drugs
- (C) Prevent enzyme product complex
- (D) Alter the shape of enzymes

Q36. BIO

Due to snake bite a person's heart stops working. Which type of venom will be found in his body?

- (A) Hemotoxic
- (B) Hepatotoxic
- (C) Neurotoxic
- (D) Cytotoxic

Q37. BIO

Identify the enzyme which shows absolute specificity:

- (A) Carbonic anhydrase
- (B) Hexokinase
- (C) Urease
- (D) Isomerase

Q38. BIO

Some industries are continuously polluting aquatic bodies. This can affect metabolic pathway of plants by changing their pH:

- (A) More alkaline
- (B) More acidic
- (C) Less acidic
- (D) Less alkaline

Q39. BIO

All flowering plants are thought to be evolved from a common ancestor on the basis of which homologous structures?

- (A) Stamen, carpel, sepals, petals
- (B) Stamen, carpel, thalamus, sepals
- (C) Stamen, carpel, thalamus, sepals, petals, stalk
- (D) Stamen, carpel, sepals, thalamus

Q40. BIO

Barriers which effect geographical distribution of life are:

- (A) Physical and chemical
- (B) Environmental & Physical
- (C) Ecological & chemical
- (D) Physical, Ecological or Environmental

Q41. BIO

Why are some genes called pseudoautosomal, even though they are present on sex chromosome?

- (A) They are present on X chromosomes only
- (B) They are present on Y chromosomes only
- (C) They are present on both X and Y chromosomes
- (D) They are absent from both X and Y chromosomes

Q42. BIO

As a result of natural disaster, few species continue to survive due to their characteristics. This results in:

- (A) Increase in favorable alleles
- (B) Decrease in favorable alleles
- (C) Increase in unfavorable alleles
- (D) Decrease in unfavorable alleles

Q43. BIO

Which of these correctly order the structure of arteries?

- (A) Connective tissues → Smooth muscle → Elastic tissue → Endothelium
- (B) Connective tissues → Smooth muscle → Endothelium → Elastic tissue
- (C) Elastic tissue → Smooth muscle → Connective tissue → Endothelium
- (D) Smooth muscle → Connective tissues → Elastic tissue → Endothelium

Q44. BIO

Epidermis is outer most layer of the skin, which is composed of:

- (A) Loosely packed cells
- (B) Tightly packed cells
- (C) Scattered cells
- (D) Ciliated cells

Q45. BIO

Which type of muscle controls the movement of substance through hollow organs?

- (A) Cardiac muscle
- (B) Smooth muscles
- (C) Sphincter muscles
- (D) Skeleton muscle

Q46. BIO

Smallest contractile unit of muscle fibers present between two lines is known as:

- (A) Sarcoplasm
- (B) Sarcolemma
- (C) Sarcomere
- (D) Sarcodina

Q47. BIO

Which ion is responsible for the attachment of tropomyosin with the head of myosin during cross bridge?

- (A) K⁺ ions
- (B) Ca⁺⁺ ions
- (C) Na⁺ ions
- (D) Mg⁺

Q48. BIO

During muscle contraction which type of events occurs respectively?

- (A) I band shorten → H-zone appears
- (B) I band strengthen → H-zone disappears
- (C) I band shorten → H-zone disappears
- (D) I band strengthen → H-zone appears

Q49. BIO

Which one of the following organism is responsible for transforming nitrogen gas into ammonium?

- (A) Cyanobacterium
- (B) Nitrobacteria
- (C) Rhizobium
- (D) Nitrosomonas

Q50. BIO

Identify one of the following chemo-therapeutic agent used to control bacterial infections:

- (A) Nitrofurans
- (B) Hydrogen peroxide
- (C) Sodium hypochlorite
- (D) Potassium sorbate

Q51. BIO

Why male gonads are present outside the body?

- (A) They need temperature equal to human body
- (B) They need 2°C temperature higher than human body
- (C) They need 2°C temperature less than human body
- (D) They need environmental condition for sperm production

Q52. BIO

Which set of events will occur if fusion of gametes does NOT take place?

- (A) Corpus luteum degenerate, LH increase, progesterone increase
- (B) Corpus luteum degenerate, LH decline, progesterone increase
- (C) Corpus luteum degenerate, LH increase, progesterone decline
- (D) Corpus luteum degenerate, LH decline, progesterone decline

Q53. BIO

Which of the following is correct order of the transport of bicarbonate from blood to lungs?

- (A) Capillaries → Alveoli → Red blood cells
- (B) Red blood cells → Alveoli → Capillaries
- (C) Alveoli → Capillaries → Red blood cells
- (D) Red blood cells → Capillaries → Alveoli

Q54. BIO

Which set of digestive enzymes play a vital role in breakdown of protein?

- (A) Pepsin, maltase, erepsin
- (B) Pepsin, trypsin, amylase
- (C) Pepsin, trypsin, erepsin
- (D) Pepsin, amylase, lipase

Q55. BIO

Gene of one allele which inhibits the effect of other allele at different locus is called as:

- (A) Hypostatic gene
- (B) Hylostatic gene
- (C) Polystatic gene
- (D) Epistatic gene

CHEM SECTION: CHEMISTRY

Questions 56 to 95 (40 MCQs)

Q56. CHEM

Which of the following is equal to 1 mole of Na^+ ?

- (A) 6.02×10^{23} atoms
- (B) 6.02×10^{23} ions
- (C) 6.02×10^{-23} atoms
- (D) 6.02×10^{-23} ions

Q57. CHEM

The e/m value for positive rays depends upon nature of gas used because:

- (A) Number of electrons
- (B) Number of neutrons
- (C) Number of protons
- (D) Number of electrons and protons

Q58. CHEM

Select the correct increasing energy order of orbitals?

- (A) $4s < 3d < 4p < 5s$
- (B) $3d > 4s < 4p < 5s$
- (C) $3d > 4s > 5s > 4p$
- (D) $4s > 3d > 4p > 5s$

Q59. CHEM

Which of the following expressions represent Boyle's law?

- (A) $P_1/V_1 = P_2/V_2$
- (B) $P_1/V_1 \neq P_2/V_2$
- (C) $P_1V_1 \neq P_2V_2$
- (D) $P_1V_1 = P_2V_2$

Q60. CHEM

Which Celsius temperature represents zero kelvin or absolute zero?

- (A) 0°C
- (B) $+273.16^\circ\text{C}$
- (C) -273.16°C
- (D) 25°C

Q61. CHEM

An egg takes 5 minutes to boil at sea level while 10 minutes at Murree hills because of:

- (A) Low vapour pressure
- (B) High vapour pressure
- (C) High external pressure
- (D) Low external pressure

Q62. CHEM

Fluorine is a gas and Iodine is a solid at room temperature due to:

- (A) High electronegativity
- (B) Low electronegativity
- (C) High polarizability
- (D) Low polarizability

Q63. CHEM

Ionic solids are bad conductors of heat and electricity because:

- (A) They have strong covalent bonds
- (B) They have strong intermolecular forces
- (C) Ions can only vibrate about their fixed position
- (D) Ions are free to move

Q64. CHEM

If 10% urea is present in aqueous solution of sodium chloride, what will be the shape of crystals obtained?

- (A) Octahedral
- (B) Triclinic
- (C) Cubic
- (D) Hexagonal

Q65. CHEM

 $K_c = K_p$ when Δn is equal to:

- (A) Zero
- (B) +1
- (C) -1
- (D) -2

Q66. CHEM

The pH of human blood is maintained at:

- (A) 5.37
- (B) 5.73
- (C) 7.53
- (D) 7.35

Q67. CHEM

The unit of rate constant is same as the rate of reaction in:

- (A) Third order reaction
- (B) Second order reaction
- (C) First order reaction
- (D) Zero order reaction

Q68. CHEM

Which of the following represents Arrhenius constant expression?

- (A) $K = Ae^{(E_a/T)}$
- (B) $K = Ae^{(-E_a/RT)}$
- (C) $K = Ae^{(RT/E_a)}$
- (D) $K = e^{(-E_a/RT)}$

Q69. CHEM

Which expression is according to the Hess's law?

- (A) $\sum \Delta H (\text{cycle}) = 0$
- (B) $\sum \Delta H = 2$
- (C) $\sum \Delta H (\text{cycle}) = 3$
- (D) $\sum \Delta H (\text{Cycle}) = -1$

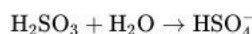
Q70. CHEM

Which of the following represents the expression of internal energy?

- (A) $\Delta E = q + t$
- (B) $\Delta E = q + w$
- (C) $\Delta E = q + v$
- (D) $\Delta E = q + p$

Q71. CHEM

Which is added in the product side to balance equation?



- (A) 1e^- , H^+
- (B) 2e^- , 3H^+
- (C) 5e^-
- (D) 3e^-

Q72. CHEM

The oxidation state of Mn in KMnO_4 is:

- (A) +6
- (B) +3
- (C) +7
- (D) +4

Q73. CHEM

When atoms approaches each other for chemical bond formation, it leads to:

- (A) Decrease in energy
- (B) Increase in energy
- (C) Energy remains same
- (D) Increase in bond length

Q74. CHEM

The number of bonds in oxygen molecules are:

- (A) Two sigma bond
- (B) Two sigma one pi bond
- (C) One sigma one pi bond
- (D) Two pi one sigma

Q75. CHEM

The decreasing order of ionization energy is:

- (A) $\text{O} < \text{S} < \text{N}$
- (B) $\text{F} > \text{Cl} > \text{Br}$
- (C) $\text{Br} < \text{Cl} < \text{F}$
- (D) $\text{C} < \text{N} < \text{B}$

Q76. CHEM

The size of Ar is larger than Cl due to:

- (A) Stearic hindrance
- (B) Inter-electronic repulsion
- (C) High ionization energy
- (D) High shielding effect

Q77. CHEM

Which element is lighter than water?

- (A) Cs
- (B) Rb
- (C) Fe
- (D) K

Q78. CHEM

Which of the following decreases as we move from top to bottom in Group IA or IIA?

- (A) Metallic bond strength
- (B) Electro-positivity
- (C) Reactivity
- (D) Ionic radii

Q79. CHEM

Which one of the following is the correct order of electronegativity of group II A elements?

- (A) $\text{Be} < \text{Mg} < \text{Ca} < \text{Sr} < \text{Ba}$
- (B) $\text{Be} < \text{Ca} < \text{Mg} < \text{Ba} < \text{Sr}$
- (C) $\text{Ba} < \text{Sr} < \text{Ca} < \text{Mg} < \text{Be}$
- (D) $\text{Be} < \text{Sr} > \text{Mg} < \text{Ca} < \text{Ba}$

Q80. CHEM

Which one of the following is heteroatom?

- (A) Pyrrole
- (B) Naphthalene
- (C) Anthracene
- (D) Cyclohexene

Q81. CHEM

The function group of acid amide is:

- (A) $-\text{C}(=\text{OH})-\text{N}$
- (B) $-\text{C}(=\text{OH})-\text{NH}$
- (C) $-\text{C}(=\text{O})-\text{NH}_2$
- (D) $-\text{C}(=\text{OH})-\text{NH}_2$

Q82. CHEM

When an alcohol is heated at 170°C in the presence of sulphuric acid, a water molecule is eliminated resulting in the formation of:

- (A) Alkyl halide
- (B) Alkane
- (C) Alkene
- (D) Alkyne

Q83. CHEM

The IUPAC name of following compound is:



- (A) Hex-2-ene
- (B) Hept-2-ene
- (C) Hex-4-ene
- (D) Hept-4-ene

Q84. CHEM

Most of the reactions shown by alkenes are:

- (A) Nucleophilic substitution
- (B) Nucleophilic addition
- (C) Electrophilic substitution
- (D) Addition reactions

Q85. CHEM

What are the conditions required for polymerization of ethene to polyethene?

- (A) 400°C and 1000 atm
- (B) 100°C and 400 atm
- (C) 450°C and 1000 atm
- (D) 450°C and 200 atm

Q86. CHEM

The reactivity order of alkyl halide is:

- (A) $R-F > R-Cl > R-Br > R-I$
- (B) $R-Cl > R-Br > R-I > R-F$
- (C) $R-Br > R-I > R-F > R-Cl$
- (D) $R-I > R-Br > R-Cl > R-F$

Q87. CHEM

$(CH_3)_3C-OH$ is an example of:

- (A) Primary alcohol
- (B) Secondary alcohol
- (C) Tertiary alcohol
- (D) Iso butyl alcohol

Q88. CHEM

Which one of the following is used in the manufacturing of plastics?

- (A) Methanol
- (B) Ethanol
- (C) Propanol
- (D) Phenol

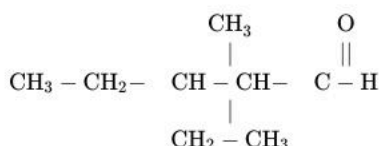
Q89. CHEM

Which of the following will give formic acid as one of the product of oxidation?

- (A) Butanone
- (B) Propanone
- (C) Pentanone
- (D) Hexanone

Q90. CHEM

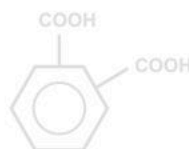
What will be the IUPAC name of the given compound?



- (A) 1-Ethyl-2-methylpentanal
- (B) 2-Ethyl-3-methylpentanal
- (C) 3-Methyl-4-ethylpentanal
- (D) 3-Methylpentanal

Q91. CHEM

What is the common name of following compound?



- (A) Benzoic acid
- (B) Malonic acid
- (C) Phthalic acid
- (D) Picric acid

Q92. CHEM

Acetic anhydride can be prepared when two molecules of carboxylic acids are dehydrated on heating strongly in the presence of:

- (A) V_2O_5
- (B) P_2O_5
- (C) H_2SO_4
- (D) $HgSO_4$

Q93. CHEM

Carboxylic acid react with metals to form salt with the evolution of which gas?

- (A) CO_2
- (B) CO
- (C) H_2
- (D) CH_4

Q94. CHEM

Which protein helps in muscles contractions and relaxation in our body?

- (A) Myosin
- (B) Albumin
- (C) Globulin
- (D) Collagen

Q95. CHEM

Various polypeptide chains in haemoglobin remain intact due to:

- (A) Chemical bonds
- (B) London dispersion forces
- (C) Salt bridges
- (D) Peptide bonds

PHY SECTION: PHYSICS

Questions 96 to 135 (40 MCQs)

Q96. PHY

The vertical height and horizontal range of projectiles are equal at angle:

- (A) 30°
- (B) 45°
- (C) 76°
- (D) 90°

Q97. PHY

Range of projectile is maximum at:

- (A) 30°
- (B) 45°
- (C) 60°
- (D) 90°

Q98. PHY

A ball is thrown vertically upward, the ball descends towards earth after achieving a certain height because:

- (A) Earth is exerting more gravitational force than ball
- (B) The ball is exerting more gravitational force than earth
- (C) The earth possesses more inertia
- (D) The ball possesses more inertia

Q99. PHY

A bomb is exploded into two fragments A and B moving in opposite direction. They conserve:

- (A) Kinetic Energy
- (B) Potential Energy
- (C) Momentum
- (D) Both kinetic energy and potential energy

Q100. PHY

Work done is negative, when the angle between F and S is:

- (A) 0°
- (B) 60°
- (C) 90°
- (D) 180°

Q101. PHY

When the speed of the car is doubled, what will be its kinetic energy?

- (A) Remains same
- (B) Doubled
- (C) Three times
- (D) Four times

Q102. PHY

The work efficiency of a dry cell battery is:

- (A) 30%
- (B) 40%
- (C) 50%
- (D) 90%

Q103. PHY

When distance r increases than gravitational P.E becomes:

- (A) Less positive
- (B) More negative
- (C) Less negative
- (D) More positive

Q104. PHY

How many Joules are there in 3KWh?

- (A) 108MJ
- (B) 10.8MJ
- (C) 1.08MJ
- (D) 0.108MJ

Q105. PHY

A car moving on a more steeply banked curves will require:

- (A) Large speed and large radii
- (B) Large speed and small radii
- (C) Small speed and large radii
- (D) Small speed and small radii

Q106. PHY

In a body angular acceleration is produced by:

- (A) Net force
- (B) Power
- (C) Pressure
- (D) Net torque

Q107. PHY

The analogue of force in circular / angular motion is:

- (A) Momentum
- (B) Torque
- (C) Angular acceleration
- (D) Angular velocity

Q108. PHY

1° is equals to:

- (A) $\pi/90$ radians
- (B) $\pi/180$ radians
- (C) π radians
- (D) 2π radians

Q109. PHY

In uniform circular motion, the angle between centripetal acceleration and linear velocity of a particle is:

- (A) $\pi/2$
- (B) π
- (C) 2π
- (D) Zero

Q110. PHY

The distance between two consecutive nodes are:

- (A) λ
- (B) $\lambda/2$
- (C) 2λ
- (D) $\lambda/4$

Q111. PHY

If a sound waves moves from air to water, there is NO change in:

- (A) Velocity
- (B) Frequency
- (C) Wavelength
- (D) Temperature

Q112. PHY

The star moving closer to earth will experience:

- (A) Blue shift
- (B) Red shift
- (C) Orange shift
- (D) Yellow shift

Q113. PHY

If the amplitude of a wave is doubled, its intensity is:

- (A) Doubled
- (B) Halved
- (C) Quadrupled
- (D) One quarter

Q114. PHY

Which of the following is an example of first law of thermodynamics?

- (A) Thunderstorm
- (B) Metabolism
- (C) Rusting
- (D) Earthquake

Q115. PHY

Thermos flask containing tea as a system is shaken vigorously then there will be:

- (A) Increase in temperature only
- (B) Increase in kinetic energy only
- (C) Increase in temperature & kinetic energy
- (D) No change in temperature & kinetic energy

Q116. PHY

Difference between molar specific heat at constant pressure and molar specific heat at constant volume is equal to:

- (A) Boltzmann constant
- (B) Universal gas constant
- (C) Planck's constant
- (D) Rydberg constant

Q117. PHY

Coulomb's law of electrostatic induction is valid for:

- (A) Point charges
- (B) Stationary charges
- (C) Stationary & point charges
- (D) Accelerated point charges

Q118. PHY

If the positive charge is placed in a uniform electric field, the charge will move in the:

- (A) Opposite direction of electric field
- (B) Direction of electric field
- (C) Perpendicular to the direction of electric field
- (D) Remains at rest

Q119. PHY

For each element, value of half-life is:

- (A) Variable
- (B) Constant
- (C) Decrease
- (D) Increase

Q120. PHY

The unit of RC is:

- (A) Ohm
- (B) Farad
- (C) Second
- (D) Ohm/Farad

Q121. PHY

The fractional change in resistance per kelvin is known as the temperature coefficient of:

- (A) Conductance
- (B) Resistance
- (C) Inductance
- (D) Conductivity

Q122. PHY

Which of the following is an example of Ohmic in nature?

- (A) Thermistor
- (B) Filament lamp
- (C) Semiconductor
- (D) Conductor

Q123. PHY

The material whose resistance decreases with increase in temperature have:

- (A) Positive temperature coefficient
- (B) Negative temperature coefficient
- (C) Thermal coefficient
- (D) Coefficient of friction

Q124. PHY

The number of magnetic field lines passing through unit area is called:

- (A) Magnetic field
- (B) Magnetic flux
- (C) Magnetic flux density
- (D) Magnetization

Q125. PHY

The magnetic force of a charged particle moving in a uniform magnetic fields depends on:

- (A) Velocity, area & magnetic field
- (B) Charge, current & velocity
- (C) Magnetic field, voltage & charge
- (D) Velocity, magnetic field & charge

Q126. PHY

The magnetic force acting on a charged particle is maximum when the angle between $\vec{v}$ and $\vec{B}$ is:

- (A) 0°
- (B) 45°
- (C) 90°
- (D) 180°

Q127. PHY

Generator effect is practical application of:

- (A) Static e.m.f
- (B) Dynamic e.m.f
- (C) Mutual induction
- (D) Back emf

Q128. PHY

If number of turns of coil becomes double, the induced emf will be:

- (A) Double
- (B) Reduced to half
- (C) Remain same
- (D) Quadruple

Q129. PHY

Electromagnetic sensor in seismograph converts ground movement into:

- (A) Magnetic signals
- (B) Electric signals
- (C) Audio signals
- (D) Vibratory signals

Q130. PHY

A full wave bridge rectifier consists of:

- (A) No diode
- (B) Four diodes
- (C) Two diodes
- (D) One diode

Q131. PHY

An electrical component used to convert AC into DC is:

- (A) Transistor
- (B) Capacitor
- (C) Diode
- (D) Resistor

Q132. PHY

A photon has:

- (A) Zero mass, zero momentum
- (B) Finite mass, finite momentum
- (C) Zero mass, finite momentum
- (D) Finite mass, zero momentum

Q133. PHY

Photo-conductive devices like photo cells and solar cells are application of:

- (A) Photo electric effect
- (B) Compton's effect
- (C) Pair production
- (D) Interference of light

Q134. PHY

Which of the following particle has smaller De Broglie wave length?

- (A) Gamma particle
- (B) Beta particle
- (C) Proton
- (D) Alpha particle

Q135. PHY

In the spectrum of hydrogen atom which of the following series has smallest wavelength?

- (A) Paschen series
- (B) Balmer series
- (C) Lyman series
- (D) Brackett series

ENG SECTION: ENGLISH

Questions 136 to 150 (15 MCQs)

Q136. ENG

The antonym for the word clarity is:

- (A) Upright
- (B) Understanding
- (C) Vagueness
- (D) Clear

Q137. ENGYasir Ameen could not pay the rent; accordingly, he was evicted. Meaning of the underlined word is:

- (A) Expelled from the house
- (B) Investigated
- (C) Threatened
- (D) Rewarded

Q138. ENG

Fill in the blank with the correct verb.

The baby _____ all morning.

- (A) Is crying
- (B) Has been crying
- (C) Cry
- (D) Have been crying

Q139. ENG

By 2040, robots _____ many of the jobs that people do today.

- (A) Will be taking over
- (B) Will take over
- (C) Will have taken over
- (D) Has taken over

Q140. ENG

"Each time one of us touches the soil, we feel a sense of personal renewal". The type of sentence is:

- (A) Compound
- (B) Complex
- (C) Compound Complex
- (D) Simple

Q141. ENG

Identify the correctly punctuated sentence.

- (A) Milton the great English Poet, was blind
- (B) Milton, the great English poet, was blind
- (C) Milton the great English poet was, blind
- (D) Milton the great, English poet was blind

Q142. ENG

Identify the correct sentence.

- (A) A Sindhi woman is going through a bazaar with bear feet.
- (B) A Sindhi women are going through a bazaar with bare feet.
- (C) A Sindhi woman is going through a bazaar with bare feet.
- (D) A Sindhi woman is going through a bazaar with bare foot.

Q143. ENG

Complete the sentence using correct preposition.

The public are cautioned _____ pick pockets.

- (A) Against
- (B) Of
- (C) For
- (D) With

Q144. ENG

Select the correct pair.

Lack of sleep can _____ your health and have a bad _____ on your grades.

- (A) Affect / affect
- (B) Effect / effect
- (C) Effect / affect
- (D) Affect / effect

Q145. ENG

Select the correct sentence in style.

- (A) Having finished his exercise, the books were put away.
- (B) Having finishing his exercise, the books were put away.
- (C) Having finishing his exercise, he put his books away.
- (D) Having finished his exercise, he put away his books.

Q146. ENG

Select the statement that best describes the given sentence.

"He is anything but a liar."

- (A) He is a liar.
- (B) He can be anything but not a liar.
- (C) He is not a good character and liar as well.
- (D) He is good character but a liar to some extent.

Q147. ENG

Select the best option to describe the given sentence.

"Unless you apologise I shall punish you."

- (A) Without apology, you will be forgiven.
- (B) With apology, you will be punished.
- (C) There is no need of apology.
- (D) Without apology you will be punished.

Q148. ENG

"From the attitude it is clear that he wants to pay off his old scores." The sentence means that he wants to:

- (A) Improve his marks.
- (B) Pay off his debt.
- (C) Help needy people.
- (D) Have his revenge.

Q149. ENG

A person needs to reflect profoundly on his/her life. The underlined word means:

- Ⓐ Deeply
- Ⓑ Superficially
- Ⓒ Shallow
- Ⓓ Mirroring

Q150. ENG

Due to his non-serious attitude, Ali took the advice with a pinch of salt. It means:

- Ⓐ Took it seriously.
- Ⓑ Did not take it seriously.
- Ⓒ Accept it candidly.
- Ⓓ Implemented it happily.

OFFICIAL VERIFIED ANSWER KEY

NUMS 2026 Official Solved Paper - Rapid Self-Grading Grid

Online Portal >

Q#	KEY	SUB	Q#	KEY	SUB	Q#	KEY	SUB	Q#	KEY	SUB	Q#	KEY	SUB
1	B	BIO	31	B	BIO	61	D	CHEM	91	C	CHEM	121	B	PHY
2	B	BIO	32	A	BIO	62	C	CHEM	92	B	CHEM	122	D	PHY
3	C	BIO	33	B	BIO	63	C	CHEM	93	C	CHEM	123	B	PHY
4	B	BIO	34	A	BIO	64	A	CHEM	94	A	CHEM	124	C	PHY
5	A	BIO	35	C	BIO	65	A	CHEM	95	C	CHEM	125	D	PHY
6	A	BIO	36	A	BIO	66	D	CHEM	96	C	PHY	126	C	PHY
7	A	BIO	37	C	BIO	67	D	CHEM	97	B	PHY	127	B	PHY
8	B	BIO	38	B	BIO	68	B	CHEM	98	C	PHY	128	A	PHY
9	B	BIO	39	A	BIO	69	A	CHEM	99	C	PHY	129	B	PHY
10	C	BIO	40	D	BIO	70	B	CHEM	100	D	PHY	130	B	PHY
11	D	BIO	41	C	BIO	71	B	CHEM	101	D	PHY	131	C	PHY
12	D	BIO	42	A	BIO	72	C	CHEM	102	D	PHY	132	C	PHY
13	C	BIO	43	A	BIO	73	A	CHEM	103	C	PHY	133	A	PHY
14	B	BIO	44	B	BIO	74	C	CHEM	104	B	PHY	134	D	PHY
15	B	BIO	45	B	BIO	75	B	CHEM	105	B	PHY	135	C	PHY
16	A	BIO	46	C	BIO	76	B	CHEM	106	D	PHY	136	C	ENG
17	D	BIO	47	B	BIO	77	D	CHEM	107	B	PHY	137	A	ENG
18	C	BIO	48	C	BIO	78	A	CHEM	108	B	PHY	138	B	ENG
19	C	BIO	49	C	BIO	79	C	CHEM	109	A	PHY	139	C	ENG
20	C	BIO	50	A	BIO	80	A	CHEM	110	B	PHY	140	B	ENG
21	A	BIO	51	C	BIO	81	C	CHEM	111	B	PHY	141	B	ENG
22	C	BIO	52	D	BIO	82	C	CHEM	112	A	PHY	142	C	ENG
23	A	BIO	53	D	BIO	83	A	CHEM	113	C	PHY	143	A	ENG
24	B	BIO	54	C	BIO	84	D	CHEM	114	B	PHY	144	D	ENG
25	A	BIO	55	D	BIO	85	A	CHEM	115	C	PHY	145	D	ENG
26	D	BIO	56	B	CHEM	86	D	CHEM	116	B	PHY	146	B	ENG
27	B	BIO	57	D	CHEM	87	C	CHEM	117	C	PHY	147	D	ENG
28	B	BIO	58	A	CHEM	88	D	CHEM	118	B	PHY	148	D	ENG
29	A	BIO	59	D	CHEM	89	B	CHEM	119	B	PHY	149	A	ENG
30	B	BIO	60	C	CHEM	90	B	CHEM	120	C	PHY	150	B	ENG

SUBJECT-WISE PERFORMANCE BREAKDOWN

SUBJECT	MAX	YOUR SCORE	ACCURACY
Biology	55		----- %
Chemistry	40		----- %
Physics	40		----- %
English	15		----- %
TOTAL	150	-----	----- %

NUMS ADMISSION MERIT FORMULA

Official Weightage Law:

- NUMS Component (50%): (Your Score / 150) × 50
- FSc / HSSC Component (40%): (FSc Marks / 1100) × 40
- Matric / SSC Component (10%): (Matric Marks / 1100) × 10

Estimated NUMS Merit Aggregate: _____ %

PROPOLIS COGNITIVE ERROR AUTOPSIES

Step-by-step conceptual derivations, formula working, and distractor autopsies for every question.

Question #1 Key: (B)

BIOLOGY
NUMS 2026

Identify the type of glycoprotein, responsible for cell fusion process in HIV cycle:

CORE CONCEPT & DERIVATION

The human immunodeficiency virus envelope spikes consist of glycoprotein complexes that mediate host cell recognition and entry. Transmembrane glycoprotein 41 directly facilitates the fusion of the viral envelope with the host plasma membrane.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- The envelope spikes of HIV are trimers composed of surface gp120 and transmembrane gp41.
- Initial attachment occurs when gp120 binds to host CD4 receptors and chemokine co-receptors.
- This binding produces a conformational change that enables the hydrophobic fusion peptide of gp41 to penetrate the host membrane, facilitating viral fusion and capsid delivery.

Why other options are incorrect:

- **Option A:** gp 40 is not a structural glycoprotein component of the HIV envelope.
- **Option C:** gp 120 mediates surface attachment and receptor binding, not membrane fusion.
- **Option D:** gp 121 does not exist in retroviral envelope nomenclature.

Question #2 Key: (B)

BIOLOGY
NUMS 2026

Which of the following enzymes converts mRNA to complementary DNA (cDNA)?

CORE CONCEPT & DERIVATION

Reverse transcriptase is an RNA-dependent DNA polymerase that synthesizes a complementary DNA strand from an RNA template.

Formula / Rule / Reaction:

Single-stranded mRNA $\xrightarrow{\text{Reverse transcriptase}}$ Complementary DNA (cDNA)

Solution:

- In retroviral replication and biotechnology workflows, reverse transcriptase synthesizes a single-stranded cDNA along an mRNA template.
- The enzyme then degrades the original RNA strand and synthesizes the complementary DNA strand, producing double-stranded DNA.

Why other options are incorrect:

- **Option A:** Integrase inserts retroviral double-stranded DNA into the host cellular chromosome.
- **Option C:** Protease cleaves nascent viral precursor polyproteins into individual active proteins.
- **Option D:** DNAase hydrolyzes phosphodiester bonds to break down DNA.

Question #3 Key: (C)

BIOLOGY
NUMS 2026

Edward Jenner used material removed from the lesion on the hand of milkmaid and vaccinated a bo...

CORE CONCEPT & DERIVATION

In 1796, Edward Jenner developed the first vaccination technique using pus from a cowpox lesion on a milkmaid to confer immunity against smallpox.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- Edward Jenner observed that dairymaids who contracted cowpox from cattle lesions were protected from smallpox outbreaks.
- He collected infectious fluid directly from a cowpox pustule on the hand of milkmaid Sarah Nelmes and inoculated a young boy named James Phipps.
- The underlying disease causing the lesion on the milkmaid's hand was cowpox.

Why other options are incorrect:

- **Option A:** Smallpox was the target disease against which Jenner provided immunity, not the disease present on the milkmaid.
- **Option B:** Chickenpox is caused by varicella-zoster virus and was not part of Jenner's inoculation experiments.
- **Option D:** Measles is an unrelated morbillivirus infection.

Question #4 Key: (B)

BIOLOGY
NUMS 2026

Adenovirus are classified as:

CORE CONCEPT & DERIVATION

Viruses are classified structurally based on capsid symmetry, where adenoviruses are recognized as non-enveloped viruses exhibiting an icosahedral or polyhedral shape.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- Adenoviruses possess a naked, non-enveloped protein shell.
- The capsid has icosahedral symmetry comprising 252 capsomeres, forming a characteristic polyhedral shape.

Why other options are incorrect:

- **Option A:** Helical capsids are cylindrical structures characteristic of the tobacco mosaic virus and rabies virus.
- **Option C:** Adenoviruses do not possess an outer lipid membrane bilayer envelope.
- **Option D:** Coupler capsid is an invalid morphological classification term.

Question #5 Key: (A)BIOLOGY
NUMS 2026

If a person is doing strenuous exercise, how many ATPs are produced by cellular respiration?

CORE CONCEPT & DERIVATION

During strenuous exercise, muscle oxygen demand exceeds vascular delivery, forcing cells into anaerobic glycolysis (lactic acid fermentation) which yields a net of 2 ATP per glucose molecule.

Formula / Rule / Reaction:**Solution:**

- Glycolysis requires an initial investment of 2 ATP and produces 4 ATP via substrate-level phosphorylation.
- This yields a net gain of 2 ATP per glucose molecule.
- Under anaerobic conditions, pyruvate is converted to lactate, preventing passage into the Krebs cycle and oxidative phosphorylation.

Why other options are incorrect:

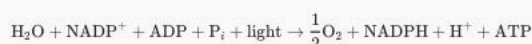
- Option B:** 3 ATP is not a stoichiometric product in either aerobic or anaerobic glucose catabolism.
- Option C:** 4 ATP represents the gross ATP generated by glycolysis before accounting for the 2 ATP invested in the preparatory phase.
- Option D:** 6 ATP represents the theoretical ATP yield from glycolytic NADH under aerobic conditions.

Question #6 Key: (A)BIOLOGY
NUMS 2026

The end product of non-cyclic electron pathway is:

CORE CONCEPT & DERIVATION

Non-cyclic photophosphorylation (Z-scheme) utilizes both photosystem II and photosystem I to drive the simultaneous synthesis of ATP and NADPH.

Formula / Rule / Reaction:**Solution:**

- Electrons derived from water photolysis travel through the electron transport chain between PS II and PS I to generate a proton gradient that drives ATP synthesis.
- Electrons excited at PS I are accepted by ferredoxin and transferred via NADP⁺ reductase to reduce NADP⁺ into NADPH.
- Both ATP and NADPH serve as assimilatory reducing equivalents for the Calvin cycle.

Why other options are incorrect:

- Option B:** ATP alone is the product of cyclic photophosphorylation, which lacks photolysis and NADPH production.
- Option C:** FADH₂ is a mitochondrial electron carrier produced in the Krebs cycle, not chloroplast light reactions.
- Option D:** NAOPH₂ represents an invalid chemical formula.

Question #7 Key: (A)BIOLOGY
NUMS 2026

Pyruvic acid is converted into acetaldehyde through which step?

CORE CONCEPT & DERIVATION

In alcoholic fermentation, pyruvate undergoes non-oxidative decarboxylation by pyruvate decarboxylase to form acetaldehyde and carbon dioxide.

Formula / Rule / Reaction:**Solution:**

- Pyruvate is a 3-carbon alpha-keto acid.
- The enzyme pyruvate decarboxylase cleaves its terminal carboxyl group, releasing carbon dioxide.
- The resulting 2-carbon product is acetaldehyde.

Why other options are incorrect:

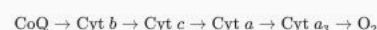
- Option B:** Acetaldehyde formation involves simple decarboxylation without oxidation.
- Option C:** Addition of coenzyme A converts pyruvate into acetyl-CoA during aerobic cellular respiration.
- Option D:** Reduction occurs in the subsequent reaction when acetaldehyde is reduced to ethanol by alcohol dehydrogenase.

Question #8 Key: (B)BIOLOGY
NUMS 2026

Choose the correct sequence of electron carrier in respiratory ETC:

CORE CONCEPT & DERIVATION

In the mitochondrial electron transport chain, electrons flow sequentially down an increasing redox potential gradient from Coenzyme Q to cytochromes b, c, a, and a₃.

Formula / Rule / Reaction:**Solution:**

- Coenzyme Q collects electrons from complex I and complex II.
- It transfers electrons to complex III, where cytochrome b resides.
- From cytochrome b, electrons pass to mobile cytochrome c, and finally to complex IV containing cytochrome a and cytochrome a₃.

Why other options are incorrect:

- Option A:** Inverts the positions of cytochromes a and a₃ with cytochromes b and c.
- Option C:** Reverses the thermodynamic direction of electron transport.
- Option D:** Places cytochrome b and c upstream of Coenzyme Q.

Question #9 Key: (B)BIOLOGY
NUMS 2026*Pumping movement of protons occur from:***CORE CONCEPT & DERIVATION**

During oxidative phosphorylation, respiratory complexes pump protons across the inner mitochondrial membrane from the mitochondrial matrix into the intermembrane space.

Formula / Rule / Reaction:**Solution:**

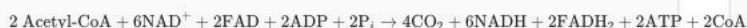
- Energy released by the transfer of electrons along the respiratory chain is coupled to proton translocation.
- Protons are drawn from the interior mitochondrial matrix and pumped outward across the inner membrane.
- This accumulates protons within the intermembrane space, generating the proton-motive force.

Why other options are incorrect:

- **Option A:** Protons are not pumped between the outer membrane and inner membrane surfaces directly from bulk lipid bilayers.
- **Option C:** Cisternae are structures characteristic of the endoplasmic reticulum and Golgi complex.
- **Option D:** The source compartment for translocated protons is the mitochondrial matrix, not the inner membrane core.

Question #10 Key: (C)BIOLOGY
NUMS 2026*Net product of Krebs cycle is:***CORE CONCEPT & DERIVATION**

For each glucose molecule metabolized, two acetyl-CoA molecules enter the Krebs cycle, yielding a combined net total of 4 CO₂, 2 ATP, 6 NADH, and 2 FADH₂.

Formula / Rule / Reaction:**Solution:**

- A single turn of the citric acid cycle processing one acetyl-CoA produces 2 CO₂, 3 NADH, 1 FADH₂, and 1 ATP.
- Since glycolysis breaks down one glucose molecule into two pyruvate units, two turns of the cycle occur per glucose molecule.
- Multiplying the single-turn output by two yields 4 CO₂, 2 ATP, 6 NADH, and 2 FADH₂.

Why other options are incorrect:

- **Option A:** Lists the stoichiometric output of only one turn for carbon dioxide while misstating ATP numbers.
- **Option B:** Inverts the ratios of ATP and NADH.
- **Option D:** Fails to state any quantitative stoichiometry.

Question #11 Key: (D)BIOLOGY
NUMS 2026*The electron carrier of mitochondria are found in:***CORE CONCEPT & DERIVATION**

The protein complexes and coenzymes of the mitochondrial electron transport chain are integrated directly into the inner mitochondrial membrane.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

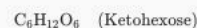
- The inner mitochondrial membrane forms infoldings termed cristae, which contain embedded respiratory complexes (I, II, III, and IV).
- These cristae house Coenzyme Q, cytochromes, and ATP synthase complexes.

Why other options are incorrect:

- **Option A:** The outer mitochondrial membrane contains large pore-forming proteins called porins and lacks respiratory complexes.
- **Option B:** The stroma is the fluid matrix found inside chloroplasts, not mitochondria.
- **Option C:** The intermembrane space stores the translocated proton gradient, but the electron transport complexes are anchored in the inner membrane.

Question #12 Key: (D)BIOLOGY
NUMS 2026*Which one of the following is a monosaccharide?***CORE CONCEPT & DERIVATION**

Monosaccharides are simple monomeric sugars that cannot be hydrolyzed into smaller carbohydrate subunits.

Formula / Rule / Reaction:**Solution:**

- Fructose is a six-carbon ketohehexose monosaccharide.
- Sucrose, maltose, and lactose are disaccharides composed of two linked monosaccharide units.

Why other options are incorrect:

- **Option A:** Sucrose is a disaccharide consisting of glucose and fructose linked by a glycosidic bond.
- **Option B:** Maltose is a disaccharide consisting of two glucose units.
- **Option C:** Lactose is a disaccharide consisting of glucose and galactose.

Question #13 Key: (C)BIOLOGY
NUMS 2026*What is percentage of water in brain cells?***CORE CONCEPT & DERIVATION**

According to the Punjab Textbook Board, water content varies across tissues based on metabolic activity, with human brain cells containing 85% water.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Tissues with high metabolic rates possess higher aqueous proportions.
- Brain cells contain 85% water, whereas dense bone cells contain approximately 20% water.

Why other options are incorrect:

- **Option A:** 20% represents the water content of bone cells.
- **Option B:** 70% represents the average total water composition of bacterial cells and the human body overall.
- **Option D:** 30% is not a recognized textbook value for neural tissue.

Question #14 Key: (B)BIOLOGY
NUMS 2026*Proportion of carbohydrate in bacterial and mammalian cell is:***CORE CONCEPT & DERIVATION**

Based on standard chemical composition tables in the Punjab Textbook Board, carbohydrates account for 3% of the total mass in a bacterial cell and 4% in a mammalian cell.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- In typical bacterial cells, carbohydrates constitute 3% of the total cellular mass.
- In typical mammalian cells, carbohydrates constitute 4% of total cellular mass.

Why other options are incorrect:

- **Option A:** 2% is the lipid content of bacterial cells.
- **Option C:** Inverts the respective values between bacterial and mammalian cells.
- **Option D:** Gives an inaccurate value for mammalian cell carbohydrate content.

Question #15 Key: (B)BIOLOGY
NUMS 2026*Water has very high heat capacity due to its:***CORE CONCEPT & DERIVATION**

Water exhibits an exceptionally high heat capacity because its extensive intermolecular hydrogen-bonding network absorbs large quantities of thermal energy before kinetic motion increases.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

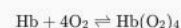
- Heat capacity is the thermal energy needed to raise the temperature of a unit mass by one degree Celsius.
- Thermal energy added to liquid water is consumed in breaking and stretching hydrogen bonds rather than directly increasing molecular translation.
- This property allows water to function as an effective thermal buffer in living organisms.

Why other options are incorrect:

- **Option A:** Polarity determines solvent capability, but thermal buffering is directly mediated by hydrogen bonding.
- **Option C:** Heat of vaporization is a separate thermal constant that also arises from hydrogen bonding.
- **Option D:** Water undergoes minimal self-ionization, which does not govern bulk heat capacity.

Question #16 Key: (A)BIOLOGY
NUMS 2026*Which one of the following biomolecule is involved in the transport of oxygen?***CORE CONCEPT & DERIVATION**

Oxygen is carried in the vertebrate circulatory system bound to hemoglobin, which is a conjugated globular protein.

Formula / Rule / Reaction:**Solution:**

- Hemoglobin is a quaternary protein composed of four polypeptide chains (two alpha and two beta globin subunits).
- Each globin subunit binds a heme prosthetic group containing a ferrous ion (Fe^{2+}) capable of reversibly binding oxygen.
- Therefore, proteins are the biomolecules responsible for biological oxygen transport.

Why other options are incorrect:

- **Option B:** Fats serve as thermal insulators and energy stores.
- **Option C:** Carbohydrates function as cellular fuels and structural matrix components.
- **Option D:** Nucleic acids store and transmit genetic information.

Question #17 Key: (D)BIOLOGY
NUMS 2026*Which is the second most abundant organic molecule on earth?***CORE CONCEPT & DERIVATION**

Cellulose is the most abundant organic biomolecule on Earth, followed by chitin, which forms arthropod exoskeletons and fungal cell walls.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

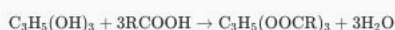
- Cellulose is the primary structural carbohydrate of plant cell walls and ranks first in global organic biomass.
- Chitin, an unbranched polymer of N-acetylglucosamine, is the second most abundant organic compound in the biosphere.

Why other options are incorrect:

- Option A:** Starch is a plant energy storage polymer with total global biomass far below structural polysaccharides.
- Option B:** Glycogen is an animal storage polysaccharide produced in comparatively minor amounts.
- Option C:** Cellulose is the first most abundant organic compound on Earth, not the second.

Question #18 Key: (C)BIOLOGY
NUMS 2026*Glycerol reacts with fatty acids to produce:***CORE CONCEPT & DERIVATION**

The condensation reaction between the trihydric alcohol glycerol and fatty acids produces ester bonds, yielding acylglycerols.

Formula / Rule / Reaction:**Solution:**

- Glycerol contains three hydroxyl groups (-OH).
- Each hydroxyl group can undergo an esterification reaction with the carboxyl group (-COOH) of a fatty acid.
- This condensation produces monoacylglycerols, diacylglycerols, or triacylglycerols.

Why other options are incorrect:

- Option A:** Phospholipids contain a phosphate group and an organic head group in addition to glycerol and fatty acids.
- Option B:** Terpenes are synthesized from repeating five-carbon isoprene units.
- Option D:** Steroids are lipids characterized by a four-ring hydrocarbon skeleton.

Question #19 Key: (C)BIOLOGY
NUMS 2026*During cell wall formation absence of magnesium results in:***CORE CONCEPT & DERIVATION**

The middle lamella is an extracellular cementing layer between adjacent plant cells composed of calcium and magnesium salts of pectin.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- During plant cell cytokinesis, vesicles derived from the Golgi apparatus coalesce to produce the cell plate.
- Pectic compounds are deposited and cross-linked with divalent magnesium (Mg^{2+}) and calcium (Ca^{2+}) ions to form the middle lamella.
- The absence of magnesium impairs this cross-linking, causing defective middle lamella formation.

Why other options are incorrect:

- Option A:** The primary cell wall is composed predominantly of cellulose microfibrils in a hemicellulose matrix.
- Option B:** The secondary cell wall consists mainly of cellulose and lignin.
- Option D:** Magnesium deficiency directly disrupts intercellular adherence in plant tissues.

Question #20 Key: (C)BIOLOGY
NUMS 2026*Identify the mismatch in the following:***CORE CONCEPT & DERIVATION**

Organelles perform specialized metabolic tasks; deamination is an enzymatic catabolic pathway of amino acid breakdown that takes place primarily in the liver, not a defining organelle-level function assigned to mitochondria.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Mitochondria carry out the Krebs cycle and oxidative phosphorylation for cellular respiration.
- Smooth endoplasmic reticulum contains enzymes responsible for the detoxification of harmful lipid-soluble compounds.
- Lysosomes digest damaged intracellular organelles through autophagy.
- Mitochondria are not defined in textbook cytology as the organelle for deamination, making option C the mismatch.

Why other options are incorrect:

- Option A:** Mitochondria are the primary site of aerobic cellular respiration.
- Option B:** The smooth endoplasmic reticulum performs metabolic detoxification.
- Option D:** Lysosomes mediate normal autophagic digestion.

Question #21 Key: (A)BIOLOGY
NUMS 2026*Which organelle will increase in number, in muscles of athlete?***CORE CONCEPT & DERIVATION**

Athletic endurance training stimulates mitochondrial biogenesis in skeletal muscle fibers to elevate aerobic capacity and sustain ongoing ATP production.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Repetitive muscular contraction increases cellular energy demand and activates signaling cascades for mitochondrial division.
- Mitochondria proliferate through binary fission inside muscle cells.
- This physiological adaptation enhances aerobic cellular respiration and delays muscular fatigue.

Why other options are incorrect:

- **Option B:** Ribosomal density supports protein translation during hypertrophy, but mitochondrial expansion is the primary physiological adaptation to athletic exercise.
- **Option C:** The Golgi apparatus processes secretory proteins, which is not the primary adaptive demand in working myocytes.
- **Option D:** Lysosomes degrade macromolecules and do not increase in number to support athletic work.

Question #22 Key: (C)BIOLOGY
NUMS 2026*In secretory cells which pathway is followed for the transport of material?***CORE CONCEPT & DERIVATION**

The secretory pathway in eukaryotic cells proceeds directionally from the rough endoplasmic reticulum to the smooth endoplasmic reticulum (transitional ER) and then to the Golgi complex for packaging.

Formula / Rule / Reaction:
$$\text{RER} \rightarrow \text{SER} \rightarrow \text{Golgi complex} \rightarrow \text{Secretory vesicles}$$
Solution:

- Proteins targeted for secretion are translated by ribosomes attached to the rough endoplasmic reticulum.
- Nascent proteins enter the lumen and migrate into smooth endoplasmic reticulum or transitional elements.
- Transport vesicles then carry the molecules to the cis-face of the Golgi complex for final processing and sorting.

Why other options are incorrect:

- **Option A:** Inverts the sequence by placing the Golgi complex ahead of the endoplasmic reticulum.
- **Option B:** Places the Golgi complex before the smooth endoplasmic reticulum.
- **Option D:** Inverts the directional flow by placing the smooth ER before the rough ER.

Question #23 Key: (A)BIOLOGY
NUMS 2026*How many number of chromosomes are present in onion?***CORE CONCEPT & DERIVATION**

The diploid somatic chromosome number ($2n$) of the common onion (*Allium cepa*) is 16.

Formula / Rule / Reaction:

$$2n = 16 \quad (n = 8)$$

Solution:

- Vegetative somatic cells of *Allium cepa* possess 8 homologous chromosome pairs.
- This yields a total somatic diploid count of 16 chromosomes.

Why other options are incorrect:

- **Option B:** 8 represents the haploid chromosome number (n) found in onion gametes.
- **Option C:** 14 is the diploid chromosome number of the garden pea (*Pisum sativum*).
- **Option D:** 26 is the diploid chromosome number of the common frog.

Question #24 Key: (B)BIOLOGY
NUMS 2026*A cell is treated with a toxin that disrupts Golgi apparatus. Which function is affected?***CORE CONCEPT & DERIVATION**

The Golgi apparatus is the primary organelle responsible for the post-translational modification, glycosylation, and sorting of proteins.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Proteins synthesized in the rough endoplasmic reticulum are delivered to the Golgi apparatus.
- Enzymes within the Golgi cisternae add carbohydrate moieties (glycosylation), cleave peptide sequences, and modify side chains.
- Disruption of this organelle halts cellular protein modification and maturation.

Why other options are incorrect:

- **Option A:** Lipid metabolism is handled mainly by the smooth endoplasmic reticulum and peroxisomes.
- **Option C:** Chromosome separation is coordinated by the spindle apparatus and centrioles.
- **Option D:** ATP synthesis occurs within the mitochondria.

Question #25 Key: (A)BIOLOGY
NUMS 2026*Where modification and packaging occur in secretory cells?***CORE CONCEPT & DERIVATION**

The Golgi apparatus serves as the intracellular sorting, modifying, and packaging hub for molecules destined for secretion.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Materials from the endoplasmic reticulum fuse with the cis-cisternae of the Golgi complex.
- After chemical modifications are completed, products are sorted and enclosed into membrane-bound secretory vesicles at the trans-Golgi network.

Why other options are incorrect:

- **Option B:** Mitochondria generate ATP through oxidative phosphorylation.
- **Option C:** The endoplasmic reticulum carries out primary polypeptide synthesis and lipid assembly.
- **Option D:** The nucleus contains chromosomal DNA and manages gene transcription.

Question #26 Key: (D)BIOLOGY
NUMS 2026*A person continuously faces water imbalance in body due to damage of which part of the brain?***CORE CONCEPT & DERIVATION**

The hypothalamus contains osmoreceptor centers that regulate thirst and synthesizes antidiuretic hormone to maintain systemic water homeostasis.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Hypothalamic osmoreceptors detect variations in blood osmolarity.
- The supraoptic and paraventricular nuclei of the hypothalamus produce ADH (vasopressin), which is transported to the posterior pituitary for release.
- Lesions in the hypothalamus abolish ADH production, leading to severe water loss and fluid imbalance.

Why other options are incorrect:

- **Option A:** The amygdala processes emotional memory and fear responses.
- **Option B:** The thalamus functions as a relay center for ascending sensory pathways.
- **Option C:** The medulla controls autonomic cardiopulmonary rhythms.

Question #27 Key: (B)BIOLOGY
NUMS 2026*Which part of brain is activated to release excess CO₂ from body produced during strenuous exer...***CORE CONCEPT & DERIVATION**

The respiratory rhythmicity center in the medulla oblongata monitors cerebrospinal fluid acidity and coordinates ventilation to expel carbon dioxide.

Formula / Rule / Reaction:**Solution:**

- Strenuous exercise elevates metabolic carbon dioxide in the blood.
- Carbon dioxide diffuses across the blood-brain barrier into cerebrospinal fluid, forming carbonic acid and increasing hydrogen ion concentration.
- Chemosensitive areas in the medulla oblongata detect this acidosis and stimulate hyperventilation to blow off excess carbon dioxide.

Why other options are incorrect:

- **Option A:** The pons contains the pneumotaxic and apneustic centers that modulate respiratory patterns, but the primary chemo-sensing rhythm center resides in the medulla.
- **Option C:** The cerebellum coordinates muscular balance and posture.
- **Option D:** The cerebrum regulates conscious thought and voluntary movement.

Question #28 Key: (B)BIOLOGY
NUMS 2026*The cerebrospinal fluid (CSF) is present between:***CORE CONCEPT & DERIVATION**

Cerebrospinal fluid circulates within the subarachnoid space, which is anatomically situated between the middle arachnoid mater and the inner pia mater.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- The brain and spinal cord are enclosed by three meningeal layers: the outer dura mater, middle arachnoid mater, and inner pia mater.
- The fluid-filled anatomical cavity between the arachnoid and pia layers is the subarachnoid space.
- This space contains the circulating cerebrospinal fluid.

Why other options are incorrect:

- **Option A:** The interface between dura mater and arachnoid mater is the subdural space, which contains minimal serous fluid.
- **Option C:** The dura mater and pia mater are separated by the intervening arachnoid layer.
- **Option D:** Identical to Option A and describes the subdural boundary.

Question #29 Key: (A)BIOLOGY
NUMS 2026*What is the role of growth hormone after adolescence?***CORE CONCEPT & DERIVATION**

Following epiphyseal plate closure at adolescence, growth hormone maintains tissue mass by stimulating amino acid uptake and protein synthesis.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Growth hormone stimulates cellular uptake of free amino acids across plasma membranes.
- It promotes translation and transcription to support ongoing protein synthesis for tissue replacement and muscle maintenance.

Why other options are incorrect:

- **Option B:** Growth hormone is an anabolic agent; it stimulates rather than inhibits protein synthesis.
- **Option C:** Growth hormone accelerates amino acid transport into cells.
- **Option D:** Growth hormone supports basal cellular replacement rather than inhibiting division.

Question #30 Key: (B)BIOLOGY
NUMS 2026*Which of the following is correct function of calcitonin?***CORE CONCEPT & DERIVATION**

Calcitonin is a hypocalcemic hormone secreted by the thyroid gland that lowers blood calcium levels by suppressing osteoclastic bone resorption and inhibiting intestinal calcium absorption.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- When systemic blood calcium rises above normal, the thyroid gland secretes calcitonin.
- Calcitonin acts antagonistically to parathyroid hormone by inhibiting bone breakdown and suppressing intestinal uptake of calcium ions.
- These coordinated actions return circulating calcium levels back down to baseline.

Why other options are incorrect:

- **Option A:** Bone resorption is stimulated by parathyroid hormone, not calcitonin.
- **Option C:** Increasing renal calcium reabsorption is mediated by parathyroid hormone.
- **Option D:** Calcitonin lowers blood calcium levels.

Question #31 Key: (B)BIOLOGY
NUMS 2026*What is secreted when the levels of blood glucose get too low?***CORE CONCEPT & DERIVATION**

Hypoglycemia triggers the alpha cells of the pancreatic islets of Langerhans to release glucagon, which promotes hepatic glycogenolysis.

Formula / Rule / Reaction:**Solution:**

- When blood glucose falls below physiological set points, pancreatic alpha cells detect the drop.
- They release glucagon into the portal circulation.
- Glucagon binds to hepatocytes to stimulate glycogen breakdown and gluconeogenesis, releasing glucose into the blood.

Why other options are incorrect:

- **Option A:** Calcitonin regulates systemic calcium balance.
- **Option C:** Insulin is secreted by beta cells in response to hyperglycemia.
- **Option D:** Corticoids respond to prolonged systemic stress rather than acute blood glucose drops.

Question #32 Key: (A)BIOLOGY
NUMS 2026*Pathway followed by nerve impulse during reflex action is:***CORE CONCEPT & DERIVATION**

In a spinal reflex arc, the axon terminal of an interneuron releases neurotransmitters across the synapse to the dendrites of the motor neuron, which conduct the signal to its soma.

Formula / Rule / Reaction:

Interneuron axon → Synapse → Motor neuron dendrites → Motor neuron soma

Solution:

- Action potentials reach the presynaptic terminal of the interneuron.
- Neurotransmitter molecules diffuse across the synaptic cleft to ligand-gated receptors on the postsynaptic dendrites of the motor neuron.
- The resulting graded potentials travel toward the motor neuron soma to initiate an action potential.

Why other options are incorrect:

- **Option B:** Erroneously places the dendrite upstream of the synaptic cleft.
- **Option C:** Bypasses the dendrites, which are the main receptive structures of multipolar motor neurons.
- **Option D:** Fails to include the synapse.

Question #33 Key: (B)BIOLOGY
NUMS 2026

Identify the animals having both mammalian and reptilian features:

CORE CONCEPT & DERIVATION

Monotremes (Prototheria), such as the spiny anteater, are primitive egg-laying mammals that display a combination of reptilian and mammalian anatomical traits.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- Reptilian characteristics of the spiny anteater include laying shelled cleidoic eggs and possessing a cloaca.
- Mammalian characteristics include hair covering the body, homeothermy, and milk-secreting mammary glands.

Why other options are incorrect:

- **Option A:** Mice are placental eutherians without primitive reptilian reproductive traits.
- **Option C:** The opossum is a metatherian marsupial mammal.
- **Option D:** Bats are placental flying mammals belonging to the order Chiroptera.

Question #34 Key: (A)BIOLOGY
NUMS 2026

An enzyme which requires a cofactor to become active is called:

CORE CONCEPT & DERIVATION

An apoenzyme is the catalytically inactive protein portion of an enzyme that strictly requires the addition of a specific non-protein cofactor to exhibit catalytic activity.

Formula / Rule / Reaction:**Solution:**

- According to the Punjab Textbook Board, an enzyme stripped of its cofactor is catalytically inactive and is termed an apoenzyme.
- When the required cofactor binds to the apoenzyme, it forms the functional holoenzyme.

Why other options are incorrect:

- **Option B:** Holoenzyme is the fully assembled, catalytically active enzyme-cofactor complex.
- **Option C:** A prosthetic group is a tightly or covalently bound non-protein cofactor.
- **Option D:** A co-enzyme is a dialyzable non-protein organic cofactor.

Question #35 Key: (C)BIOLOGY
NUMS 2026

Which statement best describes competitive inhibitors?

CORE CONCEPT & DERIVATION

Competitive inhibitors resemble the substrate structurally and bind directly to the active site, blocking substrate access and preventing enzyme-product complex formation.

Formula / Rule / Reaction:**Solution:**

- A competitive inhibitor occupies the catalytic active site of the free enzyme.
- Because the active site is blocked, the substrate cannot bind to form the enzyme-substrate (ES) complex.
- Consequently, catalysis cannot proceed and no enzyme-product (EP) complex is formed.

Why other options are incorrect:

- **Option A:** Competitive inhibition is reversible and does not denature the enzyme.
- **Option B:** Being used as drugs is an application rather than a defining mechanistic description.
- **Option D:** Altering enzyme conformation via allosteric binding describes non-competitive inhibition.

Question #36 Key: (A)BIOLOGY
NUMS 2026

Due to snake bite a person's heart stops working. Which type of venom will be found in his body...

CORE CONCEPT & DERIVATION

Hemotoxic venoms target the cardiovascular and circulatory systems, causing hemolysis, extensive hemorrhage, myocardial collapse, and cardiac arrest.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- Snake venoms are classified according to their primary physiological target.
- Hemotoxic venoms attack red blood cells, blood vessels, and myocardial tissue, causing acute circulatory collapse and heart failure.
- In contrast, neurotoxic venoms target peripheral motor neurons to induce respiratory paralysis.

Why other options are incorrect:

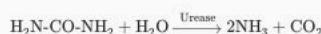
- **Option B:** Hepatotoxic substances specifically damage the liver parenchyma.
- **Option C:** Neurotoxic venoms disrupt nerve conduction and neuromuscular junctions, leading to respiratory arrest rather than direct primary heart failure.
- **Option D:** Cytotoxic venoms cause localized tissue destruction and necrosis at the bite site.

Question #37 Key: (C)BIOLOGY
NUMS 2026

Identify the enzyme which shows absolute specificity:

CORE CONCEPT & DERIVATION

Absolute specificity describes an enzyme that catalyzes the chemical transformation of only one particular substrate.

Formula / Rule / Reaction:**Solution:**

- Urease exhibits absolute specificity because it acts exclusively on urea to produce ammonia and carbon dioxide.
- It does not hydrolyze any other chemically related amide or substituted urea compound.

Why other options are incorrect:

- **Option A:** Carbonic anhydrase acts on hydration of CO_2 and related analogs.
- **Option B:** Hexokinase displays group specificity, phosphorylating several different hexose sugars including D-glucose, D-fructose, and D-mannose.
- **Option D:** Isomerase is a broad enzyme class encompassing many different isomer-converting catalysts.

Question #38 Key: (B)BIOLOGY
NUMS 2026

Some industries are continuously polluting aquatic bodies. This can affect metabolic pathway of...

CORE CONCEPT & DERIVATION

Industrial effluents containing acidic compounds and acid-forming non-metal oxides lower the pH of aquatic bodies, making them more acidic and impairing plant enzyme systems.

Formula / Rule / Reaction:**Solution:**

- Discharge of untreated chemical and industrial wastes into waterways introduces strong acids and acidic precursors.
- This reduces the pH of the aquatic environment, shifting it toward more acidic conditions.
- Acidic conditions denature plant enzymes and disrupt photosynthetic metabolic pathways.

Why other options are incorrect:

- **Option A:** Industrial pollution typically lowers environmental pH rather than increasing alkalinity.
- **Option C:** Acidic pollution increases acidity rather than making water bodies less acidic.
- **Option D:** Less alkaline does not describe the pronounced shift to an acidic environment.

Question #39 Key: (A)BIOLOGY
NUMS 2026

All flowering plants are thought to be evolved from a common ancestor on the basis of which hom...

CORE CONCEPT & DERIVATION

Flowering plants share a common evolutionary origin evidenced by the homology of the four concentric floral whorls, which represent modified leaves specialized for reproduction and protection.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- Comparative morphological studies demonstrate that sepals, petals, stamens, and carpels are homologous structures derived from ancestral foliar appendages.
- The uniform presence and developmental arrangement of these four basic whorls across angiosperm families support descent from a common ancestral angiosperm.

Why other options are incorrect:

- **Option B:** The thalamus is the receptacle or swollen stem apex, not one of the primary homologous floral appendage whorls.
- **Option C:** The stalk (pedicel) and thalamus are modified stem structures rather than the modified homologous leaf whorls.
- **Option D:** Omits the corolla (petals) while erroneously substituting the vegetative thalamus.

Question #40 Key: (D)BIOLOGY
NUMS 2026

Barriers which effect geographical distribution of life are:

CORE CONCEPT & DERIVATION

The geographical distribution of living organisms is restricted by physical barriers, ecological interactions, and environmental or climatic boundaries that limit species dispersal.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- Physical barriers include topographical obstacles such as mountain ranges, wide bodies of water, and deserts that physically block migration.
- Ecological barriers involve biotic limitations, such as competitive exclusion, predation pressure, and absence of mutualistic partners.
- Environmental barriers comprise climatic constraints including extremes of temperature, humidity, and photoperiod.

Why other options are incorrect:

- **Option A:** Omits ecological constraints and presents an incomplete classification.
- **Option B:** Lacks ecological competition and habitat-interaction parameters.
- **Option C:** Omits physical geography, which is the primary barrier to migration.

Question #41 Key: (C)BIOLOGY
NUMS 2026

Why are some genes called pseudoautosomal, even though they are present on sex chromosome?

CORE CONCEPT & DERIVATION

Pseudoautosomal genes reside within homologous regions present on both the X and Y sex chromosomes, enabling them to pair, recombine, and exhibit Mendelian autosomal inheritance patterns.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- The ends of the human sex chromosomes contain homologous sequences designated as pseudoautosomal regions.
- Because both males and females carry two functional copies of these genes (one on each sex chromosome), their transmission mimics that of standard autosomal traits.
- This dual presence on both X and Y chromosomes allows regular meiotic crossing over between heteromorphic sex chromosomes.

Why other options are incorrect:

- **Option A:** Genes located solely on the non-homologous region of the X chromosome are X-linked, not pseudoautosomal.
- **Option B:** Genes located solely on the Y chromosome are holandric (Y-linked).
- **Option D:** Pseudoautosomal genes are physically anchored to the distal segments of both sex chromosomes.

Question #42 Key: (A)BIOLOGY
NUMS 2026

As a result of natural disaster, few species continue to survive due to their characteristics. ...

CORE CONCEPT & DERIVATION

Natural selection acting via environmental catastrophes selects for phenotypes possessing adaptive survival traits, leading to an increase in the frequency of favorable alleles in surviving generations.

Formula / Rule / Reaction:

$$\Delta q = \frac{spq^2}{1 - sq^2}$$

Solution:

- Severe environmental pressures eliminate individuals lacking adaptive survival characteristics.
- The surviving individuals carry genetic variants that conferred resistance or tolerance to the adverse conditions.
- Differential reproductive success among the survivors increases the relative representation and frequency of these favorable alleles in the subsequent gene pool.

Why other options are incorrect:

- **Option B:** Favorable alleles become more frequent in surviving populations, not less frequent.
- **Option C:** Unfavorable alleles lead to selective mortality and consequently diminish in frequency.
- **Option D:** While deleterious alleles may decline, natural selection primarily operates to increase the prevalence of favorable alleles among survivors.

Question #43 Key: (A)BIOLOGY
NUMS 2026

Which of these correctly order the structure of arteries?

CORE CONCEPT & DERIVATION

Arterial walls consist of three concentric histological tunics: the external connective tissue layer, the intermediate muscular and elastic layer, and the internal endothelial lining.

Formula / Rule / Reaction:

Tunica externa → Tunica media → Tunica intima

Solution:

- Tunica externa forms the outermost sheath and is composed primarily of protective collagenous connective tissue.
- Tunica media is the middle layer and consists of circular smooth muscle fibers combined with abundant elastic tissue to withstand systolic pressures.
- Tunica intima forms the innermost surface lined with simple squamous endothelium facing the vascular lumen.
- From exterior to interior, the histological sequence is connective tissue, smooth muscle, elastic tissue, and endothelium.

Why other options are incorrect:

- **Option B:** Places the luminal endothelium outside the elastic tissue lamina.
- **Option C:** Incorrectly positions elastic tissue on the outermost external boundary.
- **Option D:** Erroneously places smooth muscle at the outer surface rather than connective tissue.

Question #44 Key: (B)BIOLOGY
NUMS 2026*Epidermis is outer most layer of the skin, which is composed of:***CORE CONCEPT & DERIVATION**

The epidermis is a keratinized stratified squamous epithelium characterized by tightly packed sheets of epithelial cells joined by intercellular desmosomes to provide a barrier against desiccation and pathogen entry.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Epithelial tissues contain minimal extracellular matrix between adjacent cells.
- In the epidermis, keratinocytes are tightly packed and anchored together through cell junctions.
- This dense arrangement creates a physical barrier that resists mechanical abrasion and prevents systemic water loss.

Why other options are incorrect:

- **Option A:** Loosely arranged cells with abundant matrix are characteristic of loose connective tissue, not epithelial sheets.
- **Option C:** Scattered cells are found in specialized connective tissues and immune niches.
- **Option D:** Ciliated epithelial cells line the lumen of the respiratory tract and oviducts, not cutaneous epidermis.

Question #45 Key: (B)BIOLOGY
NUMS 2026*Which type of muscle controls the movement of substance through hollow organs?***CORE CONCEPT & DERIVATION**

Smooth muscle consists of non-striated, involuntary, spindle-shaped myofibril cells that form the contractile walls of hollow internal viscera.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Hollow visceral organs such as the stomach, intestines, urinary bladder, uterus, and blood vessels require involuntary contractility.
- Smooth muscle tissue forms concentric and longitudinal layers within these organs.
- Coordinated, sustained contractions known as peristalsis propel fluids, digested chyme, and excretory products through these lumens.

Why other options are incorrect:

- **Option A:** Cardiac muscle tissue is restricted exclusively to the myocardium of the heart.
- **Option C:** Sphincter is an anatomical term describing circular ring arrangements of either skeletal or smooth muscle, rather than a distinct primary muscle tissue class.
- **Option D:** Skeletal muscle is striated voluntary muscle attached to the skeleton to effect somatic locomotion.

Question #46 Key: (C)BIOLOGY
NUMS 2026*Smallest contractile unit of muscle fibers present between two lines is known as:***CORE CONCEPT & DERIVATION**

The sarcomere is the fundamental structural and functional contractile unit of striated muscle, delimited at each end by a transverse Z-line.

Formula / Rule / Reaction:
$$\text{Contractile Unit} = \text{Segment between two adjacent Z-lines}$$
Solution:

- Myofibrils in striated skeletal and cardiac muscle are organized into repeating longitudinal subunits.
- The region of a myofibril situated between two successive Z-lines constitutes one sarcomere.
- Shortening of sarcomeres via sliding of thin actin filaments over thick myosin filaments produces overall muscle contraction.

Why other options are incorrect:

- **Option A:** Sarcoplasm is the cytoplasmic fluid surrounding the myofibrils in a muscle cell.
- **Option B:** Sarcolemma is the specialized excitable plasma membrane enclosing a muscle fiber.
- **Option D:** Sarcodina is a taxonomic subphylum of amoeboid protozoans.

Question #47 Key: (B)BIOLOGY
NUMS 2026*Which ion is responsible for the attachment of tropomyosin with the head of myosin during cross...***CORE CONCEPT & DERIVATION**

Excitation-contraction coupling relies on the release of divalent calcium ions from the sarcoplasmic reticulum, which bind troponin to displace tropomyosin and enable cross-bridge cycling.

Formula / Rule / Reaction:
$$\text{Ca}^{2+} + \text{Troponin C} \rightarrow \text{Tropomyosin shift} \rightarrow \text{Actin-Myosin cross-bridge}$$
Solution:

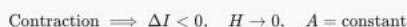
- Depolarization propagating through transverse tubules triggers the opening of ryanodine channels, releasing calcium ions into the sarcoplasm.
- Calcium ions bind to the troponin complex.
- This binding induces a conformational change that shifts inhibitory tropomyosin away from the active myosin-binding sites on actin filaments, initiating cross-bridge attachment.

Why other options are incorrect:

- **Option A:** Potassium ions maintain resting membrane potentials across excitable membranes.
- **Option C:** Sodium ions drive the depolarizing phase of action potentials along the sarcolemma.
- **Option D:** Magnesium serves as an enzymatic cofactor for ATP hydrolysis, but does not mediate steric shifting of troponin-tropomyosin.

Question #48 Key: (C)BIOLOGY
NUMS 2026*During muscle contraction which type of events occurs respectively?***CORE CONCEPT & DERIVATION**

According to the sliding filament hypothesis, muscle shortening occurs as thin actin filaments slide past thick myosin filaments into the central A band, resulting in shortening of the I band and disappearance of the H-zone.

Formula / Rule / Reaction:**Solution:**

- During myofibril contraction, actin filaments are pulled inward toward the center of the sarcomere by myosin cross-bridge power strokes.
- The isotropic I bands contain only thin filaments and narrow significantly as the overlap increases.
- The central H-zone, which represents the bare area of myosin lacking actin overlap at rest, is fully occluded by the converging actin filaments and disappears.

Why other options are incorrect:

- **Option A:** The H-zone disappears during contraction rather than appearing.
- **Option B:** I band strengthen is non-scientific terminology that fails to describe structural shortening.
- **Option D:** Fails to correctly describe the dimensional reduction of either band.

Question #49 Key: (C)BIOLOGY
NUMS 2026*Which one of the following organism is responsible for transforming nitrogen gas into ammonium?***CORE CONCEPT & DERIVATION**

Biological nitrogen fixation is carried out by nitrogen-fixing prokaryotes such as Rhizobium, which utilize the nitrogenase enzyme complex to reduce molecular dinitrogen gas into ammonium.

Formula / Rule / Reaction:**Solution:**

- Rhizobium species form mutualistic symbiotic root nodules on leguminous plants.
- Within the bacteroids, nitrogenase reduces inert atmospheric nitrogen gas directly into ammonia, which protonates into ammonium.
- This organic conversion provides usable assimilable nitrogen to the host plant.

Why other options are incorrect:

- **Option A:** While certain cyanobacteria can fix nitrogen, Rhizobium is the designated symbiotic organism emphasized in medical entrance syllabi for direct transformation into plant ammonium.
- **Option B:** Nitrobacter is a nitrifying bacterium that oxidizes nitrite into nitrate.
- **Option D:** Nitrosomonas is a chemoautotrophic bacterium that oxidizes ammonium into nitrite.

Question #50 Key: (A)BIOLOGY
NUMS 2026*Identify one of the following chemo-therapeutic agent used to control bacterial infections:***CORE CONCEPT & DERIVATION**

Chemotherapeutic agents are synthetic or biological chemical compounds administered internally to selectively destroy or inhibit infectious microorganisms without causing host toxicity.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Nitrofurans represent a recognized class of synthetic broad-spectrum chemotherapeutic antibacterial agents.
- They are metabolized by bacterial nitroreductases into reactive intermediates that induce ribosomal and DNA damage in bacterial pathogens.
- They are clinically indicated in urinary tract infections and systemic veterinary treatments.

Why other options are incorrect:

- **Option B:** Hydrogen peroxide is an oxidizing topical antiseptic and disinfectant, not an internal chemotherapeutic drug.
- **Option C:** Sodium hypochlorite is a non-selective chemical disinfectant and bleach unsuitable for internal therapy.
- **Option D:** Potassium sorbate is an antifungal and antibacterial chemical food preservative.

Question #51 Key: (C)BIOLOGY
NUMS 2026*Why male gonads are present outside the body?***CORE CONCEPT & DERIVATION**

Spermatogenesis in human males is thermally sensitive and requires an environment 2 to 3 degrees Celsius lower than core abdominal body temperature, which is achieved by housing the testes in the scrotum.

Formula / Rule / Reaction:

$$T_{\text{scrotal}} \approx T_{\text{core}} - (2^\circ\text{C to } 3^\circ\text{C}) \approx 34^\circ\text{C} - 35^\circ\text{C}$$

Solution:

- The internal core body temperature of approximately 37 degrees Celsius causes thermal denaturation of enzymes required for spermatogenic cell division and sperm maturation.
- The external descent of testes into the scrotal sac permits convective cooling, maintaining a local temperature approximately 2 degrees Celsius below basal core temperature.
- This cooler environment is mandatory for viable gamete production and storage.

Why other options are incorrect:

- **Option A:** Exposure to normal core body temperature impairs meiosis and leads to cryptorchidism-associated infertility.
- **Option B:** Elevated temperatures suppress spermatogenesis and induce germinal epithelial degeneration.
- **Option D:** Vague non-specific phrasing that lacks physiological temperature values.

Question #52 Key: (D)BIOLOGY
NUMS 2026

Which set of events will occur if fusion of gametes does NOT take place?

CORE CONCEPT & DERIVATION

In the absence of fertilization, human chorionic gonadotropin is not produced, causing the corpus luteum to regress, which precipitates a sharp drop in both luteinizing hormone and progesterone.

Formula / Rule / Reaction:**Solution:**

- Without embryonic implantation, there is no trophic stimulation from trophoblastic hCG to rescue the corpus luteum.
- Luteinizing hormone levels fall during the late secretory phase as negative feedback from prior luteal steroids dampens hypothalamic GnRH pulses.
- The corpus luteum degenerates into fibrous corpus albicans tissue.
- Steroidogenesis collapses, causing systemic progesterone concentrations to decline and triggering menstruation.

Why other options are incorrect:

- **Option A:** Progesterone levels decline precipitously rather than increasing.
- **Option B:** Incorrectly states that progesterone increases following luteal regression.
- **Option C:** LH does not increase during luteal regression; it remains suppressed until the next follicular recruitment phase begins.

Question #53 Key: (D)BIOLOGY
NUMS 2026

Which of the following is correct order of the transport of bicarbonate from blood to lungs?

CORE CONCEPT & DERIVATION

In pulmonary capillaries, bicarbonate stored in venous plasma shifts back into red blood cells, is converted into carbon dioxide gas, diffuses across capillary endothelium, and enters the alveolar air sacs.

Formula / Rule / Reaction:**Solution:**

- At the respiratory surface, plasma bicarbonate re-enters red blood cells via reversed chloride shift.
- Carbonic anhydrase within erythrocytes catalyzes the dehydration of carbonic acid into molecular carbon dioxide and water.
- Carbon dioxide gas leaves the erythrocytes, diffuses through the pulmonary capillary wall, and crosses the respiratory membrane into the alveoli for exhalation.

Why other options are incorrect:

- **Option A:** Reverses the biological direction of gas diffusion by placing red blood cells downstream of alveoli.
- **Option B:** Incorrectly places alveoli before the pulmonary capillary interface.
- **Option C:** Describes the pathway of atmospheric gas inhalation rather than excretory bicarbonate clearance.

Question #54 Key: (C)BIOLOGY
NUMS 2026

Which set of digestive enzymes play a vital role in breakdown of protein?

CORE CONCEPT & DERIVATION

Proteolytic enzymes sequentially hydrolyze peptide linkages along protein chains: pepsin acts in the gastric lumen, trypsin acts in the duodenum, and erepsin completes peptide digestion in the small intestine.

Formula / Rule / Reaction:**Solution:**

- Pepsin is secreted as inactive pepsinogen by gastric chief cells and cleaves internal peptide bonds under acidic conditions.
- Trypsin is secreted as trypsinogen by the pancreas and hydrolyzes polypeptide chains into smaller oligopeptides under alkaline conditions.
- Erepsin is an intestinal peptidase mixture that cleaves small peptides into free amino acids ready for absorption.

Why other options are incorrect:

- **Option A:** Maltase is a carbohydrase that hydrolyzes maltose into two glucose units.
- **Option B:** Amylase is a glycolytic enzyme that breaks starch down into maltose.
- **Option D:** Amylase digests starch and lipase hydrolyzes dietary triglycerides.

Question #55 Key: (D)BIOLOGY
NUMS 2026

Gene of one allele which inhibits the effect of other allele at different locus is called as:

CORE CONCEPT & DERIVATION

Epistasis is a non-allelic gene interaction in which an allele at one locus masks, suppresses, or inhibits the phenotypic expression of an allele at a completely distinct locus.

Formula / Rule / Reaction:**Solution:**

- When an allele masks the phenotype determined by a separate non-allelic gene, the masking locus is termed epistatic.
- The suppressed or overridden gene located at the alternate locus is designated as hypostatic.
- Therefore, the gene that carries out the inhibition is the epistatic gene.

Why other options are incorrect:

- **Option A:** The hypostatic gene is the one whose phenotypic expression is masked, not the one that causes inhibition.
- **Option B:** Hypostatic is a non-biological distractor term.
- **Option C:** Polystatic is an invalid genetic term.

Question #56 Key: (B)CHEMISTRY
NUMS 2026Which of the following is equal to 1 mole of Na^+ ?**CORE CONCEPT & DERIVATION**

One mole of any chemical species corresponds to Avogadro's number of elementary entities, which are discrete ions in the case of ionic charges.

Formula / Rule / Reaction:

$$1 \text{ mole of particles} = 6.022 \times 10^{23} \text{ entities}$$

Solution:

- The chemical species specified is the sodium cation, denoted Na^+ .
- Because Na^+ carries a net positive charge due to the loss of a valence electron, its individual units are classified as ions rather than neutral atoms.
- Therefore, exactly one mole of Na^+ contains 6.02×10^{23} sodium ions.

Why other options are incorrect:

- **Option A:** Neutral metallic sodium comprises atoms, but charged Na^+ represents ionic species.
- **Option C:** Uses a negative exponent of 10^{-23} and misclassifies the ions as atoms.
- **Option D:** Inverts Avogadro's number to an infinitesimally small fractional value of 10^{-23} .

Question #57 Key: (D)CHEMISTRY
NUMS 2026The e/m value for positive rays depends upon nature of gas used because:**CORE CONCEPT & DERIVATION**

Positive rays consist of residual gaseous cations formed by ionization, whose charge-to-mass ratio depends on both the ionic charge (electrons removed) and the total nuclear mass (protons and neutrons).

Formula / Rule / Reaction:

$$\frac{e}{m} = \frac{z \cdot e_0}{M_{\text{ion}}}$$

Solution:

- Unlike cathode rays which are identical fundamental electrons, positive ray particles originate from gas molecules ionized inside the discharge tube.
- The net ionic charge e is governed by the number of electrons stripped from the valence shell relative to the nuclear charge.
- The mass m is governed primarily by the number of protons and neutrons making up the nucleus of that specific gas.
- Consequently, e/m depends on both the proton content determining atomic identity and mass, and the electronic configuration determining ionization charge.

Why other options are incorrect:

- **Option A:** Mass is not determined by electrons, as electron mass is negligible compared to the atomic nucleus.
- **Option B:** Neutrons carry no net charge and cannot account for the charge component e .
- **Option C:** While protons determine nuclear mass and atomic number, the magnitude of charge e requires loss of orbital electrons.

Question #58 Key: (A)

CHEMISTRY
NUMS 2026

Select the correct increasing energy order of orbitals?

CORE CONCEPT & DERIVATION

According to the Aufbau principle and the $(n + l)$ rule, atomic subshells fill in order of increasing total quantum value, with ties resolved by lower principal quantum number n .

Formula / Rule / Reaction:

$$E \propto (n + l)$$

Solution:

- For $4s$: $n = 4, l = 0 \Rightarrow n + l = 4$.
- For $3d$: $n = 3, l = 2 \Rightarrow n + l = 5$.
- For $4p$: $n = 4, l = 1 \Rightarrow n + l = 5$; since $n = 4 > 3$, $4p$ has higher energy than $3d$.
- For $5s$: $n = 5, l = 0 \Rightarrow n + l = 5$; since $n = 5 > 4$, $5s$ has higher energy than $4p$.
- Arranging in strict ascending order gives: $4s < 3d < 4p < 5s$.

Why other options are incorrect:

- Option B:** Mixes greater-than and less-than relational signs inconsistently.
- Option C:** Displays an inverted descending sequence with incorrect relative inequalities.
- Option D:** Inverts the inequality signs, depicting a descending rather than increasing sequence.

Question #59 Key: (D)

CHEMISTRY
NUMS 2026

Which of the following expressions represent Boyle's law?

CORE CONCEPT & DERIVATION

Boyle's law states that at constant temperature, the volume of a fixed mass of an ideal gas is inversely proportional to the applied pressure, yielding a constant pressure-volume product.

Formula / Rule / Reaction:

$$P \propto \frac{1}{V} \Rightarrow PV = k \Rightarrow P_1V_1 = P_2V_2$$

Solution:

- For an ideal gas held at constant absolute temperature and mole quantity, doubling the pressure halves the volume.
- The mathematical product of pressure and volume at an initial state must equal the product at a final state.
- Therefore, the law is represented by the linear relation $P_1V_1 = P_2V_2$.

Why other options are incorrect:

- Option A:** Represents a direct proportionality relation $P/V = k$, which contradicts inverse gas compression behavior.
- Option B:** States an inequality for an incorrect direct ratio.
- Option C:** Uses a non-equality operator which denies the fundamental constancy of the PV product.

Question #60 Key: (C)

CHEMISTRY
NUMS 2026

Which Celsius temperature represents zero kelvin or absolute zero?

CORE CONCEPT & DERIVATION

Absolute zero is the theoretical thermodynamic temperature at which all translational kinetic motion ceases, corresponding to zero kelvin or -273.16°C according to textbook standards.

Formula / Rule / Reaction:

$$T(\text{K}) = t(^{\circ}\text{C}) + 273.16 \Rightarrow 0 = t + 273.16 \Rightarrow t = -273.16^{\circ}\text{C}$$

Solution:

- The absolute temperature scale defines zero kelvin (0 K) as its origin.
- Converting 0 K to the Celsius scale by subtracting the thermodynamic offset constant 273.16 yields -273.16°C .

Why other options are incorrect:

- Option A:** 0°C represents the freezing point of water at standard atmospheric pressure, equal to 273.16 K.
- Option B:** $+273.16^{\circ}\text{C}$ represents a positive Celsius temperature equivalent to 546.32 K.
- Option D:** 25°C corresponds to standard room temperature (298.16 K).

Question #61 Key: (D)

CHEMISTRY
NUMS 2026

An egg takes 5 minutes to boil at sea level while 10 minutes at Murree hills because of:

CORE CONCEPT & DERIVATION

The boiling point of a liquid is directly proportional to external atmospheric pressure; elevated altitudes exhibit reduced atmospheric pressure, lowering the boiling point of water and prolonging cooking times.

Formula / Rule / Reaction:

$$P_{\text{ext}} = P_{\text{vap}} \quad (\text{Condition for boiling})$$

Solution:

- At high altitudes such as Murree hills, the atmospheric column is shorter, causing lower external atmospheric pressure than at sea level.
- Water boils when its vapor pressure equals the prevailing external pressure.
- Because external pressure is reduced, water boils at a lower temperature (below 100°C).
- Cooking involves heat transfer that proceeds more slowly at lower boiling temperatures, requiring 10 minutes instead of 5 minutes to boil an egg.

Why other options are incorrect:

- Option A:** The vapor pressure of water depends solely on its temperature, not on altitude.
- Option B:** Liquid vapor pressure is not elevated by high altitude.
- Option C:** High external pressure occurs in deep valleys or pressure cookers, which elevates the boiling point and accelerates cooking.

Question #62 Key: (C)

CHEMISTRY
NUMS 2026

Fluorine is a gas and Iodine is a solid at room temperature due to:

CORE CONCEPT & DERIVATION

Down the halogen group, increasing atomic size and number of electron shells expand the polarizability of the electron cloud, strengthening intermolecular London dispersion forces.

Formula / Rule / Reaction:

$$\text{Polarizability } (\alpha) \propto \text{Number of electrons} \implies \text{London dispersion forces} \propto \alpha$$

Solution:

- Fluorine has a compact electron cloud with only 9 electrons per atom, resulting in low polarizability and weak dispersion forces that permit it to exist as a gas.
- Iodine contains 53 electrons per atom distributed across larger shells far from the nucleus, giving it very high polarizability.
- This substantial polarizability produces strong temporary dipole attractions that pack I_2 molecules into a solid crystal lattice at room temperature.

Why other options are incorrect:

- Option A:** Fluorine has the highest electronegativity, but electronegativity does not dictate intermolecular physical aggregation in non-polar halogens.
- Option B:** Low electronegativity is an intrinsic atomic property that does not directly generate cohesive intermolecular forces.
- Option D:** Low polarizability corresponds to weaker dispersion forces, which would favor a gaseous state rather than a solid state.

Question #63 Key: (C)

CHEMISTRY
NUMS 2026

Ionic solids are bad conductors of heat and electricity because:

CORE CONCEPT & DERIVATION

Electrical conduction requires mobile charge carriers; in solid ionic lattices, electrostatic attractions bind ions firmly into fixed coordinates, restricting them to vibrational motion.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- In crystalline ionic solids, cations and anions occupy rigid three-dimensional lattice sites held by non-directional electrostatic attractions.
- There are neither delocalized valence electrons nor mobile ions available to migrate under an applied electric field.
- The ions are confined to vibrational oscillation about their mean positions, preventing electrical conduction in the solid state.

Why other options are incorrect:

- Option A:** Ionic solids contain ionic bonds rather than covalent bonds.
- Option B:** Ionic solids are macromolecular ionic lattices rather than discrete molecular units held by intermolecular forces.
- Option D:** Free ionic mobility occurs only in the molten state or in aqueous solution, not in the solid state.

Question #64 Key: (A)

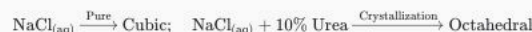
CHEMISTRY
NUMS 2026

If 10% urea is present in aqueous solution of sodium chloride, what will be the shape of crystal...

CORE CONCEPT & DERIVATION

Crystal habit describes the external geometry of a crystal; changing growth conditions or introducing impurities such as 10% urea modifies the habit of sodium chloride from cubic to octahedral.

Formula / Rule / Reaction:



Solution:

- Under normal conditions, sodium chloride crystallizes from pure aqueous solutions as cubic crystals.
- When 10% urea is added to the mother liquor, urea molecules selectively adsorb onto the {111} faces of the growing crystals.
- This preferential adsorption suppresses crystal growth along those specific faces, changing the crystal habit into an octahedral geometry.

Why other options are incorrect:

- Option B:** Triclinic is an asymmetric crystal system characterized by unequal axes and non-perpendicular angles.
- Option C:** Cubic shape is obtained only when NaCl crystallizes from pure water in the absence of urea.
- Option D:** Hexagonal geometry belongs to a different crystal family with sixfold rotational symmetry.

Question #65 Key: (A)

CHEMISTRY
NUMS 2026

$K_c = K_p$ when Δn is equal to:

CORE CONCEPT & DERIVATION

The relation between the gas-phase equilibrium constants K_p and K_c is modulated by the term $(RT)^{\Delta n}$, equating the two constants when the change in stoichiometric gaseous moles is zero.

Formula / Rule / Reaction:

$$K_p = K_c (RT)^{\Delta n}$$

Solution:

- The exponent Δn represents the difference between the moles of gaseous products and gaseous reactants: $\Delta n = \sum n_{\text{products}} - \sum n_{\text{reactants}}$.
- When $\Delta n = 0$, the term becomes $(RT)^0 = 1$.
- Substituting this into the equation yields $K_p = K_c(1)$, confirming that $K_p = K_c$.

Why other options are incorrect:

- Option B:** When $\Delta n = +1$, $K_p = K_c(RT)$, so $K_p > K_c$ at temperatures where $RT > 1$.
- Option C:** When $\Delta n = -1$, $K_p = K_c/(RT)$.
- Option D:** When $\Delta n = -2$, $K_p = K_c/(RT)^2$.

Question #66 Key: (D)

CHEMISTRY
NUMS 2026

The pH of human blood is maintained at:

CORE CONCEPT & DERIVATION

Human blood maintains a slightly alkaline physiological pH regulated within the narrow survival range of 7.35 to 7.45 by the carbonic acid-bicarbonate buffer system.

Formula / Rule / Reaction:

$$\text{pH} = \text{p}K_a + \log\left(\frac{[\text{HCO}_3^-]}{[\text{H}_2\text{CO}_3]}\right) = 6.1 + \log(20) \approx 7.40$$

Solution:

- Extracellular fluid pH is defended by the carbonic acid-bicarbonate buffer system alongside pulmonary and renal compensation.
- The normal clinical reference range for arterial human blood is 7.35 to 7.45.
- Among the provided options, 7.35 corresponds to the lower physiological baseline of normal human blood.

Why other options are incorrect:

- Option A:** A pH of 5.37 represents severe acidosis that is incompatible with human cellular life.
- Option B:** A pH of 5.73 represents critical fatal acidosis.
- Option C:** A pH of 7.53 reflects abnormal systemic alkalosis.

Question #67 Key: (D)

CHEMISTRY
NUMS 2026

The unit of rate constant is same as the rate of reaction in:

CORE CONCEPT & DERIVATION

The rate of a chemical reaction is expressed in units of concentration per unit time, which matches the units of the rate constant only when the reaction order is zero.

Formula / Rule / Reaction:

$$\text{Units of } k = (\text{mol dm}^{-3})^{1-n} \text{ s}^{-1}$$

Solution:

- Reaction rate is defined as change in concentration per unit time: $\text{mol dm}^{-3} \text{ s}^{-1}$.
- The differential rate equation for an n -th order reaction is $\text{Rate} = k[A]^n$.
- For a zero-order reaction ($n = 0$), the rate equation simplifies to $\text{Rate} = k[A]^0 = k$.
- Therefore, the unit of k for a zero-order reaction is identical to the rate of reaction: $\text{mol dm}^{-3} \text{ s}^{-1}$.

Why other options are incorrect:

- Option A:** For a third-order reaction ($n = 3$), the unit of k is $\text{mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$.
- Option B:** For a second-order reaction ($n = 2$), the unit of k is $\text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$.
- Option C:** For a first-order reaction ($n = 1$), the unit of k is s^{-1} .

Question #68 Key: (B)

CHEMISTRY
NUMS 2026

Which of the following represents Arrhenius constant expression?

CORE CONCEPT & DERIVATION

The Arrhenius equation mathematically quantifies the relationship between the rate constant of a reaction, its activation energy, and thermodynamic temperature.

Formula / Rule / Reaction:

$$k = Ae^{-\frac{E_a}{RT}}$$

Solution:

- In the Arrhenius relationship, k is the rate constant, A is the pre-exponential frequency factor, E_a is activation energy, R is the universal gas constant, and T is absolute temperature.
- The fraction of molecular collisions possessing kinetic energy equal to or greater than E_a is given by the Boltzmann factor $e^{-E_a/RT}$.
- Combining these factors gives the expression $k = Ae^{-E_a/RT}$.

Why other options are incorrect:

- Option A:** Omits the negative sign in the exponent and omits the universal gas constant R .
- Option C:** Inverts the activation energy and thermal energy quotient in the exponent.
- Option D:** Omits the pre-exponential frequency factor A .

Question #69 Key: (A)

CHEMISTRY
NUMS 2026

Which expression is according to the Hess's law?

CORE CONCEPT & DERIVATION

Hess's law of constant heat summation is an application of the first law of thermodynamics, dictating that the net enthalpy change over a complete closed cyclic path is zero.

Formula / Rule / Reaction:

$$\sum_{\text{cycle}} \Delta H = 0$$

Solution:

- Enthalpy H is a thermodynamic state function whose value depends solely on the current state of the system rather than the pathway taken.
- When a system completes a cycle and returns to its original initial state, the net change in any state function must evaluate to zero.
- Therefore, summing all stepwise enthalpy changes around a closed Born-Haber or chemical cycle yields $\sum \Delta H(\text{cycle}) = 0$.

Why other options are incorrect:

- Option B:** Arbitrary non-zero value violating the state function properties of enthalpy.
- Option C:** A closed cycle cannot produce a net enthalpy change of 3.
- Option D:** A closed cycle cannot produce a net enthalpy change of -1.

Question #70 Key: (B)

CHEMISTRY
NUMS 2026

Which of the following represents the expression of internal energy?

CORE CONCEPT & DERIVATION

According to the first law of thermodynamics, the change in the internal energy of a closed system equals the net heat added to the system plus the work done on the system.

Formula / Rule / Reaction:

$$\Delta E = q + w$$

Solution:

- Internal energy E is the sum of all microscopic kinetic and potential energies within a system.
- Energy can be transferred across system boundaries either as thermal heat (q) or mechanical work (w).
- Under IUPAC convention adopted in textbook syllabi, the algebraic statement of the first law is $\Delta E = q + w$.

Why other options are incorrect:

- Option A:** Incorporates time or temperature t rather than work w .
- Option C:** Replaces thermodynamic work with volume v .
- Option D:** Replaces thermodynamic work with pressure p .

Question #71 Key: (B)

CHEMISTRY
NUMS 2026Which is added in the product side to balance equation? $\text{H}_2\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{HSO}_4^- + 3\text{H}^+ + 2e^-$

CORE CONCEPT & DERIVATION

Balancing redox half-reactions in acidic media requires balancing oxygen using water, hydrogen using protons, and electrical charge using electrons.

Formula / Rule / Reaction:



Solution:

- Examine the initial atom count: reactants contain 1 S, 4 O, and 4 H; products contain 1 S, 4 O, and 1 H.
- Balancing hydrogen atoms requires adding 3H^+ to the product side: $\text{H}_2\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{HSO}_4^- + 3\text{H}^+$.
- The net charge on the reactant side is 0; the net charge on the product side is currently $(-1) + 3(+1) = +2$.
- To balance charge, add $2e^-$ to the product side: $\text{H}_2\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{HSO}_4^- + 3\text{H}^+ + 2e^-$.

Why other options are incorrect:

- Option A:** Adding $1e^-$ and 1H^+ leaves both hydrogen atoms and net electrical charge unbalanced.
- Option C:** Adding 5 electrons fails to supply the required hydrogen counterions.
- Option D:** Fails to balance mass and overcompensates electrical charge.

Question #72 Key: (C)

CHEMISTRY
NUMS 2026The oxidation state of Mn in KMnO_4 is:

CORE CONCEPT & DERIVATION

The oxidation state of an unknown central transition metal is determined by setting the algebraic sum of the oxidation numbers of all atoms in a neutral compound equal to zero.

Formula / Rule / Reaction:

$$\text{ON}(\text{K}) + \text{ON}(\text{Mn}) + 4[\text{ON}(\text{O})] = 0$$

Solution:

- Potassium is an alkali metal with a fixed oxidation number of +1.
- Oxygen typically exhibits an oxidation number of -2 in oxoanions.
- Setting up the equation: $(+1) + x + 4(-2) = 0$.
- Solving for x : $1 + x - 8 = 0 \Rightarrow x - 7 = 0 \Rightarrow x = +7$.

Why other options are incorrect:

- Option A:** +6 is the oxidation state of manganese in potassium manganate, K_2MnO_4 .
- Option B:** +3 is the oxidation state of manganese in Mn_2O_3 .
- Option D:** +4 is the oxidation state of manganese in manganese dioxide, MnO_2 .

Question #73 Key: (A)

CHEMISTRY
NUMS 2026

When atoms approaches each other for chemical bond formation, it leads to:

CORE CONCEPT & DERIVATION

Chemical bond formation occurs spontaneously when net attractive electrostatic forces between nuclei and electrons exceed repulsive forces, lowering the potential energy of the system.

Formula / Rule / Reaction:

$$\Delta H_{\text{bond formation}} < 0$$

Solution:

- As isolated atoms approach from infinite separation, mutual electrostatic attractions between nuclei and electrons lower the potential energy.
- A stable bond forms at an optimum internuclear distance known as the bond length, where the potential energy curve reaches an absolute minimum.
- This stabilization releases bond energy, decreasing the overall energy of the system.

Why other options are incorrect:

- Option B:** An increase in potential energy creates repulsive instability, preventing bond formation.
- Option C:** If net energy remained constant, there would be no thermodynamic driving force for chemical bonding.
- Option D:** Bond formation shortens internuclear distances relative to non-bonded van der Waals contact distances.

Question #74 Key: (C)

CHEMISTRY
NUMS 2026

The number of bonds in oxygen molecules are:

CORE CONCEPT & DERIVATION

A diatomic oxygen molecule contains a covalent double bond formed by the sharing of two pairs of valence electrons, comprising one coaxial sigma bond and one lateral pi bond.

Formula / Rule / Reaction:



Solution:

- Each oxygen atom has a ground state valence electron configuration of $2s^2 2p_x^2 2p_y^1 2p_z^1$.
- Head-on axial overlap between half-filled $2p_x$ orbitals forms one strong σ bond along the internuclear axis.
- Parallel sideways overlap between half-filled $2p_y$ orbitals forms one π bond above and below the axis.
- Therefore, the double bond in an O_2 molecule consists of one σ bond and one π bond.

Why other options are incorrect:

- Option A:** Two identical atoms cannot form two coaxial σ bonds between the same nuclear pair.
- Option B:** Two sigma bonds and one pi bond describe an impossible three-bond arrangement.
- Option D:** Two pi bonds and one sigma bond describe the covalent triple bond found in dinitrogen (N_2).

Question #75 Key: (B)

CHEMISTRY
NUMS 2026

The decreasing order of ionization energy is:

CORE CONCEPT & DERIVATION

First ionization energy decreases down a periodic group because increasing principal quantum levels expand atomic radius and augment electron shielding, weakening effective nuclear attraction for valence electrons.

Formula / Rule / Reaction:

$$\text{IE}_1 \propto \frac{Z_{\text{eff}}}{r}$$

Solution:

- Fluorine, chlorine, and bromine belong to Group 17 (halogens) in Periods 2, 3, and 4 respectively.
- Down the group, additional electron shells increase atomic radius ($r_{\text{F}} < r_{\text{Cl}} < r_{\text{Br}}$) and shielding.
- Valence electrons become easier to remove, causing first ionization energies to decline: $\text{F}(1681 \text{ kJ/mol}) > \text{Cl}(1251 \text{ kJ/mol}) > \text{Br}(1140 \text{ kJ/mol})$.
- Thus, the decreasing order is $\text{F} > \text{Cl} > \text{Br}$.

Why other options are incorrect:

- Option A:** Uses increasing inequality signs rather than decreasing order, and nitrogen has a higher first ionization energy than oxygen due to half-filled subshell stability.
- Option C:** Displays an ascending (increasing) order rather than a decreasing sequence.
- Option D:** Carbon has a higher ionization energy than boron, making the stated order incorrect.

Question #76 Key: (B)CHEMISTRY
NUMS 2026*The size of Ar is larger than Cl due to:***CORE CONCEPT & DERIVATION**

Argon possesses a completely filled valence octet whose electronic density experiences significant inter-electronic repulsion, expanding its electron cloud and resulting in a larger van der Waals radius relative to the covalent radius of chlorine.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- Across Period 3, covalent radii decrease from sodium to chlorine as effective nuclear charge rises.
- Argon has a complete octet configuration of $3s^2 3p^6$ with eight paired electrons in its outermost shell.
- The mutual electrostatic repulsion among these paired electrons pushes the orbitals outward, causing the measured non-bonded atomic boundary to exceed that of chlorine.

Why other options are incorrect:

- **Option A:** Steric hindrance describes steric clash between bulky functional groups in polyatomic molecules, not isolated monoatomic radii.
- **Option C:** High ionization energy is a consequence of stable octet configuration rather than the physical cause of boundary enlargement.
- **Option D:** Argon and chlorine possess the same core shielding electrons (10 inner core electrons).

Question #77 Key: (D)CHEMISTRY
NUMS 2026*Which element is lighter than water?***CORE CONCEPT & DERIVATION**

The density of an element determines whether it sinks or floats in liquid water; potassium has an unusually low mass-to-volume ratio with a density less than 1.0 g cm^{-3} .

Formula / Rule / Reaction:

$$\rho_{\text{water}} = 1.00 \text{ g cm}^{-3}, \quad \rho_{\text{K}} = 0.862 \text{ g cm}^{-3}$$

Solution:

- Water has a standard density of 1.00 g cm^{-3} at room temperature.
- Among the alkali metals, lithium (0.534 g cm^{-3}), sodium (0.968 g cm^{-3}), and potassium (0.862 g cm^{-3}) have densities less than water.
- Rubidium (1.532 g cm^{-3}) and cesium (1.93 g cm^{-3}) are denser than water and sink.
- Therefore, potassium floats on water and is lighter than water.

Why other options are incorrect:

- **Option A:** Cesium has a density of 1.93 g cm^{-3} , sinking rapidly in water.
- **Option B:** Rubidium has a density of 1.53 g cm^{-3} , which is greater than that of water.
- **Option C:** Iron has a high density of 7.87 g cm^{-3} .

Question #78 Key: (A)CHEMISTRY
NUMS 2026*Which of the following decreases as we move from top to bottom in Group IA or IIA?***CORE CONCEPT & DERIVATION**

Down main groups IA and IIA, atomic radius increases while valence charge remains constant, decreasing charge density and weakening the electrostatic attraction between metal cations and delocalized electrons.

Formula / Rule / Reaction:

$$\text{Metallic Bond Strength} \propto \frac{\text{Charge on cation}}{\text{Ionic radius}}$$

Solution:

- Descending Group IA or IIA adds successive electron shells, increasing atomic and ionic dimensions.
- The larger distance between the positively charged nucleus and the delocalized valence electron sea reduces binding energy.
- Consequently, lattice binding weakens, causing metallic bond strength and melting points to decrease down the group.

Why other options are incorrect:

- **Option B:** Electropositivity increases down the group because valence electrons are held less tightly.
- **Option C:** Chemical reactivity toward water and halogens increases down both groups.
- **Option D:** Ionic radii increase down the group due to the addition of principal energy levels.

Question #79 Key: (C)CHEMISTRY
NUMS 2026*Which one of the following is the correct order of electronegativity of group II A elements?***CORE CONCEPT & DERIVATION**

Electronegativity decreases down alkaline earth metals as increasing atomic radius and electron shielding diminish the electrostatic pull of the nucleus on shared bonding pairs.

Formula / Rule / Reaction:

$$\chi \propto \frac{Z_{\text{eff}}}{r}$$

Solution:

- Pauling electronegativity values for Group IIA elements are: Be = 1.5, Mg = 1.2, Ca = 1.0, Sr = 1.0, and Ba = 0.9.
- Arranging these elements in order of increasing electronegativity gives: Ba < Sr < Ca < Mg < Be.

Why other options are incorrect:

- **Option A:** Inverts the periodic trend by suggesting electronegativity increases down the group.
- **Option B:** Depicts an incorrect random sequence with improper positioning of calcium.
- **Option D:** Displays inconsistent inequality directions.

Question #80 Key: (A)

CHEMISTRY
NUMS 2026

Which one of the following is heteroatom?

CORE CONCEPT & DERIVATION

Heterocyclic compounds contain an atom other than carbon, such as nitrogen, oxygen, or sulfur, within their cyclic ring structure.

Formula / Rule / Reaction:



Solution:

- A heteroatom is any atom in an organic ring structure that is not carbon.
- Pyrrole consists of a planar five-membered aromatic ring containing four carbon atoms and one nitrogen heteroatom.
- Naphthalene, anthracene, and cyclohexene are carbocyclic systems containing only carbon atoms in their ring skeletons.

Why other options are incorrect:

- **Option B:** Naphthalene is a fused bicyclic homocyclic hydrocarbon consisting exclusively of carbon ring atoms.
- **Option C:** Anthracene is a tricyclic benzenoid hydrocarbon lacking heteroatoms.
- **Option D:** Cyclohexene is a carbocyclic cycloalkene ring composed entirely of carbon atoms.

Question #81 Key: (C)

CHEMISTRY
NUMS 2026

The function group of acid amide is:

CORE CONCEPT & DERIVATION

Acid amides are carboxylic acid derivatives in which the hydroxyl group (–OH) of the carboxyl moiety is replaced by an amino group (–NH₂).

Formula / Rule / Reaction:



Solution:

- Carboxylic acid functional groups have the connectivity –C(=O)–OH.
- Nucleophilic substitution replacing –OH with –NH₂ forms the primary carboxamide functional group.
- This structure consists of a carbonyl group double-bonded to oxygen and single-bonded to an amino group: –C(=O)–NH₂.

Why other options are incorrect:

- **Option A:** Contains an impossible double-bonded protonated enol-nitrogen system.
- **Option B:** Depicts an invalid enolic structure with improper valencies.
- **Option D:** Erroneously places a double bond onto an –OH group, violating oxygen divalent rules.

Question #82 Key: (C)

CHEMISTRY
NUMS 2026

When an alcohol is heated at 170°C in the presence of sulphuric acid, a water molecule is elimi...

CORE CONCEPT & DERIVATION

Heating primary alcohols with concentrated sulfuric acid at 170 degrees Celsius induces intramolecular beta-elimination of water, converting the alcohol into an alkene.

Formula / Rule / Reaction:



Solution:

- Sulfuric acid protonates the hydroxyl group of ethanol to yield an alkyloxonium ion.
- Loss of water generates an intermediate carbocation.
- Elimination of a proton from the adjacent beta-carbon at 170°C establishes a carbon-carbon double bond, yielding an alkene.

Why other options are incorrect:

- **Option A:** Alkyl halides require hydrohalic acids (such as HCl or HBr) or phosphorus halides.
- **Option B:** Alkanes require reducing conditions rather than dehydrating conditions.
- **Option D:** Alkynes require vicinal dihalide double dehydrohalogenation.

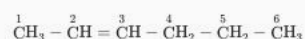
Question #83 Key: (A)

CHEMISTRY
NUMS 2026The IUPAC name of following compound is: $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

CORE CONCEPT & DERIVATION

IUPAC rules for alkenes require selecting the longest continuous carbon chain containing the double bond and numbering from the end closest to the unsaturation.

Formula / Rule / Reaction:



Solution:

- Expanding the condensed formula gives a continuous six-carbon unbranched alkene chain: CH₃ – CH = CH – CH₂ – CH₂ – CH₃.
- The six-carbon root is hexene.
- Numbering from left to right assigns the double bond to locant 2 (carbons 2 and 3), whereas numbering from right to left assigns it to locant 4.
- Assigning the lowest locant gives the name hex-2-ene.

Why other options are incorrect:

- **Option B:** Hept-2-ene specifies a seven-carbon parent chain, whereas this molecule has six carbons.
- **Option C:** Hex-4-ene numbers the double bond from the wrong end of the carbon chain.
- **Option D:** Hept-4-ene specifies an incorrect seven-carbon chain and incorrect locant.

Question #84 Key: (D)

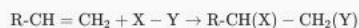
CHEMISTRY
NUMS 2026

Most of the reactions shown by alkenes are:

CORE CONCEPT & DERIVATION

Alkenes possess a nucleophilic carbon-carbon double bond with exposed pi electrons, making addition reactions their characteristic reaction mechanism.

Formula / Rule / Reaction:



Solution:

- The pi electron cloud in an alkene is loosely held above and below the internuclear sigma framework.
- These exposed electrons attack electron-deficient species, initiating electrophilic addition reactions.
- During the reaction, the pi bond is converted into two new strong sigma bonds, producing an addition adduct.

Why other options are incorrect:

- Option A:** Nucleophilic substitution is typical of alkyl halides and alcohols, not electron-rich alkenes.
- Option B:** Nucleophilic addition occurs across polarized carbonyl groups (aldehydes and ketones).
- Option C:** Electrophilic substitution is characteristic of aromatic benzene rings that maintain aromaticity.

Question #85 Key: (A)

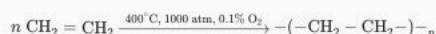
CHEMISTRY
NUMS 2026

What are the conditions required for polymerization of ethene to polyethene?

CORE CONCEPT & DERIVATION

According to the Punjab Textbook Board, high-pressure free-radical polymerization of ethene requires heating monomeric gas at 400 degrees Celsius under 1000 atmospheres of pressure with trace oxygen.

Formula / Rule / Reaction:



Solution:

- Low-density polyethylene (LDPE) is manufactured industrially by free-radical addition polymerization.
- The specified textbook conditions require heating ethene gas to 400°C under a pressure of 1000 atm in the presence of trace (0.1%) oxygen catalyst.

Why other options are incorrect:

- Option B:** A temperature of 100°C and 400 atm is insufficient to initiate non-catalytic free-radical propagation.
- Option C:** 450°C exceeds standard textbook conditions and promotes thermal cracking.
- Option D:** 200 atm provides inadequate compression for high-pressure radical propagation.

Question #86 Key: (D)

CHEMISTRY
NUMS 2026

The reactivity order of alkyl halide is:

CORE CONCEPT & DERIVATION

The chemical reactivity of alkyl halides is governed primarily by carbon-halogen bond dissociation energy, with lower bond strength producing higher reaction rates.

Formula / Rule / Reaction:

$$\text{Reactivity} \propto \frac{1}{\text{Bond Dissociation Energy}} \Rightarrow \text{C-I (238 kJ)} < \text{C-Br (276 kJ)} < \text{C-Cl (338 kJ)}$$

Solution:

- The carbon-iodine bond is the longest and weakest among carbon-halogen bonds due to poor orbital overlap.
- Iodide also acts as a superior leaving group because of its large ionic radius and low charge density.
- As bond energy decreases from fluorine to iodine, reactivity in substitution and elimination reactions increases: $\text{R-I} > \text{R-Br} > \text{R-Cl} > \text{R-F}$.

Why other options are incorrect:

- Option A:** Reflects the trend in carbon-halogen bond polarity rather than actual chemical reactivity.
- Option B:** Erroneously places alkyl chlorides above bromides and iodides.
- Option C:** Out-of-order sequence that places bromides ahead of iodides.

Question #87 Key: (C)

CHEMISTRY
NUMS 2026(CH₃)₃C-OH is an example of:

CORE CONCEPT & DERIVATION

Alcohols are classified as primary, secondary, or tertiary according to the degree of substitution of the carbon atom directly bonded to the hydroxyl group.

Formula / Rule / Reaction:



Solution:

- In (CH₃)₃C-OH (tert-butanol), the carbon bonded to the -OH group is attached to three other methyl carbon atoms.
- A carbon atom bonded directly to three adjacent alkyl carbons is designated as a tertiary carbon.
- Therefore, 2-methylpropan-2-ol is a tertiary alcohol.

Why other options are incorrect:

- Option A:** Primary alcohols have the -OH group bonded to a carbon attached to at most one other carbon atom (R-CH₂OH).
- Option B:** Secondary alcohols have the -OH group bonded to a carbon attached to two other carbon atoms (R₂CHOH).
- Option D:** Isobutyl alcohol is a primary alcohol with structure (CH₃)₂CH-CH₂OH.

Question #88 Key: (D)

CHEMISTRY
NUMS 2026

Which one of the following is used in the manufacturing of plastics?

CORE CONCEPT & DERIVATION

Phenol undergoes step-growth condensation polymerization with formaldehyde to produce phenol-formaldehyde resins, commercially known as Bakelite plastics.

Formula / Rule / Reaction:



Solution:

- Phenol possesses activated ortho and para positions on its benzene ring.
- Reaction with formaldehyde under heating yields cross-linked phenolic thermosetting polymers known as Bakelite.
- These materials are widely used in electrical switches, circuit boards, and molded plastics.

Why other options are incorrect:

- Option A:** Methanol is used as an industrial solvent and chemical feedstock, but is not the polymer backbone monomer.
- Option B:** Ethanol serves as a solvent, disinfectant, and biofuel.
- Option C:** Propanol is used primarily as an industrial solvent.

Question #89 Key: (B)

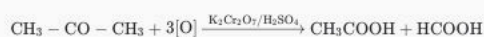
CHEMISTRY
NUMS 2026

Which of the following will give formic acid as one of the product of oxidation?

CORE CONCEPT & DERIVATION

According to Popoff's rule, vigorous oxidation of ketones causes carbon-carbon bond cleavage adjacent to the carbonyl group; oxidation of propanone yields ethanoic acid and methanoic (formic) acid.

Formula / Rule / Reaction:



Solution:

- Propanone (acetone) is a symmetrical three-carbon ketone.
- Oxidation with acidified potassium dichromate cleaves a carbon-carbon single bond adjacent to the carbonyl group.
- This cleavage produces a two-carbon carboxylic acid (acetic acid) and a one-carbon carboxylic acid (formic acid).
- Formic acid may undergo further oxidation to carbon dioxide and water under prolonged heating.

Why other options are incorrect:

- Option A:** Butanone oxidizes to yield two molecules of ethanoic acid (acetic acid).
- Option C:** Pentanone oxidizes to yield mixtures of ethanoic acid and propanoic acid.
- Option D:** Hexanone oxidation cleaves into propanoic or butanoic acids.

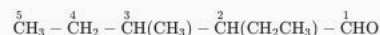
Question #90 Key: (B)

CHEMISTRY
NUMS 2026What will be the IUPAC name of the given compound? $\begin{matrix} & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \end{matrix} \text{CH}_3 \text{ & } \text{O} \text{ } \dots$

CORE CONCEPT & DERIVATION

IUPAC naming of aldehydes requires identifying the longest continuous carbon chain containing the formyl carbon (assigned as C1) and listing substituents alphabetically with their lowest locants.

Formula / Rule / Reaction:



Solution:

- The principal functional group is an aldehyde ($-\text{CHO}$), which is assigned locant 1.
- Tracing the longest continuous carbon chain starting from C1 leads through the ethyl-bearing carbon (C2), the methyl-bearing carbon (C3), and across the ethyl chain (C4–C5), yielding a 5-carbon pentanal backbone.
- Substituents on this chain are an ethyl group at position 2 and a methyl group at position 3.
- Alphabetical ordering places ethyl before methyl, giving 2-ethyl-3-methylpentanal.

Why other options are incorrect:

- Option A:** Locant 1 is reserved for the aldehyde carbon itself; an ethyl group cannot be placed at C1 of a pentanal.
- Option C:** Numbers the carbon chain backwards from the alkyl end rather than prioritizing the principal carbonyl carbon.
- Option D:** Omits the ethyl substituent at position 2.

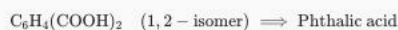
Question #91 Key: (C)

CHEMISTRY
NUMS 2026What is the common name of following compound? COOH COOH

CORE CONCEPT & DERIVATION

Benzene-1,2-dicarboxylic acid consists of two adjacent carboxyl groups bonded to an aromatic benzene ring and is known by the common name phthalic acid.

Formula / Rule / Reaction:



Solution:

- The compound contains a benzene nucleus with two carboxylic acid functional groups located at adjacent ortho positions (1,2-orientation).
- The systematic IUPAC designation is benzene-1,2-dicarboxylic acid.
- The universally recognized common name for this aromatic dicarboxylic acid is phthalic acid.

Why other options are incorrect:

- Option A:** Benzoic acid possesses only one carboxyl group bonded to the benzene ring.
- Option B:** Malonic acid is an aliphatic dicarboxylic acid with formula $\text{CH}_2(\text{COOH})_2$.
- Option D:** Picric acid is 2,4,6-trinitrophenol.

Question #92 Key: (B)

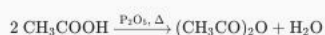
CHEMISTRY
NUMS 2026

Acetic anhydride can be prepared when two molecules of carboxylic acids are dehydrated on heat...

CORE CONCEPT & DERIVATION

Phosphorus pentoxide is an aggressive chemical dehydrating agent that removes a molecule of water from two molecules of acetic acid upon heating to produce acetic anhydride.

Formula / Rule / Reaction:



Solution:

- Two acetic acid molecules undergo bimolecular condensation when heated with phosphorus pentoxide (P_2O_5).
- Phosphorus pentoxide exhibits high affinity for water, hydrating into metaphosphoric acid (HPO_3) and driving the elimination of water.
- This reaction links the two acyl groups via an oxygen bridge, synthesizing acetic anhydride.

Why other options are incorrect:

- Option A:** V_2O_5 is an industrial oxidation catalyst used in the Contact process.
- Option C:** H_2SO_4 promotes esterification when alcohol is present, but P_2O_5 is the definitive dehydrating agent for anhydride synthesis.
- Option D:** HgSO_4 catalyzes the hydration of alkynes into aldehydes and ketones.

Question #93 Key: (C)

CHEMISTRY
NUMS 2026

Carboxylic acid react with metals to form salt with the evolution of which gas?

CORE CONCEPT & DERIVATION

Carboxylic acids act as Bronsted-Lowry acids, reacting with electropositive active metals via single-displacement redox reactions to produce carboxylate salts and hydrogen gas.

Formula / Rule / Reaction:



Solution:

- The acidic proton on the carboxyl group ($-\text{COOH}$) undergoes single displacement by active metals such as sodium, potassium, or magnesium.
- The metal atom is oxidized to its cation, donating electrons to reduce protons into molecular hydrogen gas.
- Effervescence of diatomic hydrogen gas (H_2) is observed.

Why other options are incorrect:

- Option A:** Carbon dioxide gas is evolved when carboxylic acids react with carbonates or bicarbonates, not elemental metals.
- Option B:** Carbon monoxide is produced during incomplete combustion, not acid-metal displacement.
- Option D:** Methane is not evolved during standard acid-metal displacement reactions.

Question #94 Key: (A)

CHEMISTRY
NUMS 2026

Which protein helps in muscles contractions and relaxation in our body?

CORE CONCEPT & DERIVATION

Muscle contraction and relaxation depend on the interaction between the contractile proteins actin and myosin within the sarcomeres of muscle fibers.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- Myosin constitutes the thick filaments of striated and smooth muscle myofibrils.
- Myosin heads possess ATPase activity and bind actin filaments to form cross-bridges.
- Power strokes executed by myosin heads shorten the sarcomere, driving muscular contraction and subsequent relaxation.

Why other options are incorrect:

- Option B:** Albumin is a major plasma protein responsible for maintaining intravascular colloidal osmotic pressure.
- Option C:** Globulins are plasma proteins involved in humoral immunity and lipid transport.
- Option D:** Collagen is an extracellular structural fibrous protein providing tensile strength to skin and tendons.

Question #95 Key: (C)

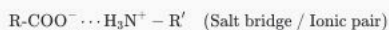
CHEMISTRY
NUMS 2026

Various polypeptide chains in haemoglobin remain intact due to:

CORE CONCEPT & DERIVATION

The quaternary structure of hemoglobin consists of four separate globin subunits held together by non-covalent electrostatic interactions, specifically salt bridges, alongside hydrogen bonding and hydrophobic contacts.

Formula / Rule / Reaction:



Solution:

- Hemoglobin is a tetramer composed of two alpha and two beta polypeptide chains.
- The quaternary arrangement of these distinct subunits is maintained by non-covalent interactions rather than interchain covalent linkages.
- Electrostatic salt bridges formed between oppositely charged basic and acidic amino acid side chains hold the chains together in the intact quaternary complex.

Why other options are incorrect:

- Option A:** Non-specific distractor that fails to designate the precise non-covalent interactions maintaining quaternary structure.
- Option B:** London dispersion forces are weak van der Waals forces insufficient on their own to organize the quaternary geometry.
- Option D:** Peptide bonds are strong covalent bonds linking amino acids within individual primary chains, but do not join separate globin chains together.

Question #96 Key: (C)

PHYSICS
NUMS 2026

The vertical height and horizontal range of projectiles are equal at angle:

CORE CONCEPT & DERIVATION

The maximum vertical height of a projectile equals its horizontal range when the projection angle satisfies the trigonometric relation $\tan \theta = 4$.

Formula / Rule / Reaction:

$$H = \frac{v_0^2 \sin^2 \theta}{2g}, \quad R = \frac{v_0^2 \sin(2\theta)}{g} = \frac{2v_0^2 \sin \theta \cos \theta}{g}$$

Solution:

- Equating height and range: $H = R$.
- $$\frac{v_0^2 \sin^2 \theta}{2g} = \frac{2v_0^2 \sin \theta \cos \theta}{g}$$
- Canceling common factors v_0^2, g , and $\sin \theta$ yields: $\frac{\sin \theta}{2} = 2 \cos \theta$.
- $$\frac{\sin \theta}{\cos \theta} = 4 \implies \tan \theta = 4$$
- $$\theta = \arctan(4) \approx 75.96^\circ \approx 76^\circ$$

Why other options are incorrect:

- Option A:** At 30° , $R = 4\sqrt{3}H \approx 6.93H$, so range far exceeds height.
- Option B:** At 45° , range reaches its maximum where $R = 4H$.
- Option D:** At 90° , the horizontal range is zero while vertical height is maximized.

Question #97 Key: (B)

PHYSICS
NUMS 2026

Range of projectile is maximum at:

CORE CONCEPT & DERIVATION

Horizontal range is proportional to the sine of twice the launch angle, reaching its absolute mathematical maximum when the argument equals 90 degrees.

Formula / Rule / Reaction:

$$R = \frac{v_0^2 \sin(2\theta)}{g}$$

Solution:

- The trigonometric factor $\sin(2\theta)$ reaches its maximum value of 1 when its argument is 90° .
- Setting $2\theta = 90^\circ$ yields $\theta = 45^\circ$.
- Therefore, in the absence of air resistance, a launch angle of 45° maximizes horizontal range.

Why other options are incorrect:

- Option A:** At 30° , $\sin(2\theta) = \sin(60^\circ) = 0.866$, achieving 86.6% of maximum range.
- Option C:** At 60° , $\sin(2\theta) = \sin(120^\circ) = 0.866$, giving the same sub-maximal range as 30° .
- Option D:** At 90° , $\sin(180^\circ) = 0$, producing zero horizontal displacement.

Question #98 Key: (C)PHYSICS
NUMS 2026

A ball is thrown vertically upward, the ball descends towards earth after achieving a certain h...

CORE CONCEPT & DERIVATION

By Newton's third law, the gravitational forces between Earth and the ball are strictly equal and opposite; however, the Earth's immense mass gives it vast inertia, making the acceleration of the low-mass ball observable.

Formula / Rule / Reaction:

$$F_{\text{Earth on ball}} = F_{\text{ball on Earth}} = G \frac{Mm}{r^2}, \quad a_{\text{ball}} = \frac{F}{m}, \quad a_{\text{Earth}} = \frac{F}{M} \approx 0$$

Solution:

- Gravitational attraction is a mutual action-reaction pair where both bodies experience identical force magnitudes.
- Inertia is directly proportional to mass. The mass of Earth is 5.97×10^{24} kg, giving it vastly greater inertia than the ball.
- Because of the Earth's huge inertia, its acceleration toward the ball is negligible, while the ball experiences an acceleration of 9.8 m s^{-2} downward.

Why other options are incorrect:

- Option A:** Stating that Earth exerts more force violates Newton's third law of motion.
- Option B:** The ball cannot exert a greater gravitational force than the Earth.
- Option D:** The ball has very small mass and therefore possesses far less inertia than the Earth.

Question #99 Key: (C)PHYSICS
NUMS 2026

A bomb is exploded into two fragments A and B moving in opposite direction. They conserve:

CORE CONCEPT & DERIVATION

In an explosion, internal chemical potential energy is converted into mechanical kinetic energy, which does not conserve kinetic energy, while linear momentum is conserved in the absence of net external forces.

Formula / Rule / Reaction:

$$\vec{P}_{\text{initial}} = \vec{P}_{\text{final}} = m_A \vec{v}_A + m_B \vec{v}_B = 0$$

Solution:

- The explosive event is driven entirely by internal chemical forces with zero net external force acting on the system.
- According to the law of conservation of linear momentum, the total vector momentum before explosion (zero at rest) must equal the total vector momentum after explosion.
- Kinetic energy is not conserved because chemical potential energy is converted into kinetic energy of the flying fragments.

Why other options are incorrect:

- Option A:** Kinetic energy increases from zero to a positive non-zero value, so it is not conserved.
- Option B:** Potential energy decreases as chemical bonds are broken during detonation.
- Option D:** Neither mechanical kinetic energy nor chemical potential energy is conserved individually.

Question #100 Key: (D)PHYSICS
NUMS 2026

Work done is negative, when the angle between F and S is:

CORE CONCEPT & DERIVATION

Mechanical work is the scalar dot product of force and displacement vectors; work is negative when the cosine of the angle between them is negative.

Formula / Rule / Reaction:

$$W = \vec{F} \cdot \vec{S} = FS \cos \theta$$

Solution:

- For $\theta = 180^\circ$, the force acts directly opposite to the displacement vector.
- Evaluating the trigonometric factor: $\cos(180^\circ) = -1$.
- Substituting gives $W = FS(-1) = -FS$, which produces negative work (such as work done by kinetic friction).

Why other options are incorrect:

- Option A:** At 0° , $\cos(0^\circ) = +1$, yielding maximum positive work.
- Option B:** At 60° , $\cos(60^\circ) = +0.5$, yielding positive work.
- Option C:** At 90° , $\cos(90^\circ) = 0$, resulting in zero work done.

Question #101 Key: (D)PHYSICS
NUMS 2026

When the speed of the car is doubled, what will be its kinetic energy?

CORE CONCEPT & DERIVATION

Kinetic energy varies with the square of translational velocity; doubling the speed increases kinetic energy by a factor of four.

Formula / Rule / Reaction:

$$K = \frac{1}{2}mv^2$$

Solution:

- Let initial kinetic energy be $K_1 = \frac{1}{2}mv^2$.
- When speed is doubled, the new velocity becomes $v' = 2v$.
- The new kinetic energy is:

$$K_2 = \frac{1}{2}m(2v)^2 = \frac{1}{2}m(4v^2) = 4\left(\frac{1}{2}mv^2\right) = 4K_1$$
- Therefore, the kinetic energy becomes four times its original value.

Why other options are incorrect:

- Option A:** Kinetic energy depends directly on speed and cannot remain unchanged.
- Option B:** Momentum doubles when speed doubles, but kinetic energy scales with speed squared.
- Option C:** Three times corresponds to a velocity increase factor of $\sqrt{3}$.

Question #102 Key: (D)PHYSICS
NUMS 2026*The work efficiency of a dry cell battery is:***CORE CONCEPT & DERIVATION**

According to standard energy conversion efficiency tables in the Punjab Textbook Board Physics curriculum, electrochemical dry cells operate with a typical efficiency of 90 percent.

Formula / Rule / Reaction:

$$\eta = \frac{\text{Useful Electrical Energy Output}}{\text{Chemical Energy Input}} \times 100\%$$

Solution:

- Electrochemical reactions inside a primary dry cell convert chemical potential energy directly into electrical energy without an intermediate thermal thermodynamic cycle.
- Because they are not constrained by Carnot heat engine limits, electrochemical cells have low internal resistance losses and high efficiency.
- The textbook value for dry cell battery efficiency is 90%.

Why other options are incorrect:

- Option A:** 30% is typical of internal combustion automobile engines.
- Option B:** 40% is typical of fossil-fuel thermal power stations.
- Option C:** 50% is typical of domestic gas heating systems.

Question #103 Key: (C)PHYSICS
NUMS 2026*When distance r increases than gravitational P.E becomes:***CORE CONCEPT & DERIVATION**

Absolute gravitational potential energy is defined with reference to zero at infinity, having a negative value at finite distances that becomes less negative as radial separation increases.

Formula / Rule / Reaction:

$$U = -\frac{GMm}{r}$$

Solution:

- Gravitational potential energy in an attractive field is negative everywhere within finite distances.
- As the radial distance r increases, the magnitude $\frac{GMm}{r}$ decreases.
- Because of the negative sign, a decrease in magnitude means U shifts closer to zero.
- Therefore, as r increases, the gravitational potential energy becomes less negative (more algebraically positive).

Why other options are incorrect:

- Option A:** Gravitational potential energy within a bound system is negative, not positive.
- Option B:** Becoming more negative occurs when r decreases as an object falls toward Earth.
- Option D:** Potential energy approaches zero from negative values and does not become positive in an attractive field.

Question #104 Key: (B)PHYSICS
NUMS 2026*How many Joules are there in 3KWh?***CORE CONCEPT & DERIVATION**

One kilowatt-hour is an electrical energy unit equal to 3.6 megajoules, which scales proportionally when multiplied by the number of units.

Formula / Rule / Reaction:

$$1 \text{ kWh} = 1000 \text{ W} \times 3600 \text{ s} = 3.6 \times 10^6 \text{ J} = 3.6 \text{ MJ}$$

Solution:

- To find the energy in 3 kWh:
- $E = 3 \text{ kWh} = 3 \times (3.6 \times 10^6 \text{ J}) = 10.8 \times 10^6 \text{ J}$
- Converting to megajoules ($1 \text{ MJ} = 10^6 \text{ J}$) yields 10.8 MJ.

Why other options are incorrect:

- Option A:** 108 MJ corresponds to 30 kWh, which is an error by a factor of 10.
- Option C:** 1.08 MJ corresponds to 0.3 kWh.
- Option D:** 0.108 MJ corresponds to 0.03 kWh.

Question #105 Key: (B)PHYSICS
NUMS 2026*A car moving on a more steeply banked curves will require:***CORE CONCEPT & DERIVATION**

The required banking angle of a curved track is directly proportional to the square of vehicle speed and inversely proportional to the radius of curvature.

Formula / Rule / Reaction:

$$\tan \theta = \frac{v^2}{rg}$$

Solution:

- A more steeply banked curve corresponds to a larger banking angle θ , which increases $\tan \theta$.
- For $\frac{v^2}{rg}$ to have a larger value, the numerator (speed v) must be large and the denominator (radius r) must be small.
- Therefore, negotiating a more steeply banked curve without relying on friction requires higher speed and tighter (smaller) radii.

Why other options are incorrect:

- Option A:** A large radius decreases $\tan \theta$, requiring a shallower banking angle.
- Option C:** Small speed and large radius result in a small banking angle.
- Option D:** A small speed reduces centripetal demand and does not require steep banking.

Question #106 Key: (D)

PHYSICS
NUMS 2026

In a body angular acceleration is produced by:

CORE CONCEPT & DERIVATION

In rotational dynamics, angular acceleration is produced when an unbalanced net torque acts on a rigid body having rotational inertia.

Formula / Rule / Reaction:

$$\vec{\tau}_{\text{net}} = I\vec{\alpha} \implies \vec{\alpha} = \frac{\vec{\tau}_{\text{net}}}{I}$$

Solution:

- Newton's second law for rotation states that the net external torque applied to an object is proportional to the resulting angular acceleration.
- The constant of proportionality is the moment of inertia I .
- Therefore, a net torque is required to produce an angular acceleration.

Why other options are incorrect:

- **Option A:** A net force produces linear acceleration, not angular acceleration unless applied at a distance to generate torque.
- **Option B:** Power is the rate of doing work, not the rotational force analog.
- **Option C:** Pressure is force per unit area and does not determine rotational acceleration.

Question #107 Key: (B)

PHYSICS
NUMS 2026

The analogue of force in circular / angular motion is:

CORE CONCEPT & DERIVATION

Torque (moment of force) is the rotational analogue of linear force, acting as the dynamic quantity that changes the angular state of motion.

Formula / Rule / Reaction:

$$\text{Linear: } F = ma \quad \longleftrightarrow \quad \text{Rotational: } \tau = I\alpha$$

Solution:

- Linear force produces linear acceleration and changes linear momentum: $F = \frac{dp}{dt}$.
- Torque produces angular acceleration and changes angular momentum: $\tau = \frac{dL}{dt}$.
- Comparing the equations shows that torque is the rotational analogue of force.

Why other options are incorrect:

- **Option A:** Linear momentum corresponds to angular momentum in rotational motion.
- **Option C:** Angular acceleration is the analogue of linear acceleration.
- **Option D:** Angular velocity is the analogue of linear velocity.

Question #108 Key: (B)

PHYSICS
NUMS 2026 1° is equals to:

CORE CONCEPT & DERIVATION

A full planar circle subtends 360° degrees or 2π radians, establishing the conversion factor between degrees and radians.

Formula / Rule / Reaction:

$$180^\circ = \pi \text{ rad} \implies 1^\circ = \frac{\pi}{180} \text{ rad}$$

Solution:

- A complete revolution contains $360^\circ = 2\pi$ radians.
- Dividing both sides by 180 gives: $180^\circ = \pi$ radians.
- Solving for one degree yields: $1^\circ = \frac{\pi}{180}$ radians ≈ 0.01745 radians.

Why other options are incorrect:

- **Option A:** $\pi/90$ radians corresponds to 2° .
- **Option C:** π radians corresponds to 180° .
- **Option D:** 2π radians corresponds to a full revolution of 360° .

Question #109 Key: (A)

PHYSICS
NUMS 2026

In uniform circular motion, the angle between centripetal acceleration and linear velocity of a...

CORE CONCEPT & DERIVATION

In uniform circular motion, instantaneous linear velocity is directed tangentially while centripetal acceleration points radially inward, making them perpendicular.

Formula / Rule / Reaction:

$$\vec{a}_c \cdot \vec{v} = 0 \implies \theta = 90^\circ = \frac{\pi}{2} \text{ rad}$$

Solution:

- Centripetal acceleration points continuously along the radius toward the center of rotation.
- Linear velocity is directed along the tangent to the circular path at that instant.
- The tangent to a circle is perpendicular to its radius at every point, so the angle between the two vectors is 90° ($\pi/2$ radians).

Why other options are incorrect:

- **Option B:** An angle of π (180°) indicates antiparallel vectors, such as velocity and opposing deceleration.
- **Option C:** An angle of 2π (360°) represents parallel alignment.
- **Option D:** An angle of zero describes parallel vectors, which would change the speed rather than the direction of motion.

Question #110 Key: (B)PHYSICS
NUMS 2026*The distance between two consecutive nodes are:***CORE CONCEPT & DERIVATION**

In a standing wave, adjacent nodes are separated by half a wavelength, representing one complete loop between points of zero displacement.

Formula / Rule / Reaction:

$$d_{\text{node-node}} = \frac{\lambda}{2}$$

Solution:

- A full wavelength (λ) of a standing wave contains two consecutive loops.
- Each loop is bounded by a node at each end with an antinode located in the center.
- Therefore, the linear distance between two consecutive nodes is equal to one half-wavelength ($\lambda/2$).

Why other options are incorrect:

- **Option A:** λ is the distance between three consecutive nodes (two complete loops).
- **Option C:** 2λ corresponds to four complete loops.
- **Option D:** $\lambda/4$ is the distance between an adjacent node and antinode.

Question #111 Key: (B)PHYSICS
NUMS 2026*If a sound waves moves from air to water, there is NO change in:***CORE CONCEPT & DERIVATION**

When a wave crosses the boundary between two media, its frequency is determined solely by the vibrating source and remains invariant.

Formula / Rule / Reaction:

$$v = f\lambda \implies f = \text{constant}$$

Solution:

- The frequency of a wave is determined by the oscillation rate of the source creating the disturbance.
- When sound transitions from air to water, it enters a medium with higher bulk modulus, causing its speed v to increase from approximately 340 m s^{-1} to 1500 m s^{-1} .
- To satisfy $v = f\lambda$, the wavelength λ increases proportionally, keeping frequency f constant.

Why other options are incorrect:

- **Option A:** Velocity changes significantly due to differences in elasticity and density between media.
- **Option C:** Wavelength changes in direct proportion to velocity.
- **Option D:** Temperature is a thermodynamic state variable of each individual medium rather than an intrinsic wave property.

Question #112 Key: (A)PHYSICS
NUMS 2026*The star moving closer to earth will experience:***CORE CONCEPT & DERIVATION**

According to the Doppler effect for light, relative motion of a source toward an observer shifts observed spectral lines toward higher frequencies and shorter wavelengths (blue shift).

Formula / Rule / Reaction:

$$\Delta\lambda = -\frac{v}{c}\lambda_0 \implies \lambda_{\text{observed}} < \lambda_0$$

Solution:

- When an astronomical light source moves toward Earth, each successive wave crest is emitted closer to the observer.
- The wavefronts compress, shortening the observed wavelength.
- In the visible spectrum, shorter wavelengths correspond to the blue end, producing a blue shift.

Why other options are incorrect:

- **Option B:** Red shift occurs when a star is moving away from Earth, shifting spectra toward longer wavelengths.
- **Option C:** Orange shift is not a designated astronomical Doppler term.
- **Option D:** Yellow shift is not a recognized Doppler term.

Question #113 Key: (C)PHYSICS
NUMS 2026*If the amplitude of a wave is doubled, its intensity is:***CORE CONCEPT & DERIVATION**

The intensity of a mechanical or electromagnetic wave is directly proportional to the square of its wave amplitude.

Formula / Rule / Reaction:

$$I \propto A^2$$

Solution:

- Wave intensity represents power transmitted per unit cross-sectional area.
- Let the initial intensity be $I_1 = kA^2$.
- When the amplitude is doubled ($A' = 2A$), the new intensity is:
- $$I_2 = k(2A)^2 = k(4A^2) = 4(kA^2) = 4I_1$$
- Therefore, the intensity is quadrupled.

Why other options are incorrect:

- **Option A:** Intensity depends on the square of amplitude, so it increases by a factor of four rather than two.
- **Option B:** Halving occurs when amplitude decreases by a factor of $\sqrt{2}$.
- **Option D:** Intensity drops to one quarter when the amplitude is halved, not doubled.

Question #114 Key: (B)PHYSICS
NUMS 2026*Which of the following is an example of first law of thermodynamics?***CORE CONCEPT & DERIVATION**

The first law of thermodynamics is the principle of conservation of energy, which asserts that energy cannot be created or destroyed, only transformed from one form to another within an isolated or biological system.

Formula / Rule / Reaction:

$$\Delta U = Q - W \quad \text{or} \quad \Delta E = q + w$$

Solution:

- In biological organisms, human metabolism serves as a prime example of the first law of thermodynamics.
- Chemical potential energy ingested through food is converted into mechanical work by contracting muscles and thermal energy to maintain body temperature.
- The total internal energy change precisely matches the difference between heat exchanged and work performed.

Why other options are incorrect:

- **Option A:** Thunderstorms involve complex macroscopic atmospheric discharges driven by thermodynamic instability and entropy gradients.
- **Option C:** Rusting is a spontaneous electrochemical corrosion process typically studied under chemical kinetics and redox equilibria.
- **Option D:** Earthquakes represent mechanical strain-energy release along tectonic faults.

Question #115 Key: (C)PHYSICS
NUMS 2026*Thermos flask containing tea as a system is shaken vigorously then there will be:***CORE CONCEPT & DERIVATION**

Vigorously shaking an insulated vessel performs mechanical work on the fluid; in an adiabatic system, this work increases internal energy, which elevates molecular kinetic energy and temperature.

Formula / Rule / Reaction:

$$Q = 0 \implies \Delta U = W > 0, \quad \langle K.E. \rangle = \frac{3}{2} k_B T$$

Solution:

- A thermos flask has insulated walls that prevent heat transfer ($Q = 0$).
- Shaking the liquid performs mechanical work (W) on the system against internal fluid friction and viscosity.
- This non-flow work increases the internal energy of the liquid, raising average molecular translational kinetic energy.
- Because macroscopic absolute temperature is directly proportional to average molecular kinetic energy, both temperature and kinetic energy increase.

Why other options are incorrect:

- **Option A:** Omits kinetic energy, which is the direct microscopic manifestation of temperature.
- **Option B:** Omits temperature, which rises proportionally with molecular kinetic energy.
- **Option D:** Violates the first law of thermodynamics by neglecting the mechanical work done on the fluid.

Question #116 Key: (B)

 PHYSICS
NUMS 2026

Difference between molar specific heat at constant pressure and molar specific heat at constant...

CORE CONCEPT & DERIVATION

Mayer's relation dictates that the difference between the molar heat capacity of an ideal gas at constant pressure and at constant volume equals the universal molar gas constant.

Formula / Rule / Reaction:

$$C_p - C_v = R$$

Solution:

- When heat is supplied at constant volume (C_v), all added energy goes into increasing internal energy because no boundary work is done.
- When heat is supplied at constant pressure (C_p), the gas must also expand against external pressure to perform work: $W = P\Delta V = R\Delta T$.
- The additional energy required per mole per kelvin is R , yielding $C_p - C_v = R$.

Why other options are incorrect:

- Option A:** The Boltzmann constant ($k_B = R/N_A$) represents gas constant per single molecule, not per mole.
- Option C:** Planck's constant relates photon energy to frequency.
- Option D:** The Rydberg constant relates atomic spectral wavelengths.

Question #117 Key: (C)

 PHYSICS
NUMS 2026

Coulomb's law of electrostatic induction is valid for:

CORE CONCEPT & DERIVATION

Coulomb's law mathematically defines the electrostatic force acting between electric charges and is strictly valid only when charges are stationary point charges.

Formula / Rule / Reaction:

$$F = \frac{1}{4\pi\epsilon_0} \frac{|q_1 q_2|}{r^2}$$

Solution:

- The law requires the spatial linear dimensions of the charged bodies to be negligible compared to the separation distance r , satisfying the point charge condition.
- The charges must be stationary (electrostatic) to eliminate magnetic field generation and electromagnetic radiation.
- Therefore, Coulomb's formulation is valid strictly for stationary and point charges.

Why other options are incorrect:

- Option A:** Incomplete because moving point charges produce magnetic fields and retarding potentials that alter the interaction force.
- Option B:** Incomplete because extended stationary charges experience charge redistribution via polarization.
- Option D:** Accelerated charges radiate electromagnetic energy, violating static Coulomb equations.

Question #118 Key: (B)

 PHYSICS
NUMS 2026

If the positive charge is placed in a uniform electric field, the charge will move in the:

CORE CONCEPT & DERIVATION

The electrostatic force experienced by a charge in an electric field is the product of charge and electric field intensity; for a positive charge, force and field vectors are parallel.

Formula / Rule / Reaction:

$$\vec{F} = q\vec{E}$$

Solution:

- The scalar charge q is positive ($q > 0$).
- Because q is positive, the vector $\vec{F}$ points in the identical direction as $\vec{E}$.
- Newton's second law gives $\vec{a} = \vec{F}/m$, so the positive charge accelerates and moves in the direction of the electric field.

Why other options are incorrect:

- Option A:** A negative charge moves opposite to the electric field because $q < 0$.
- Option C:** Perpendicular acceleration occurs in magnetic fields via Lorentz force ($\vec{F} = q\vec{v} \times \vec{B}$), not static electric fields.
- Option D:** The charge experiences an unbalanced electrostatic force and cannot remain at rest.

Question #119 Key: (B)

 PHYSICS
NUMS 2026

For each element, value of half-life is:

CORE CONCEPT & DERIVATION

Radioactive decay is a spontaneous nuclear transformation governed by first-order kinetics, making the half-life an intrinsic, invariant constant for each radioactive isotope.

Formula / Rule / Reaction:

$$T_{1/2} = \frac{\ln 2}{\lambda} = \frac{0.693}{\lambda} = \text{constant}$$

Solution:

- The decay constant λ is an immutable nuclear characteristic of a given radioisotope.
- Half-life does not depend on initial sample mass, temperature, external pressure, or chemical combination.
- Consequently, the half-life for each specific radioactive element or nuclide is constant.

Why other options are incorrect:

- Option A:** Radioactive half-life does not vary with sample size or environmental conditions.
- Option C:** Half-life remains fixed throughout the lifetime of the radioactive material.
- Option D:** Half-life does not increase as the active nucleus decays.

Question #120 Key: (C)PHYSICS
NUMS 2026The unit of RC is:**CORE CONCEPT & DERIVATION**

In capacitive circuits, the product of resistance R and capacitance C represents the capacitive time constant, having fundamental dimensions of time measured in seconds.

Formula / Rule / Reaction:

$$\tau = RC \implies [\tau] = [\text{Resistance}] \times [\text{Capacitance}]$$

Solution:

- Resistance has units of volts per ampere: V/A .
- Capacitance has units of coulombs per volt: C/V .
- Multiplying the units yields:

$$[RC] = \left(\frac{V}{A}\right) \times \left(\frac{C}{V}\right) = \frac{C}{A} = \frac{A \cdot s}{A} = \text{second}$$

Why other options are incorrect:

- Option A:** Ohm is the SI unit of electrical resistance and reactance.
- Option B:** Farad is the SI unit of capacitance.
- Option D:** Ohm/Farad represents an incorrect dimensional ratio.

Question #121 Key: (B)PHYSICS
NUMS 2026

The fractional change in resistance per kelvin is known as the temperature coefficient of:

CORE CONCEPT & DERIVATION

The temperature coefficient of resistance is defined as the fractional change in electrical resistance per unit change in thermodynamic temperature.

Formula / Rule / Reaction:

$$\alpha = \frac{R_t - R_0}{R_0 \Delta T} = \frac{\Delta R}{R_0 \Delta T}$$

Solution:

- The term $\Delta R/R_0$ expresses the fractional change in resistance relative to baseline resistance at 0°C .
- Dividing this fractional ratio by the temperature change in kelvin (ΔT) gives the temperature coefficient of resistance (α).
- Its SI unit is K^{-1} .

Why other options are incorrect:

- Option A:** Conductance is the reciprocal of resistance, measured in siemens.
- Option C:** Inductance characterizes magnetic flux linkage per unit current in a coil.
- Option D:** Temperature coefficient of conductivity defines fractional variations in specific electrical conductivity.

Question #122 Key: (D)PHYSICS
NUMS 2026

Which of the following is an example of Ohmic in nature?

CORE CONCEPT & DERIVATION

Ohmic devices maintain a strictly linear current-voltage relationship where resistance remains constant independent of applied potential under isothermal conditions.

Formula / Rule / Reaction:

$$V = IR \implies R = \text{constant}$$

Solution:

- Metallic conductors (such as copper, silver, and aluminum) obey Ohm's law over a wide potential range at constant temperature.
- Their current-voltage characteristics form a straight line passing through the origin.
- Therefore, metallic conductors represent ohmic materials.

Why other options are incorrect:

- Option A:** Thermistors are non-ohmic devices whose resistance drops exponentially with rising temperature.
- Option B:** Filament lamps are non-ohmic because resistive heating increases resistance at higher voltages, yielding a curved I-V plot.
- Option C:** Semiconductors display non-linear exponential or threshold conduction characteristics.

Question #123 Key: (B)PHYSICS
NUMS 2026

The material whose resistance decreases with increase in temperature have:

CORE CONCEPT & DERIVATION

Materials where thermal excitation liberates intrinsic charge carriers to lower electrical resistance with increasing temperature possess a negative temperature coefficient.

Formula / Rule / Reaction:

$$\alpha = \frac{\Delta R}{R_0 \Delta T} < 0 \quad (\text{when } \Delta R < 0 \text{ for } \Delta T > 0)$$

Solution:

- In semiconductors and thermistors, elevated temperatures provide energy to break covalent bonds.
- This releases additional free electrons and holes into the conduction band, increasing electrical conductivity.
- Because resistance decreases as temperature increases ($\Delta R < 0$), the coefficient α is negative.

Why other options are incorrect:

- Option A:** Metallic conductors have a positive temperature coefficient because thermal lattice vibrations increase electron scattering and resistance.
- Option C:** Thermal coefficient is an incomplete term that lacks sign designation.
- Option D:** Coefficient of friction governs mechanical resistive force between contacting surfaces.

Question #124 Key: (C)PHYSICS
NUMS 2026

The number of magnetic field lines passing through unit area is called:

CORE CONCEPT & DERIVATION

Magnetic flux density (also known as magnetic induction) is defined as the magnetic flux passing perpendicularly through a unit cross-sectional area.

Formula / Rule / Reaction:

$$B = \frac{\Phi}{A}$$

Solution:

- Magnetic flux (Φ) represents the total number of magnetic field lines passing through an arbitrary surface area.
- When the total number of lines is normalized per unit area held perpendicular to the field lines, the quantity is magnetic flux density (B).
- Its SI unit is the tesla ($T = \text{Wb m}^{-2}$).

Why other options are incorrect:

- **Option A:** Magnetic field is a general term describing the region of magnetic influence.
- **Option B:** Magnetic flux measures the total lines passing through a given surface without dividing by area.
- **Option D:** Magnetization is magnetic dipole moment per unit volume of a material.

Question #125 Key: (D)PHYSICS
NUMS 2026

The magnetic force of a charged particle moving in a uniform magnetic fields depends on:

CORE CONCEPT & DERIVATION

The magnetic Lorentz force on a moving point charge is directly proportional to the magnitude of the charge, its velocity, and the external magnetic flux density.

Formula / Rule / Reaction:

$$\vec{F} = q(\vec{v} \times \vec{B}) \implies F = qvB \sin \theta$$

Solution:

- The scalar magnitude of the magnetic force is determined by four variables:
- Magnitude of electric charge (q).
- Speed of particle motion (v).
- Strength of uniform magnetic field (B).
- Sine of the orientation angle (θ) between velocity and magnetic field vectors.

Why other options are incorrect:

- **Option A:** Area is irrelevant to the trajectory force of an isolated point charge.
- **Option B:** Current describes macroscopic charge flow over time rather than single-particle kinematics.
- **Option C:** Voltage (potential difference) is not an explicit parameter in the Lorentz force equation.

Question #126 Key: (C)PHYSICS
NUMS 2026

The magnetic force acting on a charged particle is maximum when the angle between [Formula] and...

CORE CONCEPT & DERIVATION

The magnitude of the magnetic force depends on the sine of the angle between velocity and magnetic field vectors, reaching a maximum when the angle is 90 degrees.

Formula / Rule / Reaction:

$$F = qvB \sin \theta$$

Solution:

- The trigonometric function $\sin \theta$ oscillates between -1 and $+1$.
- The maximum absolute value occurs when $\sin \theta = 1$.
- Solving for angle gives $\theta = 90^\circ$.
- Thus, maximum deflecting force occurs when a charged particle enters perpendicular to the magnetic field.

Why other options are incorrect:

- **Option A:** At 0° , $\sin(0^\circ) = 0$, resulting in zero magnetic force.
- **Option B:** At 45° , $\sin(45^\circ) = 0.707$, delivering 70.7% of maximum force.
- **Option D:** At 180° , $\sin(180^\circ) = 0$, yielding zero magnetic force.

Question #127 Key: (B)PHYSICS
NUMS 2026

Generator effect is practical application of:

CORE CONCEPT & DERIVATION

An electric generator converts mechanical energy into electrical energy by rotating a conductor coil across a magnetic field, inducing a motional or dynamic electromotive force.

Formula / Rule / Reaction:

$$\varepsilon = vBL \sin \theta \quad \text{or} \quad \varepsilon = NBA\omega \sin(\omega t)$$

Solution:

- Dynamic (motional) emf is induced whenever a conductor moves relative to a stationary magnetic field, sweeping across magnetic flux lines.
- In electrical AC and DC generators, prime movers rotate armature coils within a magnetic field.
- This mechanical rotation generates a dynamic induced electromotive force.

Why other options are incorrect:

- **Option A:** Static emf is induced without physical motion, as seen across transformer windings via time-varying magnetic fields.
- **Option C:** Mutual induction is the operating principle of electrical transformers.
- **Option D:** Back emf is the opposing counter-voltage generated within electric motors during operation.

Question #128 Key: (A)PHYSICS
NUMS 2026

If number of turns of coil becomes double, the induced emf will be:

CORE CONCEPT & DERIVATION

Faraday's law of electromagnetic induction states that the magnitude of induced electromotive force is directly proportional to the total number of turns in the coil.

Formula / Rule / Reaction:

$$\varepsilon = -N \frac{\Delta \Phi}{\Delta t} \implies \varepsilon \propto N$$

Solution:

- Let initial induced emf be $\varepsilon_1 = -N \frac{\Delta \Phi}{\Delta t}$.
- Doubling the number of turns makes $N' = 2N$.
- The new induced electromotive force is:
- $$\varepsilon_2 = -(2N) \frac{\Delta \Phi}{\Delta t} = 2 \left(-N \frac{\Delta \Phi}{\Delta t} \right) = 2\varepsilon_1$$
- Therefore, the induced electromotive force doubles.

Why other options are incorrect:

- **Option B:** Induced emf is directly proportional to turns; it does not halve.
- **Option C:** Emf depends linearly on coil turns and cannot remain constant if turns change.
- **Option D:** Quadrupling occurs in self-inductance ($L \propto N^2$), not simple linear Faraday emf.

Question #129 Key: (B)PHYSICS
NUMS 2026*Electromagnetic sensor in seismograph converts ground movement into:***CORE CONCEPT & DERIVATION**

Seismographic electromagnetic transducers operate via Faraday's law of induction, translating relative mechanical ground motion into proportional electrical voltage signals.

Formula / Rule / Reaction:

Mechanical ground displacement $\xrightarrow{\text{Electromagnetic induction}}$ Voltage signal $\varepsilon(t)$

Solution:

- A seismometer contains an inertial mass suspended within a frame that moves with seismic ground waves.
- Relative motion between a coil and magnet fixed to the frame changes magnetic flux linkage.
- This induces an electrical signal whose amplitude and frequency match the ground vibrations, allowing recording and display.

Why other options are incorrect:

- **Option A:** The sensor utilizes existing magnetic fields to generate voltages rather than emitting external magnetic signals.
- **Option C:** The direct output is an electrical waveform rather than acoustic sound waves.
- **Option D:** Ground movement already is a vibratory signal; the sensor transduces it into electrical signals.

Question #130 Key: (B)PHYSICS
NUMS 2026*A full wave bridge rectifier consists of:***CORE CONCEPT & DERIVATION**

A bridge rectifier utilizes four semiconductor diodes configured in a closed Wheatstone-type bridge network to convert both halves of an AC cycle into pulsating DC.

Formula / Rule / Reaction:*Factual recall / Qualitative concept.***Solution:**

- A full-wave bridge rectifier circuit routes current through four diodes arranged in a ring.
- During the positive half-cycle, two diagonally opposed diodes conduct in series.
- During the negative half-cycle, the remaining two diodes conduct, maintaining unipolar current flow across the load.

Why other options are incorrect:

- **Option A:** Rectification requires non-linear rectifying diode junctions.
- **Option C:** Two diodes are utilized in a center-tapped transformer full-wave rectifier, not a bridge configuration.
- **Option D:** A single diode produces half-wave rectification.

Question #131 Key: (C)PHYSICS
NUMS 2026*An electrical component used to convert AC into DC is:***CORE CONCEPT & DERIVATION**

A semiconductor p-n junction diode allows unidirectional current flow under forward bias and blocks current under reverse bias, enabling electrical rectification of AC to DC.

Formula / Rule / Reaction:

AC waveform $\xrightarrow{\text{Diode rectification}}$ Pulsating DC

Solution:

- Rectification is the process of converting alternating current (AC) into direct current (DC).
- Because a p-n junction diode conducts current primarily in one forward direction, it blocks alternating reverse half-cycles.
- This one-way conduction converts alternating waveforms into direct current.

Why other options are incorrect:

- **Option A:** Transistors function as electronic amplifiers and switches.
- **Option B:** Capacitors store electrostatic charge and act as smoothing filters.
- **Option D:** Resistors provide passive opposition to current without rectifying polarities.

Question #132 Key: (C)PHYSICS
NUMS 2026*A photon has:***CORE CONCEPT & DERIVATION**

In relativistic mechanics, a photon travels at light speed in vacuum with zero rest mass, yet carries a definite, finite momentum proportional to its frequency.

Formula / Rule / Reaction:

$$m_0 = 0, \quad E = pc = hf \implies p = \frac{h}{\lambda}$$

Solution:

- Special relativity dictates that any entity traveling at speed c must possess zero invariant rest mass ($m_0 = 0$).
- According to the de Broglie relationship and Compton scattering experiments, photons carry finite momentum given by $p = h/\lambda$.
- Therefore, a photon has zero rest mass and finite momentum.

Why other options are incorrect:

- **Option A:** Photons exert radiation pressure because they carry finite momentum.
- **Option B:** Photons do not possess finite invariant rest mass.
- **Option D:** Inverts physical reality; rest mass is zero while momentum is non-zero.

Question #133 Key: (A)PHYSICS
NUMS 2026*Photo-conductive devices like photo cells and solar cells are application of:***CORE CONCEPT & DERIVATION**

Photo-conductive and photovoltaic devices operate by absorbing incident photons whose energy frees bound valence electrons, an application of the photoelectric phenomenon.

Formula / Rule / Reaction:

$$hf = \Phi + K.E_{\max}$$

Solution:

- Photocells and solar cells rely on light interacting with photosensitive materials.
- Photons with energy greater than the work function or bandgap promote electrons into conduction states.
- This internal and external photo-emission underpins photoelectric switches and solar power generation.

Why other options are incorrect:

- **Option B:** Compton scattering involves inelastic scattering of high-energy X-ray or gamma photons by atomic electrons.
- **Option C:** Pair production is the creation of an electron-positron pair from a high-energy gamma photon near a heavy nucleus.
- **Option D:** Interference describes wave superposition that produces fringe patterns without charge liberation.

Question #134 Key: (D)PHYSICS
NUMS 2026*Which of the following particle has smaller De Broglie wave length?***CORE CONCEPT & DERIVATION**

The de Broglie wavelength of a matter wave is inversely proportional to momentum; for particles at comparable speeds, greater mass produces a smaller de Broglie wavelength.

Formula / Rule / Reaction:

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

Solution:

- An alpha particle (helium-4 nucleus) has an atomic mass of approximately 4 u ($m_{\alpha} \approx 6.64 \times 10^{-27}$ kg).
- A proton has a mass of approximately 1 u ($m_p \approx 1.67 \times 10^{-27}$ kg).
- A beta particle is an electron with mass $m_e \approx 9.11 \times 10^{-31}$ kg.
- Because the alpha particle has the largest mass among the material particles, its momentum p is greatest, producing the smallest de Broglie wavelength.

Why other options are incorrect:

- **Option A:** Gamma radiation consists of massless photons rather than material particles.
- **Option B:** Beta particles have small mass, yielding larger matter wavelengths.
- **Option C:** Protons are one-fourth the mass of alpha particles and produce longer wavelengths at equal velocities.

Question #135 Key: (C)PHYSICS
NUMS 2026

In the spectrum of hydrogen atom which of the following series has smallest wavelength?

CORE CONCEPT & DERIVATION

According to the Rydberg formula, photon wavelength is inversely proportional to transition energy; the Lyman series involves de-excitations to the lowest ground level ($n=1$), producing the highest energies and smallest wavelengths.

Formula / Rule / Reaction:

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right), \quad E = \frac{hc}{\lambda}$$

Solution:

- The Lyman series corresponds to transitions ending at the ground state $n_1 = 1$.
- Because $n_1 = 1$ provides the deepest potential well, transitions into this level release the largest energy quanta.
- Since wavelength is inversely related to photon energy ($\lambda = hc/\Delta E$), the highest energy transitions emit the smallest wavelengths (ultraviolet region).

Why other options are incorrect:

- **Option A:** Paschen series transitions end at $n_1 = 3$ in the infrared region with longer wavelengths.
- **Option B:** Balmer series transitions terminate at $n_1 = 2$ in the visible spectrum.
- **Option D:** Brackett series transitions end at $n_1 = 4$ in the far-infrared region.

Question #136 Key: (C)ENGLISH
NUMS 2026

The antonym for the word clarity is:

CORE CONCEPT & DERIVATION

Clarity denotes the quality of being clear, lucidity, precision, and easy intelligibility; its direct semantic antonym is vagueness, which denotes lack of clearness or precision.

Formula / Rule / Reaction:

Clarity (precision/lucidity) $\iff$ Antonym: Vagueness (ambiguity/obscurity)

Solution:

- Clarity refers to expression that is distinct, easily understood, and free from obscurity.
- Vagueness describes statements or thoughts that are indistinct, imprecise, and poorly defined.
- Thus, vagueness is the direct antonym.

Why other options are incorrect:

- **Option A:** Upright refers to vertical posture or moral integrity.
- **Option B:** Understanding is the cognitive capacity to comprehend meaning.
- **Option D:** Clear is a direct synonym of clarity, not an antonym.

Question #137 Key: (A)ENGLISH
NUMS 2026

Yasir Ameen could not pay the rent; accordingly, he was evicted. Meaning of the underlined word...

CORE CONCEPT & DERIVATION

The verb to evict means to legally expel or dispossess a tenant from property or leased premises, especially for failure to pay rental arrears.

Formula / Rule / Reaction:

Factual recall / Qualitative concept.

Solution:

- In real estate and rental agreements, failure to pay rent results in legal dispossession.
- The word evicted means expelled or removed from a residential property.

Why other options are incorrect:

- **Option B:** Investigated means subject to systematic examination or inquiry.
- **Option C:** Threatened indicates expressions of intent to inflict harm.
- **Option D:** Rewarded signifies receiving recompense or an accolade.

Question #138 Key: (B)ENGLISH
NUMS 2026

Fill in the blank with the correct verb. The baby _____ all morning.

CORE CONCEPT & DERIVATION

The duration adverbial all morning indicates an action that began in the past and has continued uninterrupted into the present, requiring the present perfect continuous tense with third-person singular agreement.

Formula / Rule / Reaction:

Subject (singular) + has been + verb-ing

Solution:

- The temporal phrase all morning indicates an ongoing duration spanning from earlier in the morning up to the present.
- The subject The baby is third-person singular, requiring has been rather than have been.
- Combining these grammatical requirements yields has been crying.

Why other options are incorrect:

- **Option A:** Is crying specifies present continuous action without indicating extended past duration.
- **Option C:** Cry is an uninflected base verb that violates third-person singular agreement.
- **Option D:** Have been crying uses a plural auxiliary verb with a singular subject.

Question #139 Key: (C)ENGLISH
NUMS 2026

By 2040, robots _____ many of the jobs that people do today.

CORE CONCEPT & DERIVATION

The preposition by followed by a specified future time marker (By 2040) establishes a deadline prior to which an action will be completed, requiring the future perfect tense.

Formula / Rule / Reaction:

By + [Future Point] $\Rightarrow$ will have + past participle

Solution:

- Sentences introduced by the temporal boundary by + [future date] denote perfected future events.
- The future perfect tense structure is will have + past participle.
- Applying this rule gives will have taken over.

Why other options are incorrect:

- **Option A:** Will be taking over is future continuous, which denotes an ongoing process rather than a completed event.
- **Option B:** Will take over is simple future, which lacks the prior completion sense established by by 2040.
- **Option D:** Has taken over is present perfect, which cannot modify a future temporal benchmark.

Question #140 Key: (B)ENGLISH
NUMS 2026

"Each time one of us touches the soil, we feel a sense of personal renewal". The type of sentence...

CORE CONCEPT & DERIVATION

A complex sentence consists of exactly one independent main clause and at least one dependent subordinate clause introduced by a subordinating conjunction or adverbial clause marker.

Formula / Rule / Reaction:

Complex Sentence = Dependent Subordinate Clause + Independent Main Clause

Solution:

- The clause Each time one of us touches the soil is a dependent adverbial clause of time that cannot stand alone as an independent sentence.
- The clause we feel a sense of personal renewal is an independent main clause containing a subject and a finite predicate.
- A sentence containing one dependent clause and one independent clause is classified as a complex sentence.

Why other options are incorrect:

- **Option A:** Compound sentences require two or more independent clauses joined by coordinating conjunctions (FANBOYS) or semicolons.
- **Option C:** Compound-complex sentences require at least two independent clauses and at least one dependent clause.
- **Option D:** Simple sentences contain only one independent clause with no dependent clauses.

Question #141 Key: (B)ENGLISH
NUMS 2026

Identify the correctly punctuated sentence.

CORE CONCEPT & DERIVATION

Non-restrictive appositive phrases that rename or provide supplementary information about a proper noun must be enclosed on both sides by commas, and common nouns are not capitalized.

Formula / Rule / Reaction:

Proper Noun +, +[Non-restrictive Appositive] +, +Predicate

Solution:

- The phrase the great English poet is a non-defining appositive elaborating on the subject Milton.
- Punctuation rules require setting off this non-essential phrase with a comma before it and a comma after it.
- English is capitalized as a proper adjective, whereas poet is a common noun and remains lowercase.
- Sentence B meets all these syntactical and capitalization criteria.

Why other options are incorrect:

- **Option A:** Omits the introductory comma after Milton and capitalizes the common noun Poet.
- **Option C:** Omits the opening comma and inserts an erroneous comma between auxiliary was and adjective blind.
- **Option D:** Misplaces the comma between adjective great and modifier English.

Question #142 Key: (C)ENGLISH
NUMS 2026

Identify the correct sentence.

CORE CONCEPT & DERIVATION

Subject-verb agreement requires a singular subject (woman) to take a singular auxiliary (is), homophone precision requires bare (uncovered) rather than bear, and plural feet is required for natural human locomotion.

Formula / Rule / Reaction:

Grammatical agreement / Lexical accuracy.

Solution:

- The singular noun phrase A Sindhi woman agrees with the singular present continuous verb is going.
- The adjective bare means naked or uncovered, whereas bear refers to an animal or the verb to carry.
- Locomotion on both feet requires the plural noun feet rather than singular foot.
- Sentence C satisfies all grammatical, homophonic, and number agreements.

Why other options are incorrect:

- **Option A:** Uses the incorrect homophone bear instead of bare.
- **Option B:** Combines the singular article A with plural women.
- **Option D:** Uses the singular bare foot instead of plural bare feet.

Question #143 Key: (A)ENGLISH
NUMS 2026

Complete the sentence using correct preposition. The public are cautioned
----- pickpockets...

CORE CONCEPT & DERIVATION

The verb caution functions with the dependent preposition against when warning individuals about potential hazards, criminal acts, or perils.

Formula / Rule / Reaction:

To caution + [person] + against + [danger / hazard]

Solution:

- Idiomatic English syntax pairs the verb caution with against to denote defensive vigilance against a threat.
- In this sentence, the danger consists of pickpockets.
- The preposition required is against.

Why other options are incorrect:

- **Option B:** Caution of is unidiomatic in this context.
- **Option C:** Caution for is grammatically incorrect.
- **Option D:** Caution with is unidiomatic when warning against a predatory threat.

Question #144 Key: (D)ENGLISH
NUMS 2026

Select the correct pair. Lack of sleep can ----- your health and have a bad
----- on your...

CORE CONCEPT & DERIVATION

Affect functions primarily as a verb meaning to influence or produce a change in, whereas effect functions primarily as a noun meaning a result, consequence, or outcome.

Formula / Rule / Reaction:

Modal Auxiliary (can) + Verb (affect) ... Adjective (bad) + Noun (effect)

Solution:

- The first blank follows the modal auxiliary verb can, requiring the base verb affect.
- The second blank is preceded by the article a and adjective bad, requiring the noun effect.
- Therefore, the correct word pair is Affect / effect.

Why other options are incorrect:

- **Option A:** Uses the verb affect in the second position where a noun is required.
- **Option B:** Uses the noun effect in the first position where an infinitive verb is required.
- **Option C:** Reverses both grammatical parts of speech.

Question #145 Key: (D)ENGLISH
NUMS 2026

Select the correct sentence in style.

CORE CONCEPT & DERIVATION

An introductory participial phrase must be followed immediately by the grammatical subject that performs the action described in the participle, avoiding dangling modifiers.

Formula / Rule / Reaction:

Perfect Participle (Having finished X) +, + Logical Agent (he) + Predicate

Solution:

- The introductory modifier is Having finished his exercise.
- The agent who performed the action of finishing the exercise is the person (he), not the books.
- In option D, the subject he directly follows the participial phrase, eliminating any dangling modifier.

Why other options are incorrect:

- **Option A:** Contains a dangling modifier because the books cannot perform the exercise.
- **Option B:** Contains both an ungrammatical participial construction (Having finishing) and a dangling modifier.
- **Option C:** Contains the ungrammatical participle formulation Having finishing.

Question #146 Key: (B)ENGLISH
NUMS 2026

Select the statement that best describes the given sentence. "He is anything but a liar."

CORE CONCEPT & DERIVATION

The idiomatic expression anything but serves as an emphatic negative meaning definitely not or the complete opposite of the stated noun or quality.

Formula / Rule / Reaction:

Subject + is anything but X $\iff$ Subject is definitely not X

Solution:

- The idiom anything but negates the term that follows.
- Saying He is anything but a liar emphasizes that whatever flaws he may possess, he is definitely not a liar.
- This corresponds directly to: He can be anything but not a liar.

Why other options are incorrect:

- **Option A:** Completely contradicts the meaning of the idiom by stating he is a liar.
- **Option C:** Erroneously claims that the individual is a liar.
- **Option D:** Contradicts the statement by asserting he is a liar to some extent.

Question #147 Key: (D)ENGLISH
NUMS 2026

Select the best option to describe the given sentence: "Unless you apologise I shall punish you..."

CORE CONCEPT & DERIVATION

The conditional conjunction unless introduces an exceptive negative condition equivalent in meaning to if ... not.

Formula / Rule / Reaction:

Unless P , $Q \iff$ If not P , then $Q \iff$ Without P , Q

Solution:

- The clause Unless you apologise sets a condition meaning If you do not offer an apology.
- The consequence of failing to apologize is punishment: I shall punish you.
- Expressing this relationship concisely yields: Without apology you will be punished.

Why other options are incorrect:

- **Option A:** Contradicts the conditional threat by suggesting forgiveness without an apology.
- **Option B:** Reverses the condition by asserting punishment occurs with an apology.
- **Option C:** An apology is the explicit condition required to avoid punishment.

Question #148 Key: (D)ENGLISH
NUMS 2026

"From the attitude it is clear that he wants to pay off his old scores." The sentence means that...

CORE CONCEPT & DERIVATION

The idiom to pay off old scores (or settle old scores) means to retaliate against past grievances, injuries, or insults by exacting revenge.

Formula / Rule / Reaction:

To pay off old scores $\iff$ To exact revenge / retaliate for past wrongs

Solution:

- The phrase pay off old scores does not relate to academic marks or financial debt.
- In idiomatic usage, it refers to seeking retribution for previous conflicts or grudges.
- Therefore, the expression means he wants to have his revenge.

Why other options are incorrect:

- **Option A:** Takes scores literally as academic examination marks.
- **Option B:** Takes pay off literally as financial loan repayment.
- **Option C:** Contradicts the confrontational meaning of the idiom.

Question #149 Key: (A)ENGLISH
NUMS 2026

A person needs to reflect profoundly on his/her life. The underlined word means:

CORE CONCEPT & DERIVATION

The adverb profoundly means in a profound manner, characterized by deep intellectual, emotional, or philosophical depth.

Formula / Rule / Reaction:

Profoundly $\iff$ Deeply / Thoroughly / Intensely

Solution:

- Reflecting profoundly involves introspective examination of meaning and existence.
- The direct synonym for profoundly in this context is deeply.

Why other options are incorrect:

- **Option B:** Superficially means in a shallow or surface-level manner, serving as an antonym.
- **Option C:** Shallow is an adjective denoting lack of depth.
- **Option D:** Mirroring is a physical optical or behavioral imitation term.

Question #150 Key: (B)ENGLISH
NUMS 2026

Due to his non-serious attitude, Ali took the advice with a pinch of salt. It means:

CORE CONCEPT & DERIVATION

The idiom to take something with a pinch of salt (or grain of salt) means to accept information with skepticism, doubt, or without taking it completely seriously.

Formula / Rule / Reaction:

Take with a pinch of salt $\iff$ Regard with skepticism / Not take seriously

Solution:

- Taking advice with a pinch of salt indicates that the recipient does not treat the advice as fully authoritative or serious.
- Coupled with Ali's non-serious attitude, the idiom confirms that he did not take the advice seriously.

Why other options are incorrect:

- **Option A:** The exact opposite of the skepticism implied by the idiom.
- **Option C:** Candid acceptance involves frank and sincere agreement.
- **Option D:** Implementing advice happily implies enthusiastic execution rather than skepticism.