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20. Industrial Chemistry

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41 Solved Questions

2000 to 2025 Archive

Boards: BUMHS, DUHS, NUMS, PMDC, UHS

Weightage: 27% of MDCAT (54 MCQs)

Curated by Ibrahim for fellow bees. Every question in this chapter has been verified against official UHS, NUMS, SZABMU, DUHS, and KMU answer keys. Propolis cognitive autopsies are provided at the end of this booklet to explain core concepts and break down common distractor traps.

OFFICIAL SOLVED EDITION**Q1.**

DUHS 2025

Which of following adhesive is used to bond broken pieces of jewelry?

- (A) Epoxy resin
- (B) Super glue
- (C) Silicon resin
- (D) Starch

Q2.

DUHS 2025

Which one is addition polymer?

- (A) nylon 6,6
- (B) nylon 6,10
- (C) polyvinyl chloride
- (D) polyester

Q3.

BUMHS 2025

Which monomer is used for synthesis of nylon 6,6?

- (A) Hexamethylene diamine
- (B) Sobacoyl chloride
- (C) Methylene diamine
- (D) Heptane-1, 7-dioic acid

Q4.

BUMHS 2025

Which of the following is natural adhesive?

- (A) Silicones
- (B) Polyvinylacetate
- (C) Polyamide
- (D) Casein glue

Q5.

BUMHS 2025

Which of the following group acts chromophore?

- (A) Amino Group
- (B) Azo Group
- (C) Hydroxyl Group
- (D) Sulfonic Acid Group

Q6.

NUMS 2025

Polymerization of HCHO and CH₃CHO occurs in the presence of:

- (A) DIL.H₂SO₄
- (B) Conc.H₂SO₄
- (C) Conc.H₂CO₃
- (D) DIL.H₂CO₃

Q7.

UHS 2025

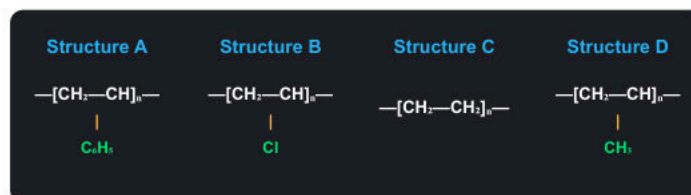
Poly vinyl chloride (PVC) is the type of?

- (A) Homopolymer
- (B) Thermosetting polymer
- (C) Thermoplastic polymer
- (D) Copolymer

Q8.

PMDC 2000

Which of the following repeating unit structures represents the addition polymer polystyrene?



- (A) Structure A
- (B) Structure B
- (C) Structure C
- (D) Structure D

Q9.

PMDC

Why is thorough surface preparation, such as degreasing and mechanical roughening, essential prior to adhesive application?

- (A) It eliminates surface contaminants and promotes interfacial wetting and mechanical interlocking.
- (B) It accelerates the rate of free-radical polymerization in the liquid adhesive matrix.
- (C) It reduces the total volume of adhesive required to span the structural gap.
- (D) It equalizes the coefficients of thermal expansion between dissimilar adherends.

Q10.

PMDC

How does high dynamic viscosity in a liquid adhesive affect its application and penetration into porous substrates?

- (A) It enhances capillary flow and increases the depth of substrate penetration.
- (B) It impedes fluid flow and diminishes penetration into substrate pores.
- (C) It eliminates interfacial tension without altering the fluid displacement rate.
- (D) It accelerates chemical cross-linking and shortens the adhesive gel time.

Q11.

PMDC

Which class of adhesives exhibits superior thermal resistance, shear modulus, and solvent resistance after complete curing?

- (A) Pressure-sensitive adhesives
- (B) Hot-melt adhesives
- (C) Solvent-borne adhesives
- (D) Thermosetting adhesives

Q12.

PMDC

What is the primary function of incorporating inert inorganic fillers, such as talc or fumed silica, into an adhesive formulation?

- (A) To catalyze free-radical decomposition and lower the glass transition temperature
- (B) To increase optical transparency and maximize electrical conductivity
- (C) To modify rheological viscosity, minimize shrinkage, and reduce formulation cost
- (D) To convert linear thermoplastic polymers into flexible elastomeric foams

Q13.

PMDC

What is the fundamental engineering purpose of an adhesive when joining two structural substrates?

- (A) To establish and sustain continuous interfacial bonding forces between adherend surfaces
- (B) To act as a temporary thermal barrier to prevent interfacial heat dissipation
- (C) To dissolve substrate materials into a homogeneous liquid phase
- (D) To provide permanent physical separation between metallic surfaces

Q14.

PMDC

In adhesive mechanics, what is the fundamental distinction between the terms adhesion and cohesion?

- (A) Adhesion represents the bulk tensile strength of the adhesive; cohesion represents substrate wetting.
- (B) Adhesion refers to temporary physical joints; cohesion refers to irreversible covalent bonds.
- (C) Adhesion is the binding force between adhesive and substrate; cohesion is the internal strength of the adhesive.
- (D) Adhesion is mediated exclusively by covalent bonds; cohesion is mediated only by London dispersion forces.

Q15.

PMDC

Under which polymer classifications do modern synthetic industrial adhesives fall?

- (A) Thermoplastics exclusively
- (B) Thermosetting resins exclusively
- (C) Elastomers exclusively
- (D) Thermoplastics, thermosetting resins, and elastomers

Q16.

PMDC

Which fundamental physical parameter governs the ability of a liquid adhesive to spread across and wet a solid adherend?

- (A) Cohesive shear modulus
- (B) Dynamic viscosity
- (C) Yield tensile strength
- (D) Glass transition temperature

Q17.

PMDC

Adhesives that are applied in a molten state and rapidly develop bond strength upon cooling and solidification are called:

- (A) Hot-melt adhesives
- (B) Solvent-activated contact adhesives
- (C) Cyanoacrylate super glues
- (D) Two-part epoxy structural adhesives

Q18.

PMDC

Which statement accurately describes the primary operational objective of an adhesive in structural applications?

- (A) To chemically degrade the surface layer of substrates
- (B) To join two solid surfaces through surface adhesion forces
- (C) To increase the internal porosity of metallic components
- (D) To serve as a sacrificial lubricant between dynamic interfaces

Q19.

PMDC

Which ancient natural dye, historically extracted from Indigofera plants and now synthesized industrially, is standard for denim?

- (A) Methyl orange
- (B) Malachite green
- (C) Indigo
- (D) Basic fuchsin

Q20.

PMDC

Which statement correctly describes the solubility transformation of vat dyes during textile application?

- (A) Insoluble pigments are reduced to a soluble leuco form, absorbed, and then re-oxidized inside the fiber.
- (B) Water-soluble salts are applied directly and permanently fixed to the fiber without redox reactions.
- (C) Insoluble solid particles sublime as a vapor and diffuse into synthetic fibers at elevated temperatures.
- (D) Cationic dye molecules form coordinate covalent complexes directly with inorganic mordant salts.

Q21.

PMDC

Which functional structural moiety in a dye molecule is primarily responsible for light absorption in the visible spectrum?

- (A) Auxochrome
- (B) Mordant
- (C) Substrate
- (D) Chromophore

Q22.

PMDC

Dyes that are insoluble in water and applied via a reduced soluble 'leuco' state, followed by in-situ oxidation, are classified as:

- (A) Direct dyes
- (B) Vat dyes
- (C) Acid dyes
- (D) Basic dyes

Q23.

PMDC

Which class of non-ionic, low-water-solubility dyes is applied as an aqueous colloidal dispersion to dye hydrophobic polyester fibers?

- (A) Acid dyes
- (B) Basic dyes
- (C) Disperse dyes
- (D) Azo direct dyes

Q24.

PMDC

What does the technological parameter 'dye fastness' denote regarding a colored textile material?

- (A) The kinetic diffusion coefficient of the dye during bath immersion
- (B) The stoichiometric solubility limit of the dye salt in boiling water
- (C) The total number of auxochromic groups per unit molecular weight
- (D) The resistance of dyed material to color change or fading under environmental exposure

Q25.

PMDC

Which functional structural group is primarily responsible for imparting color to an organic dye molecule?

- ☐ A Chromophore
- ☐ B Auxochrome
- ☐ C Solubilizing group
- ☐ D Aliphatic spacer

Q26.

PMDC

A water-soluble dye containing extended conjugated $\text{—C}=\text{C—}$ units and —OH groups that binds directly to cellulosic fibers is a:

- ☐ A Triarylmethane dye
- ☐ B Anthraquinone vat dye
- ☐ C Direct dye
- ☐ D Disperse dye

Q27.

PMDC

Why must monomer species participating in linear condensation polymerization possess at least two reactive functional groups?

- ☐ A To enable continuous bidirectional chain growth at both ends of each growing macromolecule
- ☐ B To prevent the elimination of small byproduct molecules such as water or hydrogen chloride
- ☐ C To initiate spontaneous free-radical propagation without external energy input
- ☐ D To ensure instantaneous dissolution of the resulting polymer in neutral water

Q28.

PMDC

What is the primary role of a free-radical initiator in the industrial addition polymerization of vinyl chloride at 50°C ?

- ☐ A It acts as a phase-transfer surfactant to prevent polymer precipitation.
- ☐ B It undergoes homolytic cleavage to generate active radicals that initiate chain propagation.
- ☐ C It permanently cross-links adjacent linear chains into an infusible thermosetting network.
- ☐ D It selectively extracts hydrogen chloride from the reaction vessel to prevent acid corrosion.

Q29.

PMDC

Which structural feature gives Nylon-6,6 fibers exceptionally high tensile strength and elasticity for textile applications?

- ☐ A Flexible ether linkages that permit unrestricted torsional rotation
- ☐ B Bulky pendant aromatic groups that prevent dense polymer chain packing
- ☐ C Ionic cross-links formed between ionized terminal carboxylic groups
- ☐ D Extensive intermolecular hydrogen bonding between repeating amide linkages

Q30.

PMDC

Which physical characteristic accounts for the widespread structural use of thermosetting condensation polymers?

- ☐ A Low glass transition temperatures that provide rubbery elasticity
- ☐ B High solubility in common polar organic solvents
- ☐ C High thermal stability and dimensional rigidity from dense covalent cross-linking
- ☐ D Facile remelting and infinite thermal recyclability

Q31.

PMDC

What fundamental structural feature is required for a small organic molecule to undergo addition (chain-growth) polymerization?

- ☐ A The presence of two terminal carboxylic acid or hydroxyl functional groups
- ☐ B The presence of one or more reactive carbon-carbon double or triple bonds
- ☐ C The capacity to eliminate small condensation byproducts such as water
- ☐ D A completely saturated, highly branched aliphatic hydrocarbon skeleton

Q32.

PMDC

During an addition polymerization reaction, what occurs regarding the atomic composition of the reacting monomer units?

- ☐ A A fraction of the carbon skeleton is oxidized to carbon dioxide gas.
- ☐ B Hydrogen atoms are eliminated to produce conjugated polyene chains.
- ☐ C A small byproduct molecule such as water or alcohol is released.
- ☐ D All atoms of the original monomer are fully incorporated into the polymer backbone.

Q33.

PMDC

What is the key functional group requirement for monomers participating in step-growth condensation polymerization?

- ☐ A A single reactive terminal functional site per monomer molecule
- ☐ B A completely non-polar, unreactive aliphatic hydrocarbon framework
- ☐ C At least two reactive functional groups (e.g., —OH , —COOH , —NH_2) per monomer molecule
- ☐ D An unsaturated carbon-carbon double bond with electron-donating alkyl substituents

Q34.

PMDC

Addition polymerization is also commonly designated by which mechanistic classification?

- ☐ A Step-growth polymerization
- ☐ B Chain-growth polymerization
- ☐ C Ring-opening polycondensation
- ☐ D Interfacial condensation polymerization

Q35.

PMDC

Bakelite, an early industrial thermosetting resin, is produced by the condensation reaction of:

- ☐ A Phenol and sodium hydroxide
- ☐ B Phenol and concentrated sulfuric acid
- ☐ C Phenol and acetyl chloride
- ☐ D Phenol and formaldehyde

Q36.

PMDC

An auxochrome fails to deepen the color of a chromogen if it is substituted at which position relative to the chromophore?

- ☐ A Ortho position
- ☐ B Meta position
- ☐ C Para position
- ☐ D Both ortho and para positions

Q37.

PMDC

Rayon is classified as a semi-synthetic regenerated fiber manufactured from which natural polymer feedstock?

- ☐ A Petrochemical acetyl chloride
- ☐ B Synthetic ethylene oligomers
- ☐ C Petroleum-derived acetylene
- ☐ D Natural cellulose

Q38.

PMDC

Which of the following commercial synthetic polymers is classified structurally as a copolymer?

- ☐ A Polystyrene
- ☐ B Polyvinyl acetate
- ☐ C Polyamide (Nylon-6,6)
- ☐ D Polyvinyl chloride

Q39.

PMDC

When hexanedioic acid is heated with hexamethylenediamine, the resulting synthetic polymer is:

- ☐ A Polypeptide
- ☐ B Polyvinyl chloride
- ☐ C Polyester
- ☐ D Nylon-6,6

Q40.

PMDC

Which of the following polymers is produced via step-growth condensation polymerization?

- ☐ A Polyvinyl chloride
- ☐ B Polyamide (Nylon-6,6)
- ☐ C Polystyrene
- ☐ D Polyethene

Q41.

PMDC

Nylon-6,6 belongs to which general structural family of synthetic polymers?

- ☐ A Polyester
- ☐ B Polyvinyl ester
- ☐ C Polyamide
- ☐ D Polyether

RAPID 5-COLUMN ANSWER KEY

Official PMDC verified answer keys for 20. Industrial Chemistry.

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Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD
1	B	DUHS 2025	10	B	PMDC	19	C	PMDC	28	B	PMDC	37	D	PMDC
2	C	DUHS 2025	11	D	PMDC	20	A	PMDC	29	D	PMDC	38	C	PMDC
3	A	BUMHS 2025	12	C	PMDC	21	D	PMDC	30	C	PMDC	39	D	PMDC
4	D	BUMHS 2025	13	A	PMDC	22	B	PMDC	31	B	PMDC	40	B	PMDC
5	B	BUMHS 2025	14	C	PMDC	23	C	PMDC	32	D	PMDC	41	C	PMDC
6	A	NUMS 2025	15	D	PMDC	24	D	PMDC	33	C	PMDC			
7	C	UHS 2025	16	B	PMDC	25	A	PMDC	34	B	PMDC			
8	A	PMDC 2000	17	A	PMDC	26	C	PMDC	35	D	PMDC			
9	A	PMDC	18	B	PMDC	27	A	PMDC	36	B	PMDC			

TOTAL MCQS	CORRECT	INCORRECT	BLANK	ACCURACY
41				%

Scan the booklet QR code to enter answers in
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PROPOLIS COGNITIVE ERROR AUTOPSIES

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

Question #1 Key: (B)

DUHS 2025

Which of following adhesive is used to bond broken pieces of jewelry?

CORE CONCEPT AND DERIVATION

Cyanoacrylate adhesives (commonly known as super glue) undergo rapid anionic polymerization in the presence of trace moisture, forming high-strength bonds between non-porous surfaces.

Formula / Reaction:



Solution:

- Super glue is specifically formulated for fast, rigid bonding of non-porous materials such as metals, glass, ceramics, and jewelry.
- It cures within seconds at room temperature without requiring mixing or external heat.

Why other options are incorrect:

- **Epoxy resin:** Requires manual mixing of resin and hardener and exhibits a longer curing time, making it less convenient for delicate jewelry repairs.
- **Silicon resin:** Forms flexible, elastomeric joints that lack the rigid shear strength required for fine metal and gemstone settings.
- **Starch:** A weak, water-soluble natural adhesive used primarily for paper products.

Question #2 Key: (C)

DUHS 2025

Which one is addition polymer?

CORE CONCEPT AND DERIVATION

Addition (chain-growth) polymers are formed by the successive addition of unsaturated monomer units across double or triple bonds without the elimination of any small by-product molecules.

Formula / Reaction:



Solution:

- Polyvinyl chloride (PVC) is produced by the free-radical addition polymerization of vinyl chloride (chloroethene).
- The empirical formula of the polymer repeating unit is identical to that of the monomer, confirming addition polymerization.

Why other options are incorrect:

- **nylon 6,6:** A condensation polyamide synthesized from hexamethylenediamine and adipic acid with elimination of H_2O .
- **nylon 6,10:** A condensation polyamide formed from hexamethylenediamine and sebacoyl chloride/sebacic acid.
- **polyester:** A condensation polymer formed between diols and dicarboxylic acids with elimination of H_2O .

Question #3 Key: (A)

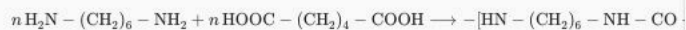
BUMHS 2025

Which monomer is used for synthesis of nylon 6,6?

CORE CONCEPT AND DERIVATION

Nylon-6,6 is a synthetic polyamide formed via step-growth condensation polymerization of a six-carbon diamine with a six-carbon dicarboxylic acid.

Formula / Reaction:



Solution:

- The monomers required for Nylon-6,6 are **hexamethylenediamine** (1,6-diaminohexane) and **adipic acid** (hexanedioic acid).
- The designation '6,6' denotes that both reacting monomer species contain exactly 6 carbon atoms.

Why other options are incorrect:

- **Sobacoyl chloride:** A 10-carbon acyl chloride monomer used in the synthesis of Nylon-6,10.
- **Methylene diamine:** Contains only 1 carbon atom and does not form Nylon-6,6.
- **Heptane-1, 7-dioic acid:** A 7-carbon dicarboxylic acid (pimelic acid) not used in Nylon-6,6 synthesis.

Question #4 Key: (D)

BUMHS 2025

Which of the following is natural adhesive?

CORE CONCEPT AND DERIVATION

Natural adhesives are bio-based polymeric substances derived directly from animal, plant, or dairy proteins and carbohydrates without synthetic polymerization.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- **Casein glue** is a natural adhesive manufactured by precipitating casein phosphoproteins from skimmed milk using dilute acid or rennet, followed by alkaline dissolution.
- It has been used historically in woodworking, bookbinding, and label bonding.

Why other options are incorrect:

- **Silicones:** Synthetic inorganic-organic polymers with a repeating $-\text{Si}-\text{O}-$ backbone.
- **Polyvinylacetate:** A synthetic thermoplastic resin prepared by the addition polymerization of vinyl acetate.
- **Polyamide:** Synthetic condensation polymers containing repeating amide linkages.

Question #5 Key: (B)

BUMHS 2025

Which of the following group acts chromophore?

CORE CONCEPT AND DERIVATION

A chromophore is an unsaturated functional group containing delocalized π -electrons that absorbs electromagnetic radiation in the visible region (400–700 nm), thereby imparting color to a molecule.

Formula / Reaction:**Solution:**

- The **azo group** ($-\text{N}=\text{N}-$) contains a double bond with a conjugated π -system capable of $\pi \rightarrow \pi^*$ transitions in the visible spectrum.
- Azo compounds constitute the largest class of synthetic organic dyes.

Why other options are incorrect:

- **Amino Group** ($-\text{NH}_2$): An auxochrome that intensifies color and shifts absorption wavelength, but cannot impart color on its own.
- **Hydroxyl Group** ($-\text{OH}$): An auxochrome containing lone pairs that enhance the chromophore's absorption.
- **Sulfonic Acid Group** ($-\text{SO}_3\text{H}$): A solubilizing group used to render dye molecules water-soluble.

Question #6 Key: (A)

NUMS 2025

Polymerization of HCHO and CH_3CHO occurs in the presence of:**CORE CONCEPT AND DERIVATION**

Lower aliphatic aldehydes undergo acid-catalyzed cyclic trimerization and polymerization in the presence of dilute mineral acids.

Formula / Reaction:**Solution:**

- Dilute sulfuric acid (dil. H_2SO_4) provides the catalytic protons (H^+) required to initiate nucleophilic addition between carbonyl molecules without causing charring or dehydration.

Why other options are incorrect:

- **Conc. H_2SO_4 :** Acts as an aggressive dehydrating and oxidizing agent, causing extensive charring, sulfonation, and oxidative decomposition.
- **Conc. H_2CO_3 & Dil. H_2CO_3 :** Carbonic acid is an unstable, weak acid that provides insufficient hydronium ion concentration to catalyze cyclic aldehyde polymerization.

Question #7 Key: (C)

UHS 2025

Poly vinyl chloride (PVC) is the type of?

CORE CONCEPT AND DERIVATION

Thermoplastic polymers are linear or moderately branched polymers held together by intermolecular forces that soften reversibly upon heating and harden upon cooling.

Formula / Reaction:**Solution:**

- Polyvinyl chloride (PVC) possesses linear chains with dipole-dipole attractions that can be repeatedly softened by thermal energy and reshaped.
- **Official UHS MDCAT Key Alignment:** Although PVC is structurally a homopolymer, the official exam key designates **Thermoplastic polymer** as the correct classification based on thermal behavior.

Why other options are incorrect:

- **Thermosetting polymer:** Thermosets form irreversible cross-linked covalent networks that degrade rather than melt upon heating.
- **Copolymer:** Formed from two or more distinct monomer types, whereas PVC is derived entirely from vinyl chloride.
- **Homopolymer:** Structurally true, but secondary to Option C in the official competitive scoring key.

Question #8 Key: (A)

PMDC 2000

Which of the following repeating unit structures represents the addition polymer polystyrene? Structure A —[CH...

CORE CONCEPT AND DERIVATION

Polystyrene is an aromatic addition polymer formed by the chain-growth polymerization of styrene (phenylethene).

Formula / Reaction:**Solution:**

- The repeating unit of polystyrene contains a saturated carbon backbone with a pendant phenyl ($-\text{C}_6\text{H}_5$) ring attached to alternating carbon atoms, as depicted in Structure A.

Why other options are incorrect:

- Structure B:** Represents polyvinyl chloride (PVC) with a pendant chloro ($-\text{Cl}$) group.
- Structure C:** Represents polyethylene (low- or high-density polyethylene).
- Structure D:** Represents polypropylene with a pendant methyl ($-\text{CH}_3$) group.

Question #9 Key: (A)

PMDC

Why is thorough surface preparation, such as degreasing and mechanical roughening, essential prior to adhesive...

CORE CONCEPT AND DERIVATION

Adhesive joint strength depends on intimate microscopic contact (wetting) and mechanical keying between the liquid adhesive and the substrate surface.

Formula / Reaction:

$$\text{Work of Adhesion: } W_A = \gamma_S + \gamma_L - \gamma_{SL}$$

Solution:

- Degreasing removes low-surface-energy contaminants (oils, oxides) that prevent spontaneous wetting.
- Roughening increases the effective surface area and creates micro-cavities that facilitate mechanical interlocking upon curing.

Why other options are incorrect:

- Option B:** Surface cleaning does not alter the fundamental chemical polymerization kinetics of the adhesive formulation.
- Option C:** Joint geometry and bondline thickness determine adhesive quantity, not cleaning.
- Option D:** Surface preparation does not alter intrinsic bulk physical constants like thermal expansion coefficients.

Question #10 Key: (B)

PMDC

How does high dynamic viscosity in a liquid adhesive affect its application and penetration into porous substr...

CORE CONCEPT AND DERIVATION

Dynamic viscosity (η) is a fluid's internal resistance to shear flow; high viscosity inhibits capillary penetration into porous micro-structures.

Formula / Reaction:

$$\text{Poiseuille Penetration Rate: } \frac{dh}{dt} = \frac{r^2 \gamma \cos \theta}{4\eta h}$$

Solution:

- According to the Lucas-Washburn relation, the rate of capillary penetration (dh/dt) is inversely proportional to viscosity (η).
- Higher viscosity slows spreading, limits capillary draw, and reduces mechanical keying in porous adherends.

Why other options are incorrect:

- Option A:** Inversely contradicts fluid dynamics; higher viscosity restricts flow rate.
- Option C:** Viscosity is a kinetic property of flow, whereas surface tension is a thermodynamic interfacial parameter.
- Option D:** Viscosity alone does not determine the chemical reaction kinetics of cross-linking.

Question #11 Key: (D)

PMDC

Which class of adhesives exhibits superior thermal resistance, shear modulus, and solvent resistance after com...

CORE CONCEPT AND DERIVATION

Thermosetting adhesives undergo irreversible cross-linking during curing to form dense, three-dimensional covalent networks that resist thermal degradation and solvent swelling.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- Thermosets (such as epoxy, phenolic, and polyurethane resins) develop covalent bridges between polymer chains.
- This network structure prevents chain slippage at elevated temperatures, providing superior creep resistance and structural integrity.

Why other options are incorrect:

- Pressure-sensitive adhesives:** Viscoelastic materials held by weak physical bonds that soften and creep easily under heat and stress.
- Hot-melt adhesives:** Thermoplastic formulations that melt reversibly at elevated temperatures.
- Solvent-borne adhesives:** Un-crosslinked polymers that remain susceptible to solvent redissolution and thermal softening.

Question #12 Key: (C)

PMDC

What is the primary function of incorporating inert inorganic fillers, such as talc or fumed silica, into an a...

CORE CONCEPT AND DERIVATION

Inorganic particulate fillers are compounding additives utilized to regulate rheology, reduce cure shrinkage, and optimize mechanical properties of polymer matrices.

Formula / Reaction:

$$\text{Volumetric Cure Shrinkage (\%)} \propto (1 - \phi_{\text{filler}})$$

Solution:

- Fillers modify thixotropy and viscosity, preventing adhesive sag on vertical surfaces.
- They reduce cure shrinkage and thermal expansion mismatch while lowering raw material costs.

Why other options are incorrect:

- **Option A:** Inert fillers do not act as chemical polymerization initiators.
- **Option B:** Mineral particulates scatter light (increasing opacity) and act as electrical insulators.
- **Option D:** Chemical blowing agents, not mineral fillers, produce polymer foams.

Question #13 Key: (A)

PMDC

What is the fundamental engineering purpose of an adhesive when joining two structural substrates?

CORE CONCEPT AND DERIVATION

An adhesive is an interfacial bonding agent designed to transfer mechanical loads across a joint through surface adhesion and internal cohesion.

Formula / Reaction:

$$\text{Total Joint Strength} = f(\text{Interfacial Adhesion, Bulk Cohesion})$$

Solution:

- Adhesives wet substrate surfaces, solidify, and distribute applied shear, tensile, and compressive stresses across the bonded area.

Why other options are incorrect:

- **Option B:** Adhesives are permanent joining materials, not temporary thermal barriers.
- **Option C:** Dissolution describes solvent welding, whereas adhesives form distinct interfacial boundary layers.
- **Option D:** Separation describes insulators or spacers, contrary to the joining purpose of adhesives.

Question #14 Key: (C)

PMDC

In adhesive mechanics, what is the fundamental distinction between the terms adhesion and cohesion?

CORE CONCEPT AND DERIVATION

Adhesive joint performance relies on two distinct force systems: adhesion (interfacial forces between unlike molecules) and cohesion (internal forces between like molecules).

Formula / Reaction:

Joint Failure Modes: Adhesive (Interfacial) vs. Cohesive (Internal)

Solution:

- **Adhesion:** The attractive forces (chemical bonds, van der Waals, mechanical interlocking) holding the adhesive to the adherend surface.
- **Cohesion:** The internal intermolecular forces holding the bulk adhesive polymer matrix together.

Why other options are incorrect:

- **Option A:** Inverts the definitions of the two phenomena.
- **Option B:** Both adhesion and cohesion operate in permanent and semi-permanent joints.
- **Option D:** Adhesion often involves secondary van der Waals forces and hydrogen bonding, not solely covalent bonding.

Question #15 Key: (D)

PMDC

Under which polymer classifications do modern synthetic industrial adhesives fall?

CORE CONCEPT AND DERIVATION

Synthetic adhesives encompass a broad range of polymeric architectures tailored for specific mechanical, thermal, and application requirements.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- **Thermoplastics:** Polyvinyl acetate (PVAc), polyacrylates, and hot-melts (EVA).
- **Thermosets:** Epoxies, phenol-formaldehyde, urea-formaldehyde, and polyurethanes.
- **Elastomers:** Polychloroprene (contact cement), nitrile rubber, and silicone adhesives.

Why other options are incorrect:

- **Options A, B, and C:** Each option incorrectly limits synthetic adhesives to a single polymer category.

Question #16 Key: (B)

PMDC

Which fundamental physical parameter governs the ability of a liquid adhesive to spread across and wet a solid...

CORE CONCEPT AND DERIVATION

Dynamic viscosity governs the fluid mobility and spreading kinetics of a liquid adhesive across microscopic substrate asperities during the wetting phase.

Formula / Reaction:

$$\text{Spreading Coefficient: } S = \gamma_S - (\gamma_L + \gamma_{SL})$$

Solution:

- While thermodynamic surface energies dictate spreading equilibrium ($S > 0$), dynamic viscosity controls the kinetic rate of liquid spreading and gap penetration.

Why other options are incorrect:

- Cohesive shear modulus:** Measures the mechanical stiffness of the cured solid adhesive.
- Yield tensile strength:** A mechanical property of the solid state indicating resistance to plastic deformation.
- Glass transition temperature (T_g):** The temperature at which a polymer transitions between glassy and rubbery states.

Question #17 Key: (A)

PMDC

Adhesives that are applied in a molten state and rapidly develop bond strength upon cooling and solidification...

CORE CONCEPT AND DERIVATION

Hot-melt adhesives are solvent-free thermoplastic polymer systems that melt to a low-viscosity liquid upon heating and solidify rapidly upon cooling to ambient temperature.

Formula / Reaction:**Solution:**

- Common hot-melt adhesives include ethylene-vinyl acetate (EVA), polyamides, and polyolefins.
- They form physical bonds without chemical curing or solvent evaporation, enabling high-speed manufacturing lines.

Why other options are incorrect:

- Contact adhesives:** Polychloroprene solutions that set through solvent evaporation and contact coalescence.
- Cyanoacrylates:** Reactive liquid monomers that cure via moisture-initiated anionic polymerization.
- Two-part epoxies:** Chemically reactive systems that cure via step-growth polyaddition.

Question #18 Key: (B)

PMDC

Which statement accurately describes the primary operational objective of an adhesive in structural applicatio...

CORE CONCEPT AND DERIVATION

The primary function of an adhesive is to bond two or more solid parts into a cohesive assembly capable of transferring stress without joint failure.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- Adhesives establish intermolecular bonds across the interface, distributing mechanical stress over the entire joint contact area.

Why other options are incorrect:

- Option A:** Adhesives must preserve substrate integrity, not degrade it.
- Option C:** Adhesives fill voids and seal pores rather than creating porosity.
- Option D:** Lubricants reduce friction to facilitate movement, opposite to the binding action of adhesives.

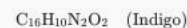
Question #19 Key: (C)

PMDC

Which ancient natural dye, historically extracted from Indigofera plants and now synthesized industrially, is ...

CORE CONCEPT AND DERIVATION

Indigo is an ancient vat dye characterized by a bis-indole conjugated ring system used globally for dyeing cotton yarns in denim production.

Formula / Reaction:**Solution:**

- Indigo is insoluble in water in its colored keto form and must be reduced to water-soluble 'leuco-indigo' for fiber absorption.
- Subsequent atmospheric oxidation traps the insoluble indigo pigment inside the cotton fibers.

Why other options are incorrect:

- Methyl orange:** A synthetic monoazo dye used primarily as an acid-base indicator.
- Malachite green:** A synthetic triarylmethane dye used for silk, wool, and as an antimicrobial agent.
- Basic fuchsin:** A synthetic triphenylmethane dye used in biological staining and textile dyeing.

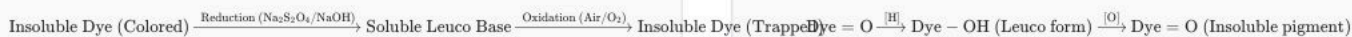
Question #20 **Key: (A)**

PMDC

Which statement correctly describes the solubility transformation of vat dyes during textile application?

CORE CONCEPT AND DERIVATION

Vat dyes are water-insoluble pigments that require a reversible two-step reduction-oxidation cycle for fabric fixation.

Formula / Reaction:**Solution:**

- **Reduction:** Sodium dithionite ($\text{Na}_2\text{S}_2\text{O}_4$) in alkali reduces insoluble carbonyl groups to soluble enolate (leuco) forms that penetrate cellulose fibers.
- **Oxidation:** Exposure to air or oxidants regenerates the original insoluble colored pigment locked within the fiber matrix.

Why other options are incorrect:

- **Option B:** Describes direct or reactive dyes, not vat dyes.
- **Option C:** Describes disperse dyes applied via high-temperature thermofixation.
- **Option D:** Describes mordant dyeing processes.

Question #21 **Key: (D)**

PMDC

Which functional structural moiety in a dye molecule is primarily responsible for light absorption in the visible range?

CORE CONCEPT AND DERIVATION

According to Witt's color theory, the color of an organic dye arises from an unsaturated light-absorbing structural unit known as a chromophore.

Formula / Reaction:

$$\Delta E = h\nu = \frac{hc}{\lambda} \quad (\text{Absorption in 400–700 nm range})$$

Solution:

- Chromophores possess conjugated π -electron systems (e.g., $-\text{N}=\text{N}-$, $>\text{C}=\text{O}$, $-\text{NO}_2$) where electronic energy gaps (ΔE) correspond to visible photons.

Why other options are incorrect:

- **Auxochrome:** An electron-donating or withdrawing group (e.g., $-\text{OH}$, $-\text{NH}_2$) that intensifies color and shifts λ_{max} , but cannot generate color alone.
- **Mordant:** An inorganic polyvalent metal salt used to fix dyes to fibers.
- **Substrate:** The textile fiber or material being dyed.

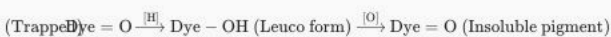
Question #22 **Key: (B)**

PMDC

Dyes that are insoluble in water and applied via a reduced soluble 'leuco' state, followed by in-situ oxidation...

CORE CONCEPT AND DERIVATION

Vat dyes are characterized by insoluble keto groups that undergo reversible reduction to alkali-soluble leuco compounds during textile dyeing.

Formula / Reaction:**Solution:**

- This two-step application grants vat dyes exceptional wash- and light-fastness because the final oxidized dye is insoluble in water.

Why other options are incorrect:

- **Direct dyes:** Water-soluble anionic compounds that adsorb directly to cellulose via hydrogen bonding.
- **Acid dyes:** Water-soluble sulfonated dyes applied to protein fibers (wool, silk) from acidic baths.
- **Basic dyes:** Cationic dyes that bind electrostatically to anionic sites on acrylic or protein fibers.

Question #23 **Key: (C)**

PMDC

Which class of non-ionic, low-water-solubility dyes is applied as an aqueous colloidal dispersion to dye hydrophobic substrates?

CORE CONCEPT AND DERIVATION

Disperse dyes are non-ionic, low-molecular-weight organic compounds applied as fine colloidal dispersions that dissolve into hydrophobic synthetic polymers at high temperatures.

Formula / Reaction:**Solution:**

- Polyester (PET) lacks ionic dye sites and is highly crystalline.
- Non-ionic disperse dye molecules diffuse into the thermally swollen amorphous regions of the polyester matrix.

Why other options are incorrect:

- **Acid dyes:** Anionic salts that cannot penetrate hydrophobic, non-polar polyester fibers.
- **Basic dyes:** Water-soluble cationic salts used primarily for polyacrylonitrile (acrylic) and wool.
- **Azo direct dyes:** Highly polar, water-soluble dyes designed for hydrophilic cellulosic fibers like cotton.

Question #24 **Key: (D)**

PMDC

What does the technological parameter 'dye fastness' denote regarding a colored textile material?

CORE CONCEPT AND DERIVATION

Dye fastness measures the resistance of a dyed substrate to color degradation or bleeding when exposed to light, laundering, perspiration, and friction.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- Fastness is rated on standard grey scales from 1 (poor) to 5 or 8 (outstanding) for parameters such as wash-fastness, light-fastness, and rub-fastness (crocking).

Why other options are incorrect:

- Option A:** Describes dyeing kinetics (strike rate), not fastness.
- Option B:** Describes thermodynamic solubility in aqueous media.
- Option C:** Pertains to molecular chemical structure, not finished textile performance.

Question #25 **Key: (A)**

PMDC

Which functional structural group is primarily responsible for imparting color to an organic dye molecule?

CORE CONCEPT AND DERIVATION

A chromophore is the essential light-absorbing electronic system of a dye molecule that enables selective absorption of visible wavelengths.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- Without a chromophoric group (such as $-\text{N}=\text{N}-$, $-\text{NO}_2$, or quinoid systems), an organic compound appears colorless in visible light.

Why other options are incorrect:

- Auxochrome:** Modifies color depth and intensity (bathochromic/hyperchromic shift) but cannot produce color independently.
- Solubilizing group:** Grants water solubility (e.g., $-\text{SO}_3\text{Na}$).
- Aliphatic spacer:** Saturated carbon chains that interrupt conjugation and reduce color intensity.

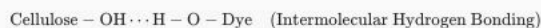
Question #26 **Key: (C)**

PMDC

A water-soluble dye containing extended conjugated [Formula] units and [Formula] groups that binds directly to...

CORE CONCEPT AND DERIVATION

Direct dyes are long, planar, conjugated organic molecules containing polar groups (such as $-\text{OH}$ and $-\text{SO}_3\text{Na}$) that bind to cellulose via hydrogen bonding and van der Waals forces without a mordant.

Formula / Reaction:**Solution:**

- Direct dyes have high affinity (substantivity) for cotton and viscose rayon due to their linear planar geometry that aligns parallel to cellulose polymer chains.

Why other options are incorrect:

- Triarylmethane dye:** Basic cationic dyes with triphenylmethane skeletons used mainly for paper and acrylics.
- Anthraquinone vat dye:** Water-insoluble polycyclic pigments requiring chemical reduction.
- Disperse dye:** Non-ionic, water-insoluble dyes for synthetic hydrophobic fibers.

Question #27 **Key: (A)**

PMDC

Why must monomer species participating in linear condensation polymerization possess at least two reactive fun...

CORE CONCEPT AND DERIVATION

Linear step-growth condensation polymerization requires monomers with a functionality of $f = 2$ (bifunctional) to build continuous macromolecular chains.

Formula / Reaction:

$$\text{Average Degree of Polymerization (Carothers): } \bar{X}_n = \frac{2}{2 - f_p}$$

Solution:

- If a monomer is monofunctional ($f = 1$), reaction with another functional group terminates the chain, preventing further propagation.
- Bifunctionality ($f = 2$) ensures that every coupling reaction leaves active functional groups at both chain termini for continuous extension.

Why other options are incorrect:

- Option B:** Condensation reactions inherently eliminate small byproduct molecules.
- Option C:** Step-growth condensation proceeds via functional group chemistry, not free-radical chain mechanisms.
- Option D:** Monomer functionality determines chain length and architecture, not water solubility.

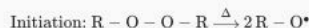
Question #28 Key: (B)

PMDC

What is the primary role of a free-radical initiator in the industrial addition polymerization of vinyl chlori...

CORE CONCEPT AND DERIVATION

Free-radical addition polymerization requires an initiator (e.g., organic peroxides or azo compounds) that cleaves homolytically under heat to form reactive radical species.

Formula / Reaction:**Solution:**

- The generated radical attacks the π -bond of vinyl chloride monomer, creating a carbon-centered radical that propagates chain growth.

Why other options are incorrect:

- Option A:** Suspension agents (e.g., polyvinyl alcohol), not initiators, manage suspension stability.
- Option C:** PVC is a linear thermoplastic; initiators do not induce cross-linking under standard conditions.
- Option D:** HCl elimination is an undesirable degradation reaction, not a function of the initiator.

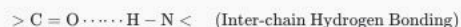
Question #29 Key: (D)

PMDC

Which structural feature gives Nylon-6,6 fibers exceptionally high tensile strength and elasticity for textile...

CORE CONCEPT AND DERIVATION

The high mechanical strength, crystallinity, and melting point of polyamides arise from regular arrays of intermolecular hydrogen bonds between adjacent linear chains.

Formula / Reaction:**Solution:**

- The carbonyl oxygen ($> \text{C} = \text{O}$) and amide hydrogen ($-\text{NH}-$) form strong hydrogen bonds across parallel aligned polymer chains.
- These cohesive forces yield high tensile strength, abrasion resistance, and elastic recovery.

Why other options are incorrect:

- Option A:** Ether linkages are found in polyethers and increase flexibility while reducing tensile strength.
- Option B:** Nylon-6,6 contains aliphatic $-(\text{CH}_2)_n-$ spacers, not bulky pendant aromatic rings.
- Option C:** Terminal groups represent a fraction of the high-molecular-weight chain; strength is governed by main-chain hydrogen bonding.

Question #30 Key: (C)

PMDC

Which physical characteristic accounts for the widespread structural use of thermosetting condensation polymer...

CORE CONCEPT AND DERIVATION

Thermosetting condensation polymers (e.g., Bakelite, melamine-formaldehyde) form dense three-dimensional networks of covalent bonds that prevent plastic deformation and thermal degradation.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- Covalent cross-links prevent chain slipping under mechanical loads and maintain structural integrity at high temperatures.

Why other options are incorrect:

- Option A:** Thermosets have high T_g values and are rigid solids at ambient conditions.
- Option B:** Highly cross-linked polymers are insoluble in organic solvents due to their covalent network.
- Option D:** Thermosets decompose rather than melt upon reheating and cannot be re-melted or recycled like thermoplastics.

Question #31 Key: (B)

PMDC

What fundamental structural feature is required for a small organic molecule to undergo addition (chain-growth)...

CORE CONCEPT AND DERIVATION

Addition polymerization requires monomer unsaturation ($\text{C} = \text{C}$ or $\text{C} \equiv \text{C}$) whose π -bonds open to link adjacent units into a continuous carbon chain.

Formula / Reaction:**Solution:**

- The reactive π -bond undergoes addition via free-radical, cationic, or anionic intermediates without removing any atoms from the monomer.

Why other options are incorrect:

- Option A:** Terminal difunctional polar groups participate in condensation polymerization, not addition.
- Option C:** Byproduct elimination is the defining feature of condensation (step-growth) polymerization.
- Option D:** Saturated hydrocarbons (alkanes) lack reactive π -electrons and do not polymerize.

Question #32 Key: (D)

PMDC

During an addition polymerization reaction, what occurs regarding the atomic composition of the reacting monom...

CORE CONCEPT AND DERIVATION

Addition polymerization proceeds with 100% atom economy; the molecular formula of the polymer repeating unit is identical to that of the monomer.

Formula / Reaction:

$$M_{\text{repeating unit}} = M_{\text{monomer}}$$

$$\text{Molecular Weight of Polymer} = n \times M_{\text{monomer}}$$

Solution:

- The reaction involves rearrangement of π -bonding electrons into σ -bonds connecting adjacent monomers without the loss of any constituent atoms.

Why other options are incorrect:

- Options A and B:** No oxidation to CO_2 or dehydrogenation occurs in standard addition polymerizations.
- Option C:** Elimination of small molecules characterizes condensation polymerization.

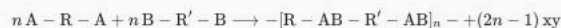
Question #33 Key: (C)

PMDC

What is the key functional group requirement for monomers participating in step-growth condensation polymeriza...

CORE CONCEPT AND DERIVATION

Step-growth condensation requires polyfunctional monomers (functionality $f \geq 2$) capable of forming chemical linkages at two or more positions.

Formula / Reaction:**Solution:**

- Bifunctional monomers (diols, dicarboxylic acids, diamines) allow step-wise chain extension from both ends to build high-molecular-weight polymers.

Why other options are incorrect:

- Option A:** Monofunctional species terminate chain propagation prematurely.
- Option B:** Non-polar unreactive frameworks cannot undergo condensation reactions.
- Option D:** Carbon-carbon double bonds undergo chain-growth addition polymerization.

Question #34 Key: (B)

PMDC

Addition polymerization is also commonly designated by which mechanistic classification?

CORE CONCEPT AND DERIVATION

Addition polymerization is mechanistically termed chain-growth polymerization because monomer molecules add exclusively to an active propagating chain center (radical, carbocation, or carbanion).

Formula / Reaction:**Solution:**

- In chain-growth polymerization, high-molecular-weight polymer forms early in the reaction, and monomer concentration decreases steadily throughout.

Why other options are incorrect:

- Step-growth polymerization:** The mechanism for classical condensation reactions where any two molecular species can react.
- Options C and D:** Condensation variations involving step-growth mechanisms.

Question #35 Key: (D)

PMDC

Bakelite, an early industrial thermosetting resin, is produced by the condensation reaction of:

CORE CONCEPT AND DERIVATION

Bakelite (polyoxybenzylmethyleneglycolanhydride) is a cross-linked phenolic resin prepared by the acid- or base-catalyzed condensation of phenol with formaldehyde.

Formula / Reaction:**Solution:**

- Electrophilic aromatic substitution of formaldehyde at the *ortho* and *para* positions of phenol yields hydroxymethylphenols.
- Further thermal condensation forms methylene ($-\text{CH}_2-$) cross-links, producing a rigid, three-dimensional thermoset.

Why other options are incorrect:

- Option A:** Forms sodium phenoxide salt without polymer chain extension.
- Option B:** Sulfonates the aromatic ring to produce phenolsulfonic acids.
- Option C:** Esterifies phenol to yield phenyl acetate.

Question #36 Key: (B)

PMDC

An auxochrome fails to deepen the color of a chromogen if it is substituted at which position relative to the ...

CORE CONCEPT AND DERIVATION

Auxochromes deepen color (bathochromic shift) by donating or withdrawing electron density via resonance into the conjugated chromophoric π -system.

Formula / Reaction:

Qualitative concept / No formula required.

Solution:

- Resonance delocalization between electron-donating auxochromes (e.g., $-\text{NH}_2$, $-\text{OH}$) and electron-accepting chromophores operates efficiently only at *ortho* and *para* positions.
- At the **meta** position, resonance interaction is electronically isolated, meaning the auxochrome cannot effectively extend conjugation or induce a significant bathochromic shift.

Why other options are incorrect:

- **Ortho and Para positions:** Enable direct quinoid-type resonance delocalization, maximizing the bathochromic color-deepening effect.
- **Option D:** Contradicts resonance stabilization theory.

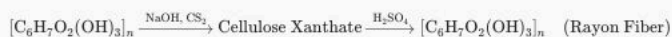
Question #37 Key: (D)

PMDC

Rayon is classified as a semi-synthetic regenerated fiber manufactured from which natural polymer feedstock?

CORE CONCEPT AND DERIVATION

Rayon is a regenerated semi-synthetic fiber produced by chemical solubilization and re-precipitation of naturally occurring cellulose derived from wood pulp or cotton linters.

Formula / Reaction:**Solution:**

- In the Viscose process, natural cellulose is treated with alkali and carbon disulfide to form a soluble xanthate, which is extruded through spinnerets into an acid bath to regenerate cellulose fibers.

Why other options are incorrect:

- **Acetyl chloride:** An organic acylating reagent, not a polymer precursor for rayon.
- **Ethylene and Acetylene:** Petrochemical hydrocarbons used in purely synthetic polymers (e.g., polyethylene, polyacetylene).

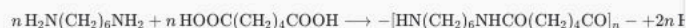
Question #38 Key: (C)

PMDC

Which of the following commercial synthetic polymers is classified structurally as a copolymer?

CORE CONCEPT AND DERIVATION

A copolymer is synthesized from two or more chemically distinct monomer species, whereas a homopolymer is derived from a single monomer type.

Formula / Reaction:**Solution:**

- **Nylon-6,6** is a copolymer synthesized from two distinct monomers: hexamethylenediamine and adipic acid.

Why other options are incorrect:

- **Polystyrene:** A homopolymer formed entirely from styrene.
- **Polyvinyl acetate (PVAc):** A homopolymer formed entirely from vinyl acetate.
- **Polyvinyl chloride (PVC):** A homopolymer formed entirely from vinyl chloride.

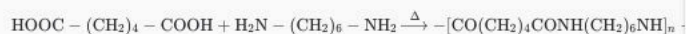
Question #39 Key: (D)

PMDC

When hexanedioic acid is heated with hexamethylenediamine, the resulting synthetic polymer is:

CORE CONCEPT AND DERIVATION

Condensation of a primary diamine with an aliphatic dicarboxylic acid at elevated temperatures yields a synthetic linear polyamide.

Formula / Reaction:**Solution:**

- Hexanedioic acid (adipic acid) reacts with 1,6-hexamethylenediamine with the elimination of water, forming amide linkages that constitute **Nylon-6,6**.

Why other options are incorrect:

- **Polypeptide:** Polyamides formed from α -amino acid monomers.
- **Polyvinyl chloride:** Formed by the addition polymerization of vinyl chloride.
- **Polyester:** Formed from the condensation of diols with dicarboxylic acids (forming ester links).

Question #40 **Key: (B)**

PMDC

Which of the following polymers is produced via step-growth condensation polymerization?

CORE CONCEPT AND DERIVATION

Condensation polymers form step-wise between functional groups (e.g., amine, carboxyl, hydroxyl) with the release of small by-product molecules like water.

Formula / Reaction:**Solution:**

- Polyamides (such as Nylon-6,6 and Nylon-6,10) grow through condensation reactions between amine and carboxylic acid functional groups.

Why other options are incorrect:

- **Polyvinyl chloride (PVC):** Chain-growth addition polymer of vinyl chloride.
- **Polystyrene:** Chain-growth addition polymer of styrene.
- **Polyethene (PE):** Chain-growth addition polymer of ethene.

Question #41 **Key: (C)**

PMDC

Nylon-6,6 belongs to which general structural family of synthetic polymers?

CORE CONCEPT AND DERIVATION

Polymers characterized by repeating amide linkages ($-\text{CO}-\text{NH}-$) in their main backbone chain are classified as polyamides.

Formula / Reaction:**Solution:**

- Nylon-6,6 is a synthetic polyamide containing recurring amide linkages connecting alternating hexamethylene and adipoyl segments.

Why other options are incorrect:

- **Polyester:** Contains repeating ester functional groups ($-\text{COO}-$).
- **Polyvinyl ester:** Polymers with ester groups on side-chains (e.g., polyvinyl acetate).
- **Polyether:** Polymers with repeating ether linkages ($-\text{C}-\text{O}-\text{C}-$).