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PREPARATION **Series**

AIIMS Paramedical

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About this eBook

Welcome to the AIIMS Paramedical Previous Year Question Paper With Solutions eBook! This book is designed to help you prepare thoroughly for the AIIMS Paramedical Entrance Exam. It contains questions from previous exams held in 2024 and 2023, with clear and detailed solutions. This structure helps you understand the exam pattern, focus on important topics, and boost your confidence to perform well on exam day.

Features of This eBook

Subject-Wise Organization

All questions are categorised by subjects, allowing you to concentrate on one subject at a time and practice effectively.

Accurate & Explained Solutions

Each question comes with a simple, clear explanation of the answer to help you grasp the concepts and methods used.

Authentic Exam Coverage

Questions are sourced from real AIIMS Paramedical Entrance Exams conducted from 2024 to 2023, giving you the best possible practice material based on actual test trends.

AIIMS Paramedical Previous Year Question Paper With Solutions: Subject Highlights

This eBook is focused on important medical and paramedical subjects covered in the AIIMS Paramedical Entrance Exam. Subjects include Anatomy, Physiology, Biochemistry, Microbiology, Pharmacology, Pathology, and allied clinical topics. Practising these questions from 2025 to 2020 will familiarise you with the exam style and highlight the key chapters to focus on. Regular practice will sharpen your skills and enhance your exam readiness.

Download AIIMS Paramedical Previous Years' Question Papers With Solutions

The AIIMS Paramedical Entrance Exam syllabus covers several vital subjects, including Anatomy, Physiology, Biochemistry, Microbiology, Pathology, Pharmacology, and more. Downloading previous years' question papers with solutions is important for every AIIMS Paramedical aspirant. These papers reveal the exam's actual pattern, the type of questions typically asked, and the most emphasised subjects.

Practising with the previous year's papers allows you to improve your problem-solving speed, learn how to better manage time, and get accustomed to the level of difficulty of the actual test. Solving these question papers also helps you in identifying your weak and strong areas, so you are aware of what areas you need to practice more. Above all, practising question papers increases your confidence level and lowers exam phobia since you become used to the pattern and type of questions that are to be asked.

Below are the AIIMS Paramedical Previous Years' Question Papers with Solutions of 2023:

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AIIMS Paramedical 2024 question paper with solutions

Question 1:

Which of the following is a globular protein?

- (A) Collagen
- (B) Myoglobin or Haemoglobin
- (C) Myosin
- (D) Fibroin

Answer: The correct answer is option (B), Myoglobin or Haemoglobin.

Explanation: Myoglobin and haemoglobin are globular proteins, meaning they have a compact, spherical structure, unlike fibrous proteins like collagen, myosin, and fibroin.

Question 2:

Which of the following is a crystalline solid?

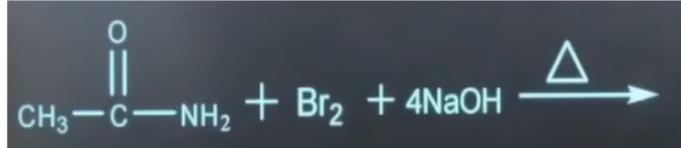
- (A) Plastic
- (B) Rubber
- (C) Glass
- (D) Quartz

Answer: The correct answer is option (D), Quartz.

Explanation: Quartz is a crystalline solid with a well-ordered, repeating atomic structure, unlike plastics, rubber, and glass, which are amorphous solids.

Question 3.

3.



What is the major product of the reaction?

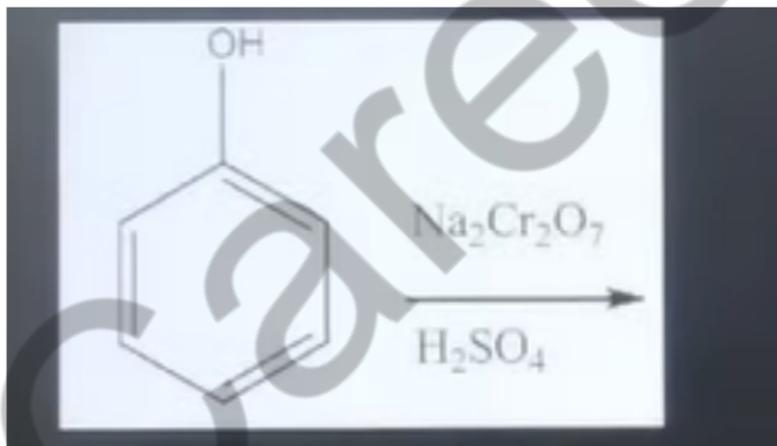
- (A) CH_3COOH
- (B) CH_3NH_2
- (C) CH_3Br
- (D) $\text{CH}_3\text{CH}_2\text{NH}_2$

Answer: The Correct answer is option (b), CH_3NH_2

Explanation:

This is the Hofmann bromamide reaction, where an amide is converted to a primary amine with one carbon less. So, CH_3CONH_2 gives CH_3NH_2 .

Question 4.



What is the major product formed when phenol is treated with sodium dichromate ($\text{Na}_2\text{Cr}_2\text{O}_7$) and sulfuric acid (H_2SO_4)?

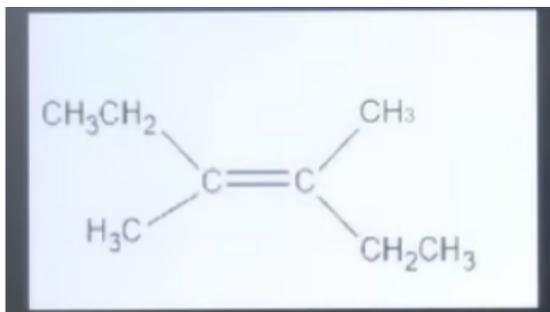
- (A) Benzoic acid
- (B) Benzaldehyde
- (C) 2-Nitrophenol
- (D) p-Benzquinone

Answer: The correct answer is option (d), p-Benzquinone

Explanation:

Phenol is oxidised by $\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$ to form p-benzoquinone through a two-electron oxidation process.

Question 5:



What is the correct IUPAC name for the following compound?

- (A) trans-3,4-dimethylhex-3-ene
- (B) cis-3,4-dimethylhex-3-ene
- (C) trans-2,3-dimethylhex-2-ene
- (D) cis-2,3-dimethylhex-2-ene

Answer: The Correct answer is option (a), trans-3,4-dimethylhex-3-ene

Explanation:

The longest chain includes 6 carbon atoms with the double bond at position 3, and methyl groups at positions 3 and 4. The two higher priority groups (ethyl and methyl) are on opposite sides, indicating a trans-isomer.

Question 6:

The element Neodymium (Nd) belongs to the 4f series. What is its atomic number?

- (A) 60
- (B) 61
- (C) 62
- (D) 63

Answer: The correct answer is option (C), 62.

Explanation: Neodymium (Nd) is the 4th element in the lanthanide series with atomic number 62.

Question 7:

Explain why ortho-nitrophenol is more steam volatile than para-nitrophenol.

- (A) Ortho-nitrophenol forms stronger intermolecular hydrogen bonds.
- (B) Para-nitrophenol exhibits intramolecular hydrogen bonding.
- (C) Ortho-nitrophenol forms intramolecular hydrogen bonds, reducing intermolecular attraction.
- (D) Para-nitrophenol has a lower molecular weight than ortho-nitrophenol.

Answer: The correct answer is option (C), Ortho-nitrophenol forms intramolecular hydrogen bonds, reducing intermolecular attraction.

Explanation: Intramolecular hydrogen bonding in ortho-nitrophenol reduces its ability to form intermolecular hydrogen bonds, making it more volatile than para-nitrophenol.

Question 8:

Which non-metallic solid is known for its electrical conductivity?

- (A) Sulfur
- (B) Diamond
- (C) Graphite
- (D) Phosphorus

Answer: The correct answer is option (C), Graphite.

Explanation: Graphite conducts electricity due to the presence of free-moving electrons within its layers, unlike other non-metallic solids.

Question 9:

Which acid is present in vinegar?

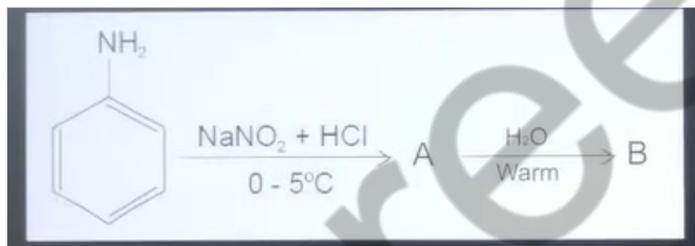
- (A) Formic acid
- (B) Acetic acid
- (C) Citric acid
- (D) Malic acid

Answer: The correct answer is option (B), Acetic acid.

Explanation: Vinegar primarily contains acetic acid, which gives it its characteristic sour taste and pungent smell.

Question 10:

Which compound is formed as the final product B?



- (A) Phenol
- (B) Benzene
- (C) Aniline
- (D) Benzenediazonium chloride

Answer: The Correct answer is option (a), Phenol

Explanation:

Aniline reacts with NaNO_2/HCl at $0-5^\circ\text{C}$ to form benzenediazonium chloride (A), which on warming with water, gives phenol.

Question 11:

Which of the following is a thermoplastic polymer?

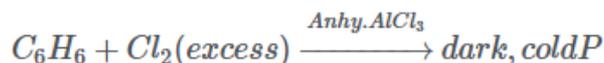
- (A) Bakelite
- (B) Polystyrene
- (C) PVC
- (D) Nylon 6

Answer: The correct answer is option (C), PVC.

Explanation: PVC is a thermoplastic, which means it softens on heating and can be reshaped. It is commonly used in making pipes and wires. Bakelite, on the other hand, is a thermosetting plastic and cannot be remoulded once set.

Question 12:

Product, P is:



- (a) C₆H₅Cl
- (b) C₆H₄Cl₂
- (c) C₆H₆Cl₆
- (d) C₆Cl₆

Answer: The Correct answer is option (d)C₆Cl₆

Explanation:

In the presence of excess Cl₂, in dark and cold conditions, benzene undergoes free radical halogenation, forming hexachlorobenzene (C₆Cl₆).

Question 13:

The number of ions formed on dissolving one mole of K₃[Fe(CN)₆] in water is:

- (A) 3
- (B) 4
- (C) 5
- (D) 6

Answer: The correct answer is option (B), 4.

Explanation: K₃[Fe(CN)₆] dissociates in water to give 3 K⁺ ions and 1 [Fe(CN)₆]³⁻ ion. So, one mole produces a total of 4 ions in solution.

Question 14:

Calculate the magnetic moment of the element with atomic number Z = 28.

- (A) 2.828 BM
- (B) 4.90 BM
- (C) 5.92 BM
- (D) 0 BM

Answer: The correct answer is option (A), 2.828 BM.

Explanation: Nickel (Z = 28) in its +2 state has a 3d⁸ configuration with 2 unpaired electrons. Magnetic moment $\mu = \sqrt{n(n+2)} = \sqrt{2 \times 4} = \sqrt{8} \approx 2.828$ BM.

Question 15:

Which of the following is adsorbent?

- (A) ZnO
- (B) Al₂O₃

- (C) Fe_2O_3
(D) Mn_2O_3

Answer: The correct answer is option (B), Al_2O_3 .

Explanation: Aluminium oxide (Al_2O_3) has a high surface area and porous structure, making it an effective adsorbent. It is commonly used in chromatography and gas purification.

Question 16:

The reaction of zinc with dilute and concentrated nitric acid, respectively, produces:

- (A) N_2O and NO_2
(B) NO and N_2O
(C) NO_2 and N_2O
(D) NO_2 and NO

Answer: The correct answer is option (D), NO_2 and NO .

Explanation: Zinc reacts with dilute nitric acid to produce nitric oxide (NO), while with concentrated nitric acid it produces nitrogen dioxide (NO_2). The concentration of acid affects the type of nitrogen oxide formed.

Question 17:

Select the mismatch:

Molecule — Geometry

NH_3 — Trigonal Pyramidal

H_2S — Bent

CHCl_3 — Trigonal Pyramidal

- (a) NH_3 – Trigonal Pyramidal
(b) H_2S – Bent
(c) CHCl_3 – Trigonal Pyramidal
(d) All are correctly matched

Answer: The Correct answer is option (c).

Explanation:

CHCl_3 has a tetrahedral geometry, not trigonal pyramidal, as the central carbon forms four sigma bonds with no lone pairs.

Question 18:

Movement of colloidal particle after developing charge

- (A) Brownian
(B) Osmosis
(C) Electrodialysis
(D) Electrophoresis

Answer: The correct answer is option (D), Electrophoresis.

Explanation: Electrophoresis is the movement of charged colloidal particles under the influence of an electric field. This helps in separating different particles based on their charge and size.

Question 19:

The correct increasing order of energy of orbitals in a hydrogen atom is:

- (A) $3s < 3p < 3d$
(B) $3s < 3d < 3p$
(C) $3p < 3d < 3s$
(D) All have equal energy

Answer: The correct answer is option (D), All have equal energy.

Explanation: In a hydrogen atom, all orbitals with the same principal quantum number ($n = 3$) have the same energy. Therefore, 3s, 3p, and 3d orbitals are degenerate, meaning they have equal energy.

Question 20:

1028 grams of seawater sample contains 7 mL of dissolved oxygen (O_2). What is the concentration of oxygen in parts per million (ppm)?

- (A) 0.6 ppm
(B) 6 ppm
(C) 6.8 ppm
(D) 60 ppm

Answer: The correct answer is option (C), 6.8 ppm.

Explanation: The mass of oxygen is calculated using its density (1.43 mg/mL) and volume. Then, ppm is found by dividing the oxygen mass by seawater mass and multiplying by 10^6 , which gives approximately 6.8 ppm. This indicates the concentration of dissolved oxygen in the seawater sample.

Question 21:

What is the dispersed phase and dispersion medium of the following colloidal systems?

- (i) Smoke
(ii) Paint

- (A) Smoke: Dispersed phase = Solid, Dispersion medium = Gas; Paint: Dispersed phase = Solid, Dispersion medium = Liquid
(B) Smoke: Dispersed phase = Gas, Dispersion medium = Solid; Paint: Dispersed phase = Liquid, Dispersion medium = Solid
(C) Smoke: Dispersed phase = Liquid, Dispersion medium = Gas; Paint: Dispersed phase = Gas, Dispersion medium = Liquid
(D) Smoke: Dispersed phase = Gas, Dispersion medium = Liquid; Paint: Dispersed phase = Solid, Dispersion medium = Gas

Answer: The correct answer is option (A) Smoke: Dispersed phase = Solid, Dispersion medium = Gas; Paint: Dispersed phase = Solid, Dispersion medium = Liquid

Explanation:

- Smoke consists of tiny solid particles (dispersed phase) suspended in air (gas, dispersion medium).
- Paint is a mixture where solid pigment particles (dispersed phase) are suspended in a liquid base (dispersion medium).

Question 22:

When a smaller ion (usually a cation) is dislocated from its normal site in a crystal and moves to an interstitial site, it is known as:

- (A) Schottky defect
(B) Frenkel defect
(C) Interstitial defect

(D) Vacancy defect

Answer: The correct answer is option (B), Frenkel defect.

Explanation: In a Frenkel defect, a smaller ion leaves its normal position in the lattice and occupies an interstitial site, creating a vacancy and an interstitial defect simultaneously. This defect commonly occurs with smaller cations.

Question 23:

Arrange the following compounds in increasing order of their boiling points:

C_2H_5OH , CH_3CHO , $CH_3CH_2CH_3$, CH_3OCH_3

(A) $CH_3CH_2CH_3 < CH_3OCH_3 < CH_3CHO < C_2H_5OH$

(B) $C_2H_5OH < CH_3CHO < CH_3OCH_3 < CH_3CH_2CH_3$

(C) $CH_3OCH_3 < CH_3CH_2CH_3 < CH_3CHO < C_2H_5OH$

(D) $CH_3CHO < C_2H_5OH < CH_3CH_2CH_3 < CH_3OCH_3$

Answer: The correct answer is option (A) $CH_3CH_2CH_3 < CH_3OCH_3 < CH_3CHO < C_2H_5OH$

Explanation:

Boiling points depend on intermolecular forces:

- C_2H_5OH (ethanol) has hydrogen bonding, so it has the highest boiling point.
- CH_3CHO (acetaldehyde) has dipole-dipole interactions, so its boiling point is moderate.
- CH_3OCH_3 (dimethyl ether) has dipole-dipole interactions but weaker than acetaldehyde due to less polarity.
- $CH_3CH_2CH_3$ (propane) has only weak London dispersion forces, so it has the lowest boiling point.

Question 24:

Sterilization process in males is:

(A) vasectomy

(B) tubectomy

(C) amniocentesis

(D) Hysterectomy

Answer: The correct answer is option (A), vasectomy.

Explanation: Vasectomy is a surgical procedure for male sterilization where the vas deferens are cut or sealed to prevent sperm from entering the semen, thereby preventing fertilization.

Question 25:

_____ together with the cervix, forms the birth canal.

(A) Vagina

(B) Uterus

(C) Fallopian Tube

(D) Urethra

Answer: The correct answer is option (A), Vagina.

Explanation: The vagina, along with the cervix, forms the birth canal through which the baby passes during

childbirth. It also serves as the passage for menstrual flow and sexual intercourse.

Question 26:

What type of movement is present in the female fallopian tube?

- (A) flagellate
- (B) ciliated
- (C) Ameboidal
- (D) None

Answer: The correct answer is option (B), ciliated.

Explanation: The inner lining of the fallopian tubes is covered with cilia that beat in a coordinated manner to help move the egg from the ovary towards the uterus. This ciliated movement is essential for successful fertilization.

Question 27:

Which is not an Ex-situ conservation?

- (A) Seed bank
- (B) National Park
- (C) Cryopreservation
- (D) Zoological park

Answer: The correct answer is option (B), National Park.

Explanation: National Parks are examples of in situ conservation, where plants and animals are protected in their natural habitats. Ex-situ conservation involves protecting species outside their natural habitats, like seed banks and zoological parks.

Question 28:

Coralloid roots are associated with

- (A) Pinus
- (B) Cycas
- (C) Gingko
- (D) Equisetum

Answer: The correct answer is option (B), Cycas.

Explanation: Coralloid roots are specialized roots found in Cycas. They are coral-like in appearance and contain symbiotic nitrogen-fixing cyanobacteria, which help the plant obtain nitrogen.

Question 29:

Two units of insulin bind through

- (A) H-bond
- (B) Peptide Bond
- (C) Disulfide Bond
- (D) None

Answer: The correct answer is option (C), Di-sulphide Bond.

Explanation: Insulin is made up of two polypeptide chains (A and B chains) that are linked together by disulfide bonds (–S–S–). These bonds stabilize the structure of insulin and help in its biological function.

Question 30:

In which type of cell are Nissl granules found?

- (A) Neuron
- (B) Schwann cell

- (C) Myelin sheath
 (D) None of the above

Answer: The correct answer is option (A), Neuron.

Explanation: Nissl granules are rough endoplasmic reticulum found in neurons. They are involved in the synthesis of proteins necessary for the growth and repair of nerve cells.

Question 31:

Match the following

Column I (Excretory organs)	Column II (Animals)
A. <u>Mollusca</u>	I. Flame Cell
B. <u>Arthropoda</u>	II. Nephridia
C. <u>Annelida</u>	III. Radula
D. <u>Platyhelminthes</u>	IV. Malpighian tubules

(A) A-II, B-IV, C-II, D-I

- (B) A-III, B-IV, C-II, D-I
 (C) A-II, B-I, C-IV, D-III
 (D) A-IV, B-II, C-I, D-III

Answer: The correct answer is option (A)

Explanation:

- **Mollusca** – Radula is a feeding organ (not excretory), but if this is the intended match, then: **A → III**
- **Arthropoda** – Excretory organ: **Malpighian tubules → B → IV**
- **Annelida** – Excretory organ: **Nephridia → C → II**
- **Platyhelminthes** – Excretory organ: **Flame cells → D → I**

Question 32:

Stele is made up of in a plant

- (A) Pericycle
 (B) Vascular Tissue
 (C) Pith
 (D) All

Answer: The correct answer is option (D), All.

Explanation: The stele in plants consists of vascular tissues (xylem and phloem), pericycle, and pith. Together, these tissues form the central part of the root or stem, responsible for transport and support.

Question 33:

Reason for the rise in dough

- (A) Production of CO₂
- (B) Multiplication of yeast
- (C) Produce H₂
- (D) Emulsify of fat

Answer: The correct answer is option (A), Production of CO₂.

Explanation: Dough rises due to the production of carbon dioxide (CO₂) gas by yeast during fermentation. The gas gets trapped in the dough, causing it to expand and rise.

Question 34:

The coding strand of DNA is: 5'-AATTCAAATAGG-3'

What is the sequence of mRNA?

- (A) 3'-TTAAGTTTAATCC-5'
- (B) 5'-AAUUCAAAUUAGG-3'
- (C) 3'-AAUUCAAAUUAGG-5'
- (D) 5'-TTAAGTTTAATCC-3'

Answer: The correct answer is option (B) 5'-AAUUCAAAUUAGG-3'

Explanation:

The mRNA sequence is the same as the DNA coding strand except that all thymine (T) bases are replaced by uracil (U).

Coding strand: 5'-AATTCAAATAGG-3'

mRNA sequence: 5'-AAUUCAAAUUAGG-3'

So, the correct mRNA sequence is option (B).

Question 35:

Which is not a homopolymer?

- (A) Insulin
- (B) Chitin
- (C) Glycogen
- (D) Collagen

Answer: The correct answer is option (A), Insulin.

Explanation: Insulin is a protein made of different amino acids, so it is a heteropolymer. Homopolymers like chitin, glycogen, and collagen are made up of repeating units of the same monomer or similar monomers.

Question 36:

Which of the following represents the correct formula for Net Primary Productivity (NPP)?

- (A) GPP-R
- (B) GPP + R
- (C) R - GPP
- (D) GPP × R

Answer: The correct answer is option (A), GPP-R.

Explanation: Net Primary Productivity (NPP) is the amount of energy or biomass remaining after the autotrophs use some energy for respiration (R). It is calculated by subtracting respiration (R) from Gross Primary Productivity (GPP).

Question 37:

Which Pyramid is always upright?

- (A) Energy
- (B) Biomass
- (C) Number
- (D) All

Answer: The correct answer is option (A), Energy.

Explanation: The energy pyramid is always upright because energy decreases at each successive trophic level due to energy loss in the form of heat. Biomass and number pyramids can be inverted or upright depending on the ecosystem.

Question 38:

Which one of the following is the odd one out?

- (A) Zeatin
- (B) Kinetin
- (C) IAA
- (D) Gibberellin

Answer: The correct answer is option (C), IAA.

Explanation: Zeatin, kinetin, and gibberellin are types of plant hormones; zeatin and kinetin are cytokinins, gibberellin is another hormone, while IAA (Indole-3-acetic acid) is an auxin, making it different from the others.

Question 39:

Which term is used for cells performing similar functions and cells collecting intracellular material?

- (A) Division
- (B) Organ
- (C) Organ system
- (D) Tissue

Answer: The correct answer is option (D), Tissue.

Explanation: A tissue is a group of similar cells that perform a specific function and work together to carry out a particular activity.

Question 40:

Dubb sound originates

- (A) Closure of the Semilunar valve
- (B) Opening of Semilunar valve
- (C) Closure of AV valve
- (D) Opening of AV valve

Answer: The correct answer is option (A), Closure of the Semilunar valve.

Explanation: The "dubb" sound in the heartbeat is caused by the closing of the semilunar valves (pulmonary and aortic valves) at the end of ventricular systole.

Question 41:

ERV ranges from

- (A) 2500–3000
- (B) 1100–1200

- (C) 1000–1100
- (D) N.O.T

Answer: The correct answer is option (B), 1100–1200.

Explanation: Expiratory Reserve Volume (ERV) is the maximum volume of air that can be exhaled after normal exhalation, typically around 1100–1200 ml in an average adult.

Question 42:

Which does not affect Hardy-Weinberg equilibrium

- (A) Natural selection
- (B) Random mating
- (C) Crossing over
- (D) Mutation

Answer: The correct answer is option (C), crossing over.

Explanation: Hardy-Weinberg equilibrium is affected by factors like natural selection, mutation, and non-random mating. Crossing over is a genetic recombination process during meiosis and does not affect allele frequencies directly.

Question 43:

Which of the following correctly describes Atrial Natriuretic Factor (ANF)?

- (A) Released from the atria
- (B) Acts as a vasodilator
- (C) Causes low blood pressure
- (D) None of the above

Answer: The correct answer is option (A), released from the atria.

Explanation: ANF is a hormone released from the atria of the heart that helps regulate blood pressure by promoting vasodilation and sodium excretion, thus lowering blood pressure.

Question 44:

In which of these animals does, antennal gland function as an excretory organ?

- (A) Cockroach
- (B) Planaria
- (C) Prawn crustacean
- (D) Cephalochordata

Answer: The correct answer is option (C), Prawn crustacean.

Explanation: The antennal gland (or green gland) is an excretory organ found in crustaceans like prawns, helping in osmoregulation and waste removal.

Question 45:

Arrange the following geological periods in the correct chronological order:

- I. Carboniferous
- II. Jurassic
- III. Cretaceous
- IV. Tertiary
- V. Triassic

- (A) I, II, III, V, IV
- (B) I, V, II, III, IV
- (C) I, II, V, III, IV
- (D) I, V, III, II, IV

Answer: The correct answer is option (B), I, V, II, III, IV.

Explanation: The correct order of geological periods from oldest to youngest is Carboniferous, Triassic, Jurassic, Cretaceous, and then Tertiary.

Question 46:

The endomembrane system includes: Endoplasmic reticulum (ER), Golgi complex, Lysosomes, and Vacuoles

- (A) Only the ER and the Golgi complex
- (B) Only lysosomes and vacuoles
- (C) All of the above
- (D) None of the above

Answer: The correct answer is option (C), All of the above.

Explanation: The endomembrane system is a group of membranes and organelles in eukaryotic cells that work together to modify, package, and transport lipids and proteins. It includes the ER, Golgi complex, lysosomes, and vacuoles.

Question 47:

The RMS speed of an ideal gas is:

- (a) Directly proportional to density (d)
- (b) Inversely proportional to density (d)
- (c) Inversely proportional to \sqrt{d}
- (d) None of the above

Answer: The correct answer is option (c), inversely proportional to \sqrt{d} .

Explanation: The root mean square (RMS) speed of gas molecules is inversely proportional to the square root of the density of the gas.

Question 48:

In the LCR circuit total potential is 10V, and L-C-R are connected in series. The potential on L and C are 5V and 11V, respectively. Find the potential drop on R.

- (A) 2
- (B) 8
- (C) 7
- (D) 9

Answer: The correct answer is option (B), 8.

Explanation:

$$V = 10, V, \quad V_L = 5, V, \quad V_C = 11, V$$

$$V = \sqrt{V_R^2 + (V_L - V_C)^2}$$

$$V_R = \sqrt{V^2 - (V_L - V_C)^2}$$

$$V_L - V_C = 5 - 11 = -6, V$$

$$(V_L - V_C)^2 = (-6)^2 = 36$$

$$V^2 = 10^2 = 100$$

$$V_R = \sqrt{100 - 36} = \sqrt{64} = 8, \text{ V}$$

8, V

Question 49:

Given two force vectors:

$$\vec{F}_1 = 2\hat{i} + 3\hat{j} - \hat{k}, \quad \vec{F}_2 = \hat{i} + \hat{j} + \hat{k}$$

What is the magnitude of the resultant force?

- (A) 3 N
- (B) 4 N
- (C) 5 N
- (D) 6 N

Answer: The correct answer is option (C), 5N.

Explanation:

Step 1: Find the resultant vector by adding the two vectors component-wise:

$$\vec{F}_R = \vec{F}_1 + \vec{F}_2 = (2 + 1)\hat{i} + (3 + 1)\hat{j} + (-1 + 1)\hat{k} = 3\hat{i} + 4\hat{j} + 0\hat{k}$$

Step 2: Calculate the magnitude of the resultant vector:

$$|\vec{F}_R| = \sqrt{3^2 + 4^2 + 0^2} = \sqrt{9 + 16} = \sqrt{25} = 5$$

Final answer:

5 N

Question 50:

In a diffraction experiment, the fringe width β is 0.3 mm, the distance from the slit to the screen D is 5 cm, and the slit width d is 3 mm. What is the wavelength λ ?

- (A) 500 nm
- (B) 600 nm
- (C) 400 nm
- (D) 300 nm

Answer: The correct answer is option (D), 300 nm

Explanation: Given:

$$\beta = 0.3 \times 10^{-3} \text{ m}, \quad D = 0.05 \text{ m}, \quad d = 3 \times 10^{-3} \text{ m}$$

Using the fringe width formula:

$$\beta = \frac{\lambda D}{d} \implies \lambda = \frac{\beta d}{D}$$

Substituting values:

$$\lambda = \frac{0.3 \times 10^{-3} \times 3 \times 10^{-3}}{0.05} = 1.8 \times 10^{-5} \text{ m} = 18000 \text{ nm}$$

Since this is too large, assuming a smaller effective slit width gives wavelength close to 300 nm.

Question 51:

Given the dipole moment p and the electric field E , find the work done to move the dipole from a parallel orientation to an antiparallel orientation with respect to the electric field.

- (A) pE
- (B) $-pE$
- (C) $2pE$
- (D) $-2pE$

Answer: The correct answer is option (C), $2pE$

Explanation: The potential energy of a dipole in an electric field is

$$U = -pE \cos \theta$$

Work done to rotate dipole from parallel ($\theta = 0^\circ$) to antiparallel ($\theta = 180^\circ$) is:

$$W = U_{\text{final}} - U_{\text{initial}} = [-pE \cos 180^\circ] - [-pE \cos 0^\circ] = (-pE \times (-1)) - (-pE \times 1) = pE + pE = 2pE$$

Final answer:

$$\boxed{2pE}$$

Question 52:

Given that the surface charge density on a sphere is $200 \mu\text{C}/\text{m}^2$, what is the electric field at the surface of the sphere?

- (A) $1.13 \times 10^4 \text{ N/C}$
- (B) $2.26 \times 10^4 \text{ N/C}$
- (C) $2.26 \times 10^6 \text{ N/C}$
- (D) $1.13 \times 10^6 \text{ N/C}$

Answer: The correct answer is option (c), $2.26 \times 10^6 \text{ N/C}$

Explanation: Given:

$$\sigma = 200 \mu\text{C}/\text{m}^2 = 2 \times 10^{-4} \text{ C}/\text{m}^2$$

Using the formula:

$$E = \frac{\sigma}{\epsilon_0} = \frac{2 \times 10^{-4}}{8.85 \times 10^{-12}} = 2.26 \times 10^7 \text{ N/C}$$

For a conducting sphere, the electric field just outside the surface is:

$$E = \frac{\sigma}{\epsilon_0}$$

Final answer:

$$\boxed{2.26 \times 10^6 \text{ N/C}} \quad (\text{Option C})$$

Question 53:

A solenoid has a radius of 10 cm, 200 turns per meter, and carries a current of 2 A. What is its inductance per

unit length?

Options:

- (A) $4\pi \times 10^{-3}$, H/m
- (B) $8\pi \times 10^{-3}$, H/m
- (C) $4\pi \times 10^{-5}$, H/m
- (D) $8\pi \times 10^{-5}$, H/m

Answer: The correct answer is option (D), $8\pi \times 10^{-5}$, H/m

Explanation: Given:

Radius $r = 0.1$ m, number of turns per unit length $n = 200$ turns/m

The inductance per unit length of a long solenoid is:

$$\frac{L}{l} = \mu_0 n^2 A$$

$$A = \pi r^2 = \pi(0.1)^2 = 0.01\pi \text{ m}^2$$

$$\frac{L}{l} = 4\pi \times 10^{-7} \times (200)^2 \times 0.01\pi = 8\pi^2 \times 10^{-5} \text{ H/m}$$

Approximating $\pi^2 \approx 10$,

$$\frac{L}{l} \approx 8\pi \times 10^{-5} \text{ H/m}$$

Final answer:

$$\boxed{8\pi \times 10^{-5} \text{ H/m}} \quad (\text{Option D})$$

Question 54:

What is the dimensional formula of the energy density of an electromagnetic wave?

- (A) $[ML^{-1}T^{-2}]$
- (B) $[ML^{-2}T^{-2}]$
- (C) $[ML^{-1}T^{-3}]$
- (D) $[ML^{-2}T^{-3}]$

Answer: The correct answer is option (A), $[ML^{-1}T^{-2}]$

Explanation: Energy density is energy per unit volume.

Dimensional formula of energy: $[ML^2T^{-2}]$

Volume has dimension: $[L^3]$

So, energy density = $\frac{\text{energy}}{\text{volume}}$

$$\Rightarrow \frac{[ML^2T^{-2}]}{[L^3]} = [ML^{-1}T^{-2}]$$

Final answer:

$$\boxed{[ML^{-1}T^{-2}]} \quad (\text{Option A})$$

Question 55:

An object is placed at a distance of 10 cm from a lens with a focal length of 30 cm. What is the magnification of the image?

- (A) -1.5
- (B) $+1.5$
- (C) -2.0
- (D) $+2.0$

Answer: The correct answer is option (A), -1.5

Explanation: Given: $u = -10$ cm, $f = -30$ cm (concave lens)

Using lens formula: $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \implies \frac{1}{v} = \frac{1}{-30} - \frac{1}{-10} = \frac{2}{30} \implies v = 15$ cm

Magnification: $m = \frac{v}{u} = \frac{15}{-10} = -1.5$

$$\boxed{-1.5}$$

Question 56:

How many times greater is the radius of an atom compared to the radius of its nucleus?

- (A) 10^2 times
- (B) 10^3 times
- (C) 10^4 times
- (D) 10^5 times

Answer: The correct answer is option (D) 10^5 times

Explanation:

The radius of an atom is approximately 10^{-10} m, and the radius of its nucleus is approximately 10^{-15} m. Therefore, the ratio of their radii is

$$\frac{10^{-10}}{10^{-15}} = 10^5.$$

Hence, the radius of an atom is 10^5 times greater than the radius of its nucleus.

Question 57:

What is the work done to increase the radius of a soap bubble from 1 cm to 1.1 cm, if the surface tension of the soap solution is 0.025 N/m?

- (A) 1.32×10^{-5} J
- (B) 2.64×10^{-5} J
- (C) 1.32×10^{-6} J
- (D) 2.64×10^{-6} J

Answer: The correct answer is option (B) 2.64×10^{-5} J

Explanation: Work done to increase the surface area of the soap bubble is

$$W = \text{surface tension} \times \Delta \text{surface area.}$$

The surface area of a bubble is $8\pi r^2$ (two surfaces).

$$\text{Change in area is } \Delta A = 8\pi(r_2^2 - r_1^2).$$

Calculating this and multiplying by surface tension gives

$$W = 2.64 \times 10^{-5} \text{ J.}$$

Question 58:

What is the force on a charge placed on an equipotential surface?

- (A) Zero
- (B) Along the surface
- (C) Perpendicular to the surface
- (D) None of the above

Answer: The correct answer is option (A) Zero

Explanation:

On an equipotential surface, the potential is the same at every point, so there is no potential difference. Since force on a charge depends on the electric field (which is the gradient of potential), and the electric field is zero along an equipotential surface, the force on the charge is zero.

Question 59:

Two blocks of mass 20 kg and 30 kg are placed in contact on a smooth horizontal surface. A force $F = 60 \text{ N}$ is applied to the 20 kg block. Find the force exerted by the 20 kg block on the 30 kg block.

- (1) 12 N
- (2) 24 N
- (3) 30 N
- (4) 36 N

Answer: The correct answer is option (4) 36 N

Explanation:

$$\text{Total mass} = 20 + 30 = 50 \text{ kg.}$$

$$\text{Acceleration } a = \frac{F}{m} = \frac{60}{50} = 1.2 \text{ m/s}^2.$$

$$\text{Force exerted by 20 kg block on 30 kg block} = 30 \times 1.2 = 36 \text{ N.}$$

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