MHT CET 2026 May 14 Shift 1

Question Paper (Memory-Based) with Solutions

Conducted by Maharashtra State CET Cell

General Instructions

(i) **Duration:** The total duration of the examination is 3 hours (180 minutes).

(ii) **Total Marks:** The complete paper carries a maximum of 200 marks.

(iii) **Structure:** The paper has 3 Sections:

- **Section A:** 50 Multiple Choice Questions (Physics)
- **Section B:** 50 Multiple Choice Questions (Chemistry)
- **Section C:** 50 Multiple Choice Questions (Mathematics)

(iv) **Compulsory Questions:** All 150 questions are compulsory.

(v) Each question has four options. Only **one** option is correct.

(vi) **Right Answer:** +1 marks for Physics and Chemistry Questions. +2 marks for Mathematics Questions

(vii) **Incorrect Answer:** (No Negative marking).

(viii) **Unanswered/Marked for Review:** 0 marks.

1. Calculate the solubility in mol dm^{-3} of sparingly soluble salt BA if its solubility product is 4.9×10^{-13} at the same temperature.

(A) 7.0×10^{-7}

(B) 7.5×10^{-7}

(C) 8.0×10^{-7}

(D) 4.9×10^{-7}

Correct Answer: (A) 7.0×10^{-7}

Solution:

Step 1: Concept

For a binary salt of type BA the dissociation is $BA(s) \rightleftharpoons B^{+}(aq) + A^{-}(aq)$. The solubility product is $K_{sp} = S^2$, where S is the molar solubility.

Step 2: Meaning

We are given $K_{sp} = 4.9 \times 10^{-13}$. We need S, the maximum amount of salt that dissolves in $1\,\text{dm}^3$ of solution.

Step 3: Analysis

Rearranging: $S = \sqrt{K_{sp}} = \sqrt{4.9 \times 10^{-13}}$. Rewrite as $\sqrt{49 \times 10^{-14}}$ to simplify the square root.

Step 4: Conclusion

$S = \sqrt{49 \times 10^{-14}} = 7 \times 10^{-7}\,\text{mol}\,\text{dm}^{-3}$.

Final Answer: (A)

Quick Tip: For AB-type salts, solubility is always the square root of K_{sp}. Adjust the power of 10 to an even number for easy square-rooting.

---

2. Calculate the pH of 0.01 M strong dibasic acid.

(A) 5.5

(B) 2.5

(C) 2.0

(D) 1.7

Correct Answer: (D) 1.7

Solution:

Step 1: Concept

A strong dibasic acid (e.g. H_2SO_4) dissociates completely, releasing two H^+ ions per formula unit. Hence $[H^+] = 2 \times \text{Molarity}$.

Step 2: Meaning

The molarity is 0.01 M, so $[H^+] = 2 \times 0.01 = 0.02\,M = 2 \times 10^{-2}\,M$.

Step 3: Analysis

$pH = -\log[H^+] = -\log(2 \times 10^{-2}) = 2 - \log 2$. Using $\log 2 \approx 0.3010$.

Step 4: Conclusion

$pH = 2 - 0.3010 = 1.699 \approx 1.7$.

Final Answer: (D)

Quick Tip: For dibasic acids, double the concentration before taking the log. $pH = n - \log(\text{coeff})$ where the concentration is $\text{coeff} \times 10^{-n}$.

---

3. The solubility product of $PbCl_2$ at 298 K is 3.2×10^{-5}. What is its solubility in $mol\,dm^{-3}$?

(A) 8×10^{-6}

(B) 2×10^{-2}

(C) 5.6×10^{-3}

(D) 5.0×10^{-2}

Correct Answer: (B) 2×10^{-2}

Solution:

Step 1: Concept

$PbCl_2$ is an AB_2-type salt. $PbCl_2 \rightleftharpoons Pb^{2+} + 2\,Cl^-$. The solubility product expression is $K_{sp} = (S)(2S)^2 = 4S^3$.

Step 2: Meaning

Given $K_{sp} = 3.2 \times 10^{-5}$, solve $4S^3 = 3.2 \times 10^{-5}$.

Step 3: Analysis

$S^3 = \dfrac{3.2 \times 10^{-5}}{4} = 0.8 \times 10^{-5} = 8 \times 10^{-6}$.

Step 4: Conclusion

$S = \sqrt[3]{8 \times 10^{-6}} = 2 \times 10^{-2}\,mol\,dm^{-3}$.

Final Answer: (B)

Quick Tip: For AB_2 or A_2B salts use $K_{sp} = 4S^3$. Adjust the exponent to a multiple of 3 before taking the cube root.

---

4. Identify base$_2$ **for the following equation according to Brønsted–Lowry theory:**

$\mathrm{HCl}(aq) + \mathrm{H_2O}(l) \rightleftharpoons \mathrm{H_3O^+}(aq) + \mathrm{Cl^-}(aq)$

(A) $\mathrm{H_3O^+}(aq)$

(B) $\mathrm{H_2O}(l)$

(C) $\mathrm{Cl^-}(aq)$

(D) $\mathrm{HCl}(aq)$

Correct Answer: (C) $\mathrm{Cl^-}(aq)$

Solution:

Step 1: Concept

According to Brønsted–Lowry theory, an acid is a proton donor and a base is a proton acceptor. Conjugate acid–base pairs differ by one proton.

Step 2: Meaning

Labelling the species: $\underbrace{\mathrm{HCl}}_{\mathrm{Acid_1}} + \underbrace{\mathrm{H_2O}}_{\mathrm{Base_2}} \rightleftharpoons \underbrace{\mathrm{H_3O^+}}_{\mathrm{Acid_2}} + \underbrace{\mathrm{Cl^-}}_{\mathrm{Base_1}}$.

Step 3: Analysis

HCl (Acid$_1$) donates a proton to form $\mathrm{Cl^-}$ (Base$_1$). $\mathrm{H_2O}$ (Base$_2$) accepts the proton to form $\mathrm{H_3O^+}$ (Acid$_2$). The question asks for Base$_1$, the conjugate base of HCl.

Step 4: Conclusion

$\mathrm{Cl^-}$ is the conjugate base produced when HCl loses a proton, making it the correct answer.

Final Answer: (C)

Quick Tip: A Brønsted base is what remains after an acid loses $\mathrm{H^+}$. $\mathrm{HCl} - \mathrm{H^+} = \mathrm{Cl^-}$.

---

5. What is the pH of 2×10^{-3} M solution of a monoacidic weak base if it ionises to the extent of 5%?

(A) 14

(B) 10

(C) 4

(D) 2

Correct Answer: (B) 10

Solution:

Step 1: Concept

For a weak base, $[\text{OH}^-] = C\alpha$, where C is the molar concentration and α is the degree of dissociation. $\text{pOH} = -\log[\text{OH}^-]$ and $\text{pH} = 14 - \text{pOH}$.

Step 2: Meaning

$C = 2 \times 10^{-3}\,\text{M}$, $\alpha = 0.05$. $[\text{OH}^-] = (2 \times 10^{-3}) \times 0.05 = 1 \times 10^{-4}\,\text{M}$.

Step 3: Analysis

$\text{pOH} = -\log(10^{-4}) = 4$.

Step 4: Conclusion

$\text{pH} = 14 - 4 = 10$.

Final Answer: (B)

Quick Tip: Always check whether the question asks for pH or pOH. For bases, compute pOH first, then use $\text{pH} = 14 - \text{pOH}$.

---

6. Twelve identical wires, each of resistance r, are joined to form the skeleton of a cube. The equivalent resistance between two diagonally opposite corners of the cube is:

(A) $\frac{5}{6}r$

(B) $\frac{3}{4}r$

(C) $\frac{7}{12}r$

(D) $\frac{12}{5}r$

Correct Answer: (A) $\frac{5}{6}r$

Solution:

Step 1: Concept

This is a symmetric 3-D resistor network. Cubic symmetry allows us to use current-distribution analysis to simplify the circuit.

Step 2: Meaning

A body diagonal connects two corners sharing no face. Injecting total current $6I$ at one corner, symmetry forces it to split into $2I$ along each of the three edges meeting there.

Step 3: Analysis

Tracing the potential drop along one representative path:

$$V = (2I)(r) + (I)(r) + (2I)(r) = 5Ir.$$

Step 4: Conclusion

$R_{\text{eq}} = \dfrac{V}{I_{\text{total}}} = \dfrac{5Ir}{6I} = \dfrac{5}{6}r.$

Final Answer: (A)

Quick Tip: Cube resistance triad: edge diagonal $= \frac{7}{12}r$, face diagonal $= \frac{3}{4}r$, body diagonal $= \frac{5}{6}r$.

---

7. A long straight wire carries a current I. A proton travels with velocity v parallel to the wire at a distance d from it, in the same direction as the current. The magnetic force acting on the proton is:

(A) Attractive, magnitude $\dfrac{\mu_0 eIv}{2\pi d}$

(B) Repulsive, magnitude $\dfrac{\mu_0 eIv}{2\pi d}$

(C) Attractive, magnitude $\dfrac{\mu_0 eIv}{4\pi d}$

(D) Zero

Correct Answer: (A) Attractive, magnitude $\dfrac{\mu_0 eIv}{2\pi d}$

Solution:

Step 1: Concept

The field due to a long wire at distance d is $B = \mu_0 I/(2\pi d)$. Force on a moving charge: $\vec{F} = q(\vec{v} \times \vec{B})$.

Step 2: Meaning

By the right-hand thumb rule, for current flowing upward, $\vec{B}$ at the proton's location points into the page.

Step 3: Analysis

With $\vec{v}$ upward and $\vec{B}$ into the page, $\vec{v} \times \vec{B}$ points toward the wire. Magnitude: $F = ev\left(\frac{\mu_0 I}{2\pi d}\right) = \frac{\mu_0 e I v}{2\pi d}$.

Step 4: Conclusion

The force is directed toward the wire (attractive) with magnitude $\frac{\mu_0 e I v}{2\pi d}$.

Final Answer: (A)

Quick Tip: Like currents attract. A moving proton constitutes a current parallel to and in the same direction as the wire, so the force is attractive.

---

8. A circular coil of N turns and radius R carries a current I. It is unwound and rewound to make another coil of radius $R/2$. For the same current, the ratio of the magnetic field at the centre of the new coil to that of the old coil is:

(A) $4:1$

(B) $2:1$

(C) $1:2$

(D) $1:4$

Correct Answer: (A) $4:1$

Solution:

Step 1: Concept

Field at centre of a circular coil: $B = \mu_0 N I/(2R)$. Total wire length $L = N \cdot 2\pi R$ is conserved on rewinding.

Step 2: Meaning

New radius $R' = R/2$. Conservation of length: $N(2\pi R) = N'(2\pi R/2) \Rightarrow N' = 2N$.

Step 3: Analysis

$B' = \dfrac{\mu_0 N' I}{2R'} = \dfrac{\mu_0 (2N) I}{2(R/2)} = \dfrac{4\mu_0 N I}{2R} = 4B.$

Step 4: Conclusion

$B' : B = 4 : 1.$

Final Answer: (A)

Quick Tip: When rewinding a coil, $B \propto N/R$. Halving R doubles N, giving a net factor of $2 \times 2 = 4$.

---

9. An electron revolves in a circular orbit of radius r with frequency f. Its equivalent magnetic dipole moment is:

(A) $\pi e f r^2$
(B) $\frac{1}{2} e f r^2$
(C) $2\pi e f r^2$
(D) $e f r^2$

Correct Answer: (A) $\pi e f r^2$

Solution:

Step 1: Concept

Magnetic dipole moment of a current loop: $M = I \times A$, where I is the equivalent current and A is the area enclosed.

Step 2: Meaning

Equivalent current due to the revolving electron: $I = e/T = ef$ (since $f = 1/T$).

Step 3: Analysis

Area of the circular orbit: $A = \pi r^2$. Therefore $M = ef \cdot \pi r^2$.

Step 4: Conclusion

$M = \pi e f r^2.$

Final Answer: (A)

Quick Tip: $M = IA$. Current $= e \times f$ and area $= \pi r^2$; multiply directly.

---

10. A step-down transformer reduces 220 V to 110 V. If the primary current is 5 A and the efficiency is 80%, the secondary current is:

(A) 10 A

(B) 8 A

(C) 4 A

(D) 12.5 A

Correct Answer: (B) 8 A

Solution:

Step 1: Concept

Transformer efficiency: $\eta = P_s/P_p = (V_s I_s)/(V_p I_p)$.

Step 2: Meaning

$V_p = 220\,\text{V}$, $V_s = 110\,\text{V}$, $I_p = 5\,\text{A}$, $\eta = 0.80$.

Step 3: Analysis

$$I_s = \frac{\eta V_p I_p}{V_s} = \frac{0.80 \times 220 \times 5}{110} = 0.80 \times 2 \times 5 = 8\,\text{A}.$$

Step 4: Conclusion

The secondary current is 8 A.

Final Answer: (B)

Quick Tip: Power out = efficiency × power in. At 100% the secondary current would be 10 A; at 80% it is $10 \times 0.8 = 8\,\text{A}$.

---

11. If $I = \int \frac{\sin x + \sin^3 x}{\cos 2x}\,dx = P\cos x + Q\log\left|\frac{\sqrt{2}\cos x - 1}{\sqrt{2}\cos x + 1}\right| + C$**, then the values of** P **and** Q **are respectively:**

(A) $\frac{1}{2}, \quad \frac{3}{4\sqrt{2}}$

(B) $\frac{1}{2}, \quad \frac{-3}{4\sqrt{2}}$

(C) $\frac{1}{2}, \quad \frac{3}{2\sqrt{2}}$

(D) $\frac{1}{2}, \quad \frac{-3}{2\sqrt{2}}$

Correct Answer: (B) $\frac{1}{2}, \quad \frac{-3}{4\sqrt{2}}$

Solution:

Step 1: Concept

Use $\cos 2x = 2\cos^2 x - 1$ and $\sin^3 x = \sin x(1 - \cos^2 x)$ to simplify the integrand.

Step 2: Meaning

Numerator: $\sin x + \sin x(1 - \cos^2 x) = \sin x(2 - \cos^2 x)$.

$$I = \int \frac{\sin x(2 - \cos^2 x)}{2\cos^2 x - 1}\, dx.$$

Step 3: Analysis

Substitute $u = \cos x$, $du = -\sin x\, dx$:

$$I = -\int \frac{2 - u^2}{2u^2 - 1}\, du = \int \frac{u^2 - 2}{2u^2 - 1}\, du = \int \left(\frac{1}{2} - \frac{3/2}{2u^2 - 1}\right) du.$$

Integrating via partial fractions on the second term:

$$I = \tfrac{1}{2}u - \tfrac{3}{4\sqrt{2}} \log\left|\frac{\sqrt{2}u - 1}{\sqrt{2}u + 1}\right| + C.$$

Step 4: Conclusion

Re-substituting $u = \cos x$ and comparing with the given form: $P = \frac{1}{2}, Q = \frac{-3}{4\sqrt{2}}$.

Final Answer: (B)

Quick Tip: The substitution $u = \cos x$ converts the integrand into a rational function, readily handled by partial fractions.

12. In a triangle $\triangle ABC$, if a, b, and c are in arithmetic progression, then $\cos A + 2\cos B + \cos C =$

(A) 1

(B) 2

(C) $\frac{3}{2}$

(D) $\sqrt{3}+1$

Correct Answer: (B) 2

Solution:

Step 1: Concept

If a, b, c are in A.P., then $2b = a + c$. By the Sine Rule this is equivalent to $2\sin B = \sin A + \sin C$.

Step 2: Meaning

Using sum-to-product: $4\sin\frac{B}{2}\cos\frac{B}{2} = 2\sin\frac{A+C}{2}\cos\frac{A-C}{2}$. Since $\frac{A+C}{2} = 90^\circ - \frac{B}{2}$, we get $\cos\frac{A-C}{2} = 2\sin\frac{B}{2}$.

Step 3: Analysis

$$\cos A + \cos C + 2\cos B = 2\cos\tfrac{A+C}{2}\cos\tfrac{A-C}{2} + 2\left(1 - 2\sin^2\tfrac{B}{2}\right).$$

Substitute $\cos\frac{A+C}{2} = \sin\frac{B}{2}$ and $\cos\frac{A-C}{2} = 2\sin\frac{B}{2}$:

$$= 4\sin^2\tfrac{B}{2} + 2 - 4\sin^2\tfrac{B}{2} = 2.$$

Step 4: Conclusion

$\cos A + 2\cos B + \cos C = 2$.

Final Answer: (B)

Quick Tip: Quick check: equilateral triangle $(A = B = C = 60^\circ)$ gives $0.5 + 1 + 0.5 = 2$. ✓

---

13. If the area of triangle ABC is $b^2 - (c-a)^2$, then $\tan B =$

(A) 1

(B) $\frac{13}{15}$

(C) $\frac{1}{4}$

(D) $\frac{8}{15}$

Correct Answer: (D) $\frac{8}{15}$

Solution:

Step 1: Concept

Area $= \frac{1}{2}ac\sin B$. Expand: $b^2-(c-a)^2 = b^2-c^2-a^2+2ac$.

Step 2: Meaning

Cosine Rule: $b^2-c^2-a^2 = -2ac\cos B$. So the given area $= 2ac(1-\cos B)$.

Step 3: Analysis

Equating: $\frac{1}{2}ac\sin B = 2ac(1-\cos B) \Rightarrow \sin B = 4(1-\cos B)$. Half-angle substitution gives $\tan\frac{B}{2} = \frac{1}{4}$.

Step 4: Conclusion

$$\tan B = \frac{2\tan(B/2)}{1-\tan^2(B/2)} = \frac{2\cdot\frac{1}{4}}{1-\frac{1}{16}} = \frac{\frac{1}{2}}{\frac{15}{16}} = \frac{8}{15}.$$

Final Answer: (D)

Quick Tip: When area is given in terms of sides, use the Cosine Rule to reduce the expression to a single trigonometric equation in one angle.

---

14. In a $\triangle ABC$, $a=1$, $b=\sqrt{3}$ and $\angle C = \frac{\pi}{6}$. Then the measure of the third side $c =$

(A) 4

(B) 3

(C) 1

(D) 2

Correct Answer: (C) 1

Solution:

Step 1: Concept

Apply the Cosine Rule: $c^2 = a^2 + b^2 - 2ab\cos C$.

Step 2: Meaning

$a = 1$, $b = \sqrt{3}$, $C = \dfrac{\pi}{6} = 30^\circ$, so $\cos C = \dfrac{\sqrt{3}}{2}$.

Step 3: Analysis

$$c^2 = 1 + 3 - 2(1)(\sqrt{3}) \cdot \frac{\sqrt{3}}{2} = 4 - 3 = 1.$$

Step 4: Conclusion

$c = 1$.

Final Answer: (C)

Quick Tip: For SAS (two sides and included angle), the Cosine Rule is the direct and only formula needed to find the third side.

---

15. The integral $\displaystyle\int \frac{1}{\sqrt[4]{(x-1)^3(x+2)^5}}\,dx$ is equal to (where C is a constant of integration):

(A) $\dfrac{3}{4}\left(\dfrac{x+2}{x-1}\right)^{1/4} + C$

(B) $\dfrac{3}{4}\left(\dfrac{x+2}{x-1}\right)^{5/4} + C$

(C) $\dfrac{4}{3}\left(\dfrac{x-1}{x+2}\right)^{1/4} + C$

(D) $\dfrac{4}{3}\left(\dfrac{x-1}{x+2}\right)^{5/4} + C$

Correct Answer: (C) $\dfrac{4}{3}\left(\dfrac{x-1}{x+2}\right)^{1/4} + C$

Solution:

Step 1: Concept

Rewrite: $(x-1)^{3/4}(x+2)^{5/4} = (x+2)^2\left(\dfrac{x-1}{x+2}\right)^{3/4}$.

Step 2: Meaning

Let $t = \dfrac{x-1}{x+2}$. Then $dt = \dfrac{3}{(x+2)^2}\,dx$, so $\dfrac{dx}{(x+2)^2} = \dfrac{dt}{3}$.

Step 3: Analysis

$$\int \frac{dx}{(x+2)^2 \cdot t^{3/4}} = \frac{1}{3}\int t^{-3/4}\,dt = \frac{1}{3}\cdot\frac{t^{1/4}}{1/4} + C = \frac{4}{3}t^{1/4} + C.$$

Step 4: Conclusion

Re-substituting: $I = \dfrac{4}{3}\left(\dfrac{x-1}{x+2}\right)^{1/4} + C.$

Final Answer: (C)

Quick Tip: For integrands with fractional powers of two linear factors, try $t = \dfrac{ax+b}{cx+d}$; this reduces the integral to a simple power function.
