JEE Main – 24th January – 2025 (Shift-1)

[Memory Based Questions] PHYSICS

1. Body projected with initial velocity v_0 at $45°$ angle in $X - Y$ Plane. Angular momentum at highest point is.

   a) $mv_0^3/4\sqrt{2}g$ b) $mv_0^3/8\sqrt{2}g$ c) $mv_0^3/2\sqrt{2}\,g$ d) $mv_0^3/6\sqrt{2}\,g$

   Ans: (a)

2. A solid cylinder rolling on the inclined plane at an angle 30o without slipping. The acceleration is

   a) $\dfrac{g}{3}$ b) $\dfrac{g}{2}$ c) g   d) 2g

   Ans: (a)

3. A wire of resistance 9 ohm is bent into a form of equilateral triangle the equivalent resistance between any two points of its vertex will be

   Ans: 2Ω

4. A big spherical drop break down to 27 drops the work done to break is 10 J and the same drop break into 64 droplets of same radius find the work done.

   Ans: 15J

5. An alternating current is given by I = I1cos ωt + I2sin ωt. The RMS value of current is given by?

   a) $\dfrac{I_1+I_2}{\sqrt{2}}$ b) $\sqrt{2}I_2$ c) $\dfrac{\sqrt{I_1^2 +I_2^2}}{2}$ d) $\dfrac{\sqrt{I_1^2 - I_2^2}}{2}$

   Ans: (c)

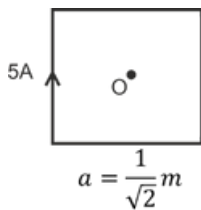6. What is relative shift of focal length of a lens when optical power is increased from 0.1 D to 2.5 D?

   a) $\dfrac{24}{25}$ b) $\dfrac{13}{10}$ c) $\dfrac{21}{25}$ d) $\dfrac{1}{10}$

   Ans: (a)

7. A particle execute shm with time 2 s and has amplitude of 1 cm. What is the ratio of total distance and displacement in 12.5 sec i.e. D/d

   a) 25/4   b) 25/3   c) 25/1   d) 25/2

   Ans: (c)

8. Find magnetic field at the center O of the given square

   $$a = \frac{1}{\sqrt{2}}m$$

   Ans: 8μT

9. $F = \alpha + \beta x^2$, α = 1 (constant)

   Distance travelled is (1 m) & work done is (5 J). find ?

   a) 15   b) 12   c) 10   d) 11

   Ans: (b)

10. Radius of Curvature of plano convex lens is 2 cm and refractive index is 1.5 has focal length f_1 in air and f_2 in a medium of refractive index 1.2. Calculate f_1/f_2 ?

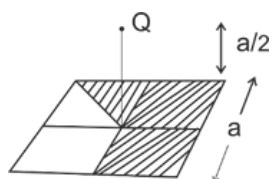   a) 1/4   b) 1/3   c) 1/6   d) 1/2

    Ans: (d)

11. Radius of curvature of two lenses are R_1 and R_2 whose refractive index μ_1 and μ_2. Ratio of focal length is

    a) $\frac{(\mu_1-1)\,R_2}{(\mu_2-1)\,R_1}$ b) $\frac{\mu_1 R_2}{2R_1}$ c) $\frac{(\mu_2-1)\,R_1}{(\mu_1-1)\,R_2}$ d) $\frac{R_2}{R_1}$

    Ans: (c)

12. The electric flux through the shaded area of square plate of side a due to point charge placed at distance of $a/2$ from it as shown in fig is $\frac{NQ}{48 \varepsilon_0}$, then N is

    Ans: 5

13. Time period of planet A of radius R is T1 and time period of planet B or radius $1.3R$ is $T2$. Then find the ratio of $T1$ and $T2$

a) 2/3   b) 3/2   c) 3/4   d) 4/3

Ans: (a)

14. De Broglie wavelength of electron when it moves from A to C is $2000A\circ$ and becomes $6000A\circ$ when it moves from B to C. Then wavelength when it moves from A to B

Ans: 3000Ao

15. If the distance between two parallel plates of a capacitor is d, A is the area of each plate, and E is the electric field. Find the energy stored in capacitor

a) $\dfrac{1}{2} E^2 A \varepsilon_0 d$ b) $\dfrac{1}{4} E^2 A \varepsilon_0 d$ c) $\dfrac{3}{4} E^2 A \varepsilon_0 d$ d) $E^2 A \varepsilon_0 d$

Ans: (a)

16. One mole of monoatomic gas is heated at constant pressure. If the ratio of Heat absorbed to change in internal energy is x, then find the value of x.

Ans: $\dfrac{9}{15}$

17. A man is taking a turn across a banked road. with friction coefficient (μ) & Banking angle θ. Find the value of max speed with he can take the turn without slipping?

Ans: $V\text{max} = \sqrt{\left(\dfrac{\mu + \tan\theta}{1 - \mu\tan\theta}\right)}$

CHEMISTRY

1. Which of the following strong oxidizing agent?

   a) Eu^{2+} b) Ce^{2+} c) Ce^{4+} d) Eu^{4+}

   Ans: (c)

2. Process is non-spontaneous at freezing point but spontaneous at boiling point, find ΔH and ΔS.

   a) Both are Positive

   b) Both are Negative

   c) ΔS Positive, ΔH Negative

   d) ΔS Negative, ΔH Positive

   Ans: (a)

3. If 10 mol CO and 10 mol of Fe_3O_4 reacts according to $Fe_3O_4 + 4CO \rightarrow 4CO_2 + 3Fe$. What is the weight of Fe produce?

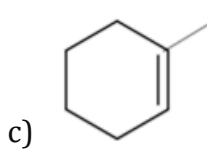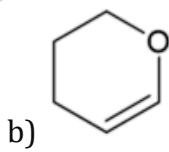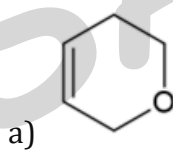   a) 420g   b) 540g   c) 340g   d) 620g

   Ans: (a)

4. The difference in melting point and boiling point of oxygen and sulphur can be explained by

   a) Electronegativity

   b) Electron gain enthalpy

   c) Atomicity

   d) Ionization energy

   Ans: (c)

5. Which of the following will react with HBr faster ?
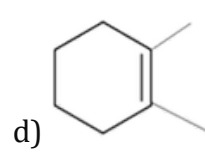
   a)   b)   c)   d)

   Ans: (b)

6. Ribose present in DNA is
    (A) It is a pentose sugar
    (B) Present in pyranose form
    (C) α-anomeric carbon is present
    (D) Present in D configuration
    (E) It is reducing sugar in free form
    Choose the correct statements:

    a) A, C & E only
    b) A, D & E only
    c) A, B, C, D & E
    d) A & E only

    Ans: (b)

7. In H_2O, NH_3 and CH_4
    (A) All central atoms are sp3 hybridised
    (B) Order of dipole moment is $CH_4 < NH_3 < H_2O$
    (C) NH_3 in H_2O is basic in nature, NH_3 and H_2O are Bronsted-Lowry acid and bases respectively
    (D) Bond angle of H_2O, NH_3 and CH_4 respectively are 104.5°, 107° and 109.5°

    a) A and B only
    b) A, B and C only
    c) A, B, C and D
    d) A, B and D only

    Ans: (d)

8. In the preparation of potassium permanganate from pyrolusite ore (MnO_2), the fusion of pyrolusite ore is done with an alkali metal hydroxide like KOH in the presence of air or an oxidising agent like KNO_3, which first produces?
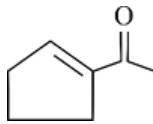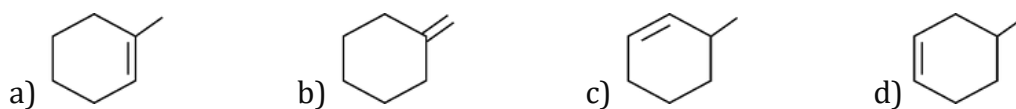
    a) K_2MnO_4 b) $KMnO_6$ c) K_2MnO d) K_2MnO_6

    Ans: (a)

9. If the Ksp of $Cr(OH)_3$ is $1.6 \times 10^{-30} M^4$. The molar solubility of salt in water is 1.56×10^{-x}, then value of x is

    a) 6   b) 8   c) 10   d) 4

    Ans: (b)

10. This compound is aldol condensation product of which of the following alkene after ozonolysis ?
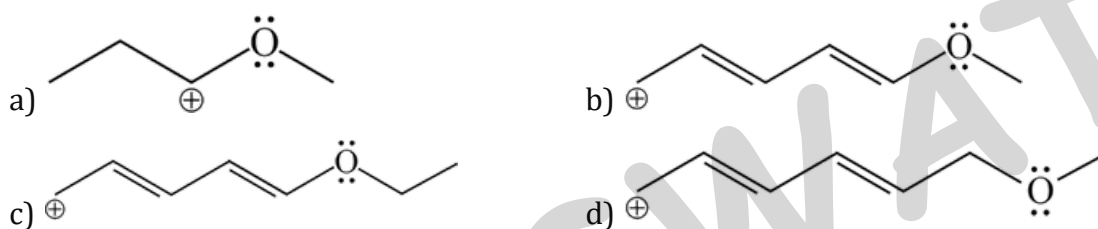
a)   b)   c)   d)

Ans: (a)

11. In Duma's method, which gas is evolved?

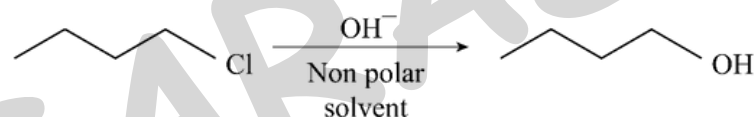a) N_2 b) O_2 c) SO_2 d) SO_3

Ans: (a)

12. Stability of carbocation is maximum in ?
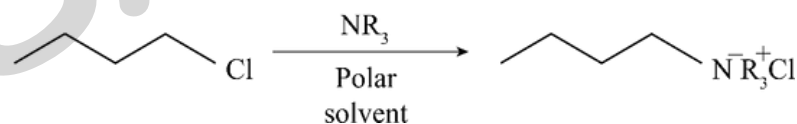
a)   b)

c)   d)
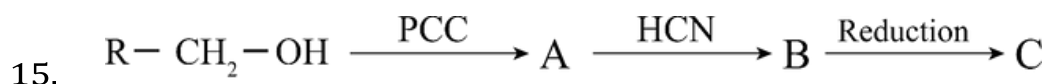
Ans: (c)

13. **Statement-1**

Statement-2

a) Both Statement-1 and Statement-2 are false

b) Both Statement-1 and Statement-2 are true

c) Statement-1 is true and Statement-2 are false

d) Statement-1is false and Statement-2 are true

Ans: (b)

14. Which of the following is most reactive towards nucleophilic addition reaction.

    a) Para-nitro benzaldehyde

    b) Para-methyl benzaldehyde

    c) Benzaldehyde

    d) Acetophenone

    Ans: (a)

15. $R-CH_2-OH \xrightarrow{\text{PCC}} A \xrightarrow{\text{HCN}} B \xrightarrow{\text{Reduction}} C$

    What is 'C' Compound ?

    a) $R-\overset{\overset{\text{OH}}{|}}{C}H-CH_2-NH_2$

    b) $R-CH=CH-NH_2$

    c) $R-CH_2-CH_2-NH_2$

    d) $R-\overset{\overset{\text{O}}{||}}{C}H-CH_2-NH_2$

    Ans: (a)

16. Which of the following complex produce 2 mole of AgCl precipitate in the presence of excess $AgNO_3$ solution.

    a) $CoCl_3 . 4NH_3$ b) $CoCl_3 . 5NH_3$ c) $CoCl_3 \cdot 3NH_3$ d) $CoCl_3 \cdot 6NH_3$

    Ans: (b)
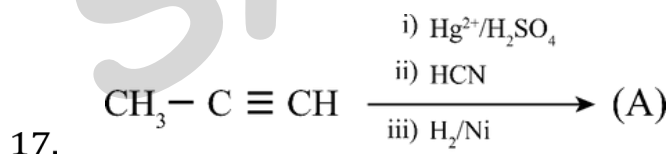
17. $CH_3-C\equiv CH \xrightarrow[\text{iii) } H_2/Ni]{\overset{\text{i) } Hg^{2+}/H_2SO_4}{\text{ii) } HCN}} (A)$

    a) $CH_3-\overset{\overset{\text{OH}}{|}}{\underset{\underset{\text{CH}_2\text{NH}_2}{|}}{C}}-CH_3$

    b) $CH_3-\overset{\overset{\text{OH}}{|}}{\underset{\underset{\text{CH}_2\text{NH}_2}{|}}{C}}-CH_2-CH_3$

    c) $CH_3-\overset{\overset{\text{OH}}{|}}{\underset{\underset{\text{CH}_2\text{CN}}{|}}{C}}-CH_2$

    d) $CH_3-\overset{\overset{\text{OH}}{|}}{\underset{\underset{\text{CH}_2-CH_2-NH_2}{|}}{C}}-CH_2$

    Ans: (a)

18. Which of the following give nucleophile substitution reaction fastest?

a)

b)

c)

d)
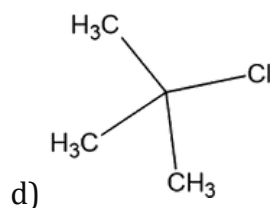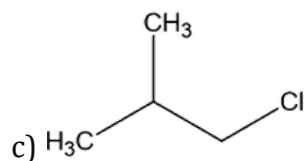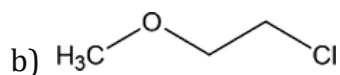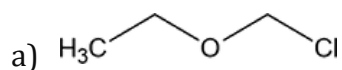
Ans: (a)

19. $Ag^+ + e^- \rightarrow Ag \quad E^0 = xV$

$Fe^{+2} + 2e^- \rightarrow Fe^0 = yV$

$Fe^{+3} + 3e^- \rightarrow Fe E^0 = zV$

Then Find the E^0_{cell} for $Fe^{+2} + Ag \rightarrow Fe^{+3} + Ag^+$

a) $x - 2y$ b) $x + 2y - 3z$ c) $x + y - z$ d) $x + y + z$

Ans: (b)

MATHEMATICS

1. If the 5th, 6th and 7th term of the binomial expansion of $(1 + x^2)^{n+4}$ are in A.P. Then the greatest binomial coefficient in the expansion of $(1 + x^2)^{n+4}$ is

   a) 10   b) 35   c) 25   d) 14

   Ans: (b)

2. Number of 3 digit number which are divisible by 2 & 3 but not divisible by 4 & 9.

   Ans: 125

3. If A is 3 × 3 matrix such that det(A) = 2. Then det(adj(adj(adj(adj A))))

   a) 2^{32} b) 2^{16} c) 2^8 d) 2^{12}

   Ans: (b)

4. Evaluate $\lim_{x \to 0} \operatorname{cosec} x \cdot (\sqrt{2\cos 2x + 3\cos x} - \sqrt{\cos 2x + \sin x + 4})$

   a) 0   b) 1   c) $\frac{1}{2\sqrt{5}}$ d) $-\frac{1}{2\sqrt{5}}$

   Ans: (d)

5. If the images of the points $A(1, 3)$, $B(3, 1)$ and $C(2, 4)$ in the line $x + 2y = 4$ are D, E and F respectively, then the centroid of the triangle DEF is

   a) (1/3, 0)   b) (0, -1/3)   c) (2, 4)   d) (2/3, 0)

   Ans: (d)

6. Let the parabola $y = x^2 + px - 3$ cuts the coordinate axes at P, Q and R. A circle with centre $(-1, -1)$ passes through P, Q and R, then the area of triangle PQR.

   a) 6   b) 8   c) 9   d) 11

   Ans: (a)

7. The area of the region bounded by $S(x, y)$ such that $S = \{(x, y): x^2 + 4x + 2 \leq y \leq |x + 2|\}$ is (in sq. units)

   a) $\frac{24}{5}$ b) 5   c) $\frac{20}{3}$ d) 7

   Ans: (c)

8. If $a = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$, $\vec{b} = 3\hat{\imath} + \hat{\jmath} - \hat{k}$ and $\vec{c}$ is coplanar with a and $\vec{b}$. Also $a \cdot \vec{c} = 5$ and $\vec{c}$ is perpendicular to $\vec{b}$. Then $|\vec{c}|$ is

   a) 18   b) 16   c) $\frac{\sqrt{5}}{14}$ d) $\sqrt{\frac{\pi\pi}{6}}$

   Ans: (d)

9. $f(x) - 6f(\frac{1}{x}) = \frac{35}{3x} - \frac{5}{2}$. If $\lim_{x \to 0} (\frac{1}{\alpha x} + f(x)) = \beta$. Find $(\alpha + 2\beta)$

   a) 4   b) 7   c) 11   d) 3

   Ans: (a)

10. Mean of 10 numbers is 5.5, $\sum_{i=1}^{10} x_i 2 = 371$. Two numbers are read wrong of 4 and 5 is instead of 6 and 8. Find correct variance.

    a) 5   b) 11   c) 7   d) 9

    Ans: (c)

11. If α and β are real numbers such that $\sec2(\tan-1(\alpha)) + \csc2(\cot-1(\beta)) = 36$ and $\alpha + \beta = 8$, then $(\alpha2 + \beta)$ is $(\alpha > \beta)$

    a) 23   b) 28   c) 24   d) 27

    Ans: (b)

12. A and B throws dies. A wins if he get sum of 5 before B gets 8. B wins if he get sum of 8 before A gets. The probability that A wins is

    a) 1/3   b) 7/11   c) 9/19   d) 8/17

    Ans: (c)

13. If $\frac{dy}{dx} + (\frac{x}{1+x2}) y = \frac{\sqrt{x}}{\sqrt{1+x2}}$; $y(0) = 0$, then $y(1)$ will be

    a) $\frac{2}{3}$ b) $\frac{2}{\sqrt{3}}$ c) $\frac{\sqrt{2}}{3}$ d) $\frac{\sqrt[2]{}}{3}$

    Ans: (c)

14. Find product of all real roots of equation $(x2 - 9x + 11)2 - (x - 4)(x - 5) = 2$ is

    a) 99   b) 118   c) 78   d) 54

    Ans: (a)

15. If S be the set of 10 distinct primes and let A be the set of product of two or more elements from the set S. If $P = \{(x, y): x \in S$ and $y \in A$ and y is divided by $x\}$. Then $n(P)$ is equal to

a) 5110   b) 5000   c) 5220   d) 5420

Ans: (a)