

MOMENTUM

PHYSICS

(24 Feb 2021) Shift-1

1. If two identical capacitor once capacitor connected in series ($C_{eq} = C_1$) and once connected in parallel

($C_{eq} = C_2$) then find ratio $\frac{C_1}{C_2}$.

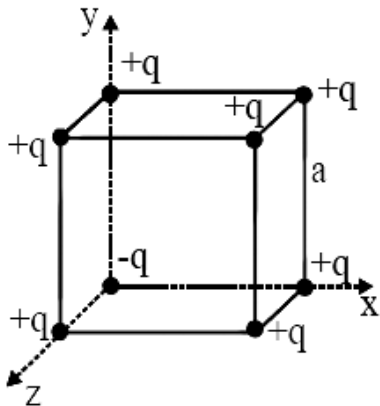
(1) $\frac{3}{4}$

(2) $\frac{5}{6}$

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

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

2.



Find electric field at centre of cube ?

(1) $\frac{-2q}{\pi 3\sqrt{3}\epsilon_0 a^2} [\hat{i} + \hat{j} + \hat{k}]$

(2) $\frac{q}{\pi 3\sqrt{3}\epsilon_0 a^2} [\hat{i} + \hat{j} + \hat{k}]$

(3) $\frac{-q}{\pi 3\sqrt{3}\epsilon_0 a^2} [\hat{i} + \hat{j} + \hat{k}]$

(4) $\frac{2q}{\pi 3\sqrt{3}\epsilon_0 a^2} [\hat{i} + \hat{j} + \hat{k}]$

3. In a transistor if increase in emitter current is 4 mA and corresponding increase in collector current is 3.5 mA. Find β .

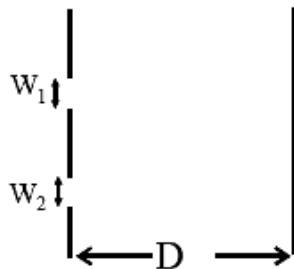
(1) .875

(2) .5

(3) 7

(4) 1

4. If $\frac{w_1}{w_2} = \frac{1}{3}$ (w is width) and its given that amplitude is proportional to w . Find $\frac{I_{max}}{I_{min}}$.



(1) 1 : 4

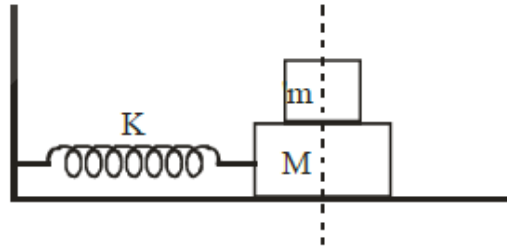
(2) 3 : 1

(3) 4 : 1

(4) 2 : 1

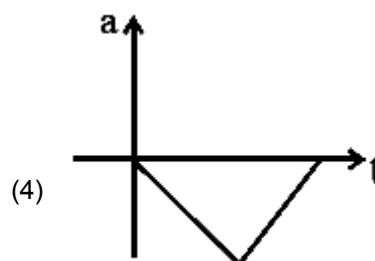
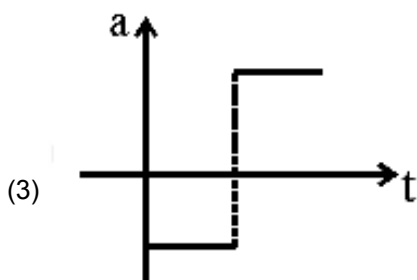
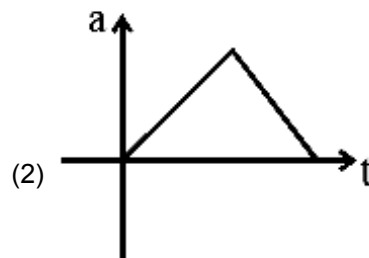
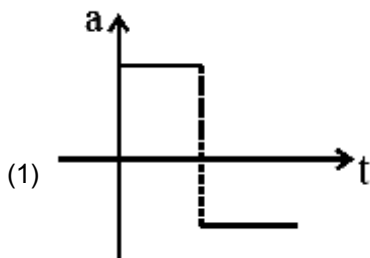
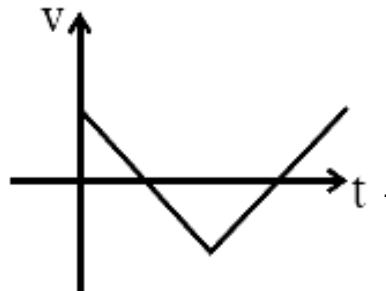
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5. If a small block of mass m is placed gently on M when M is passing through its mean position. Find its new amplitude of SHM, if initial amplitude is A .



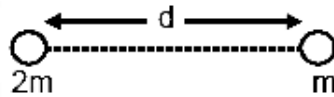
- (1) $\sqrt{\frac{M}{M+m}}(A)$ (2) $\sqrt{\frac{M+m}{M}}(A)$ (3) $\sqrt{\frac{M+m}{2M}}(A)$ (4) $\sqrt{\frac{M}{M-m}}(A)$

6. From given velocity time graph which of the following is acceleration time graph



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7. Two stars are rotating about their common center of mass. Find the period of revolution of mass m about center of mass.



- (1) $2\pi\sqrt{\frac{d^3}{3Gm}}$ (2) $2\pi\sqrt{\frac{3Gm}{d^3}}$ (3) $\frac{1}{2\pi}\sqrt{\frac{d^3}{3Gm}}$ (4) $\frac{1}{2\pi}\sqrt{\frac{3Gm}{d^3}}$

8. Find relation between modulus μ

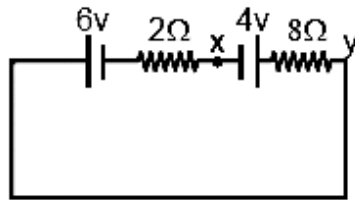
$Y \rightarrow$ young's modulus

$K \rightarrow$ Bulk modulus

$\eta \rightarrow$ modulus of rigidity

- (1) $K = \frac{\eta Y}{9\eta - 3Y}$ (2) $Y = \frac{\eta K}{9\eta - 3K}$ (3) $K = \frac{\eta Y}{9\eta + 3Y}$ (4) $Y = \frac{\eta K}{9\eta + 3K}$

9. Circuit is given find $|V_x - V_y|$



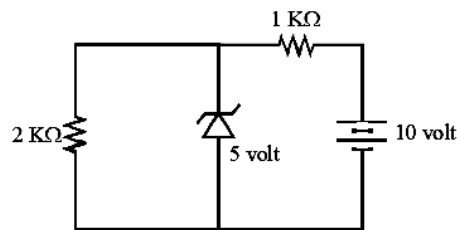
- (1) 5.6 volt (2) 3.6 volt (3) 10 v (4) 240 volt

10. If work $= \alpha \beta^2 e^{-\frac{x^2}{\alpha K T}}$,

Where, $K =$ Boltzman constant, $T =$ temp, then find dimension of β

- (1) $M^1 L^1 T^{-2}$ (2) $M^{-1} L^{-1} T^2$ (3) $M^{-1} L^2 T^{-2}$ (4) $M^2 L^1 T^2$

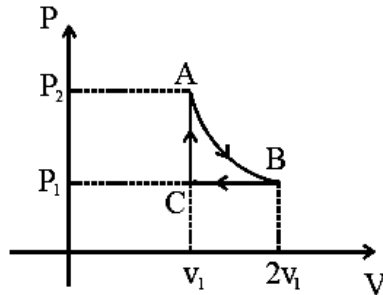
11. Zener diode is connected in circuit as shown. Find current in $2k\Omega$ resistance.



- (1) 2.5 mA (2) 30 mA (3) 10 mA (4) 20 mA

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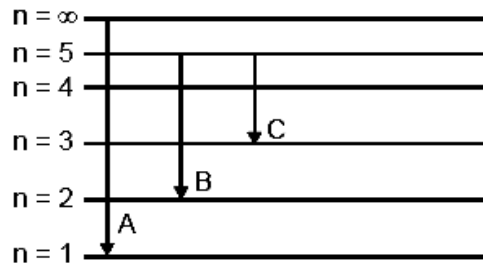
12. Given AB is Isothermal and BC is Isobaric and CA is isobaric process. Find total work done in cyclic process. (Given $p_1 v_1 = nRT$.)



- (1) $nRT[\ell n 2 - 2]$ (2) $2nRT[\ell n 2 - 1/2]$ (3) $nRT[\ell n 2 - 1/2]$ (4) $nRT[\ell n 2 + 2]$
13. A side of a cube a is made from 6 identical sheet. If coefficient of linear expansion is α and temperature is now made $T + \Delta T$ from temperature T then find change in volume
- (1) $\Delta V = 3a^3 \alpha \Delta T$ (2) $\Delta V = \frac{4}{3} \pi a^3 \alpha \Delta T$ (3) $\Delta V = 4a^3 \alpha \Delta T$ (4) $\Delta V = 6a^3 \alpha \Delta T$
14. If intensity after passing through a polaroid is 100 Lumen. Now this same polaroid is rotated by 30° about its axis then find new intensity after passing through it.
- (1) 50 Lumen (2) 100 Lumen (3) 25 Lumen (4) 65 Lumen
15. Four particles, each of mass 1 kg and equidistant from each other, move along a circle of radius 1 m under the action of their mutual gravitational attraction. The speed of each particle is :
- (1) $\sqrt{G(1+2\sqrt{2})}$ (2) $\frac{1}{2} \sqrt{G(1+2\sqrt{2})}$ (3) \sqrt{G} (4) $\sqrt{2\sqrt{2}G}$
16. Choose the correct options.
- | | |
|-----------------|----------------------------|
| Column-I | Column-II |
| (P) Adiabatic | (i) Pressure constant |
| (Q) Isothermal | (ii) Volume constant |
| (R) Isochoric | (iii) Temperature constant |
| (S) Isobaric | (iv) Heat content constant |
- From above match the column find out the correct options.
- (1) P-iv; Q-iii; R-ii; S-i (2) P-iv; Q-iii; R-i; S-ii
 (3) P-iii; Q-ii; R-iv; S-i (4) P-iv; Q-ii; R-iii; S-i
17. Relation between radius of curvature & focal length of a convex mirror is.
- (1) $f = \frac{R}{2}$ (2) $R = \frac{f}{2}$ (3) $2f = 3R$ (4) None
18. I_1 = Moment of Inertia of ring if mass M and radius R about its diameter.
 I_2 = Moment of Inertia of Disc of mass M and radius R through central axis perpendicular to plane of ring.
 I_3 = Moment of Inertia of solid cylinder mass M and radius R about its axis.
 I_4 = Moment of Inertia of solid sphere through its diameter.
- (1) $I_1 + I_2 = I_3 + \frac{5}{4} I_4$ (2) $I_1 = I_2 = I_3 < I_4$ (3) $I_1 > I_2 = I_3 = I_4$ (4) $I_1 + I_2 = I_3 + \frac{2}{5} I_4$

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19. Spectral lines of hydrogen atoms are given is below



which of the following is correct for spectral lines A, B & C

- (1) Series limit of lyman, 3rd line of Balmer, 2nd line of paschan
- (2) Series limit of lyman, 2nd line of Balmer, 2nd line of paschan
- (3) 2nd line of lyman, 3rd line of Balmer, 2nd line of paschan
- (4) Series limit of lyman, 3rd line of Balmer, 3rd line of paschan

20. **Statement-1:** de-Broglie wavelength of proton varies inversely with linear momentum.

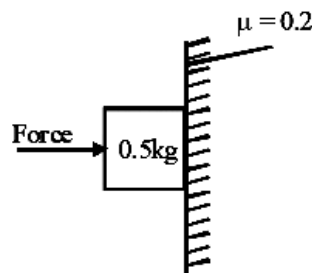
Statement-2: As λ increases, energy and momentum increases.

- (1) Statement-1 is true and Statement-2 is false.
- (2) Statement-1 is false and Statement-2 is true.
- (3) Statement-1 is false and Statement-2 is false.
- (4) Statement-1 is true and Statement-2 is true.

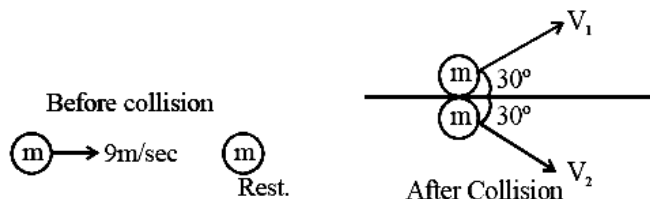
21. A 220 volts AC supply is given to the primary circuit of transformer and as output of 12 volts DC is taken out using rectifier. If secondary number of turns was 24, then find the no. of turns in primary coil.

22. A vertical cross-section of plane is $y = \frac{x^2}{4}$, coefficient of friction is 0.5. Find maximum height at which particle can stay (in cm).

23. Find out minimum force required to stop block from falling (given $g = 10 \text{ m/s}^2$)



24. Two identical particles of same mass are shown just before collision and just after collision than $\frac{V_1}{V_2}$ is



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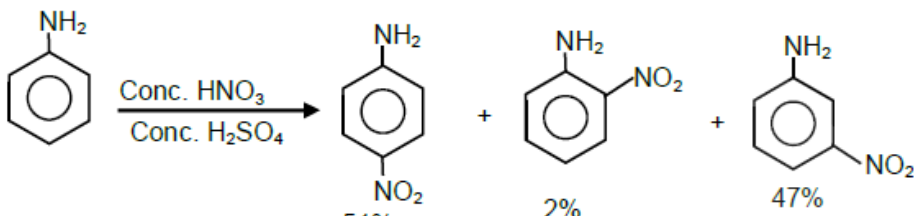
25. $i = 20t + 8t^2$
Find charge flown during $0 \leq t \leq 15$
26. A 100 kg block can be lift by placing a mass m on a piston (hydraulic lift). If a diameter of piston placed at one end is increased by 4 times and that of second piston is decreased by 4 times. Now same mass m is placed at piston that how many kg weight can be lift up for the new set up?
27. Two planet are revolving about planet with $\frac{T_1}{T_2} = \frac{1}{8}$. Find the ratio of angular speed $\frac{\omega_1}{\omega_2}$
28. An electromagnetic wave is propagating in medium, where $\mu_r = \epsilon_r = 2$. If speed of light in medium is $x \times 10^7$ m/s. Find out x .
29. $v_m = 20 \sin[100\pi t + \frac{\pi}{4}]$
 $v_c = 80 \sin[10^4 \pi t + \frac{\pi}{6}]$
For amplitude modulation wave findout percentage modulation index.
30. In AC series R-L-C resonance circuit Resistance $R = 6.28$ ohm, frequency 10 Mhz and self inductance $L = 2 \times 10^{-4}$ Henry is given. Find Quality factor of circuit.

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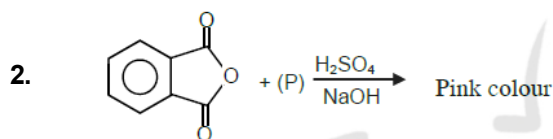
CHEMISTRY

(24 Feb 2021) Shift-1

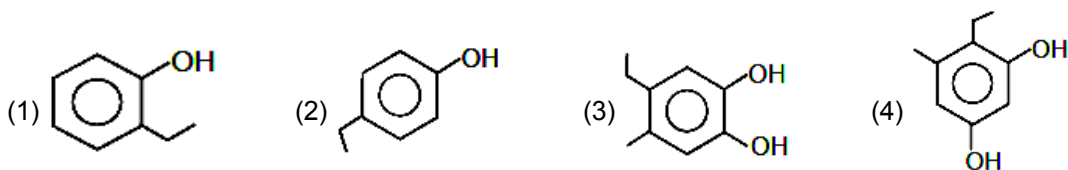
1. What is the reason for the formation of meta product in the following reaction?



- (1) Aniline is ortho/para directing
(2) Aniline is meta directing
(3) In acidic medium, aniline is converted into anilinium ion which is ortho/para directing
(4) In acidic medium, aniline is converted into anilinium ion which is meta directing



Missing reagent(P) is



3. Which force is responsible for the stacking of α -helix structure of protein?
(1) H-bonding (2) Ionic bond (3) Covalent bond (4) Vanderwal forces
4. The gas evolved due to anaerobic degradation of vegetation causes?
(1) Global warming and caner
(2) Acid rain
(3) Ozone hole
(4) Metal corrosion
5. The gas CH_4 evolved due to anaerobic degradation of vegetation which causes global warming and caner.

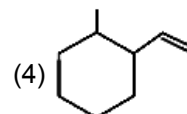
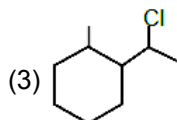
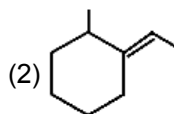
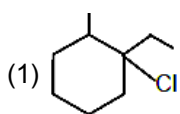
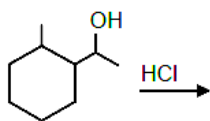
Match the column

- | | |
|------------------------------|--------------------|
| (i) Caprolactum | (a) Neoprene |
| (ii) Acrylo nitrile | (b) Buna N |
| (iii) 2-chlorobuta-1,3-diene | (c) Nyolon-6 |
| (iv) 2-Methylbuta-1,3-diene | (d) Natural rubber |

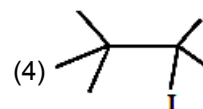
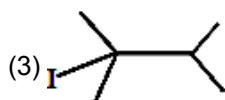
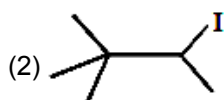
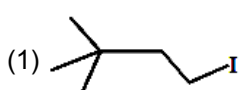
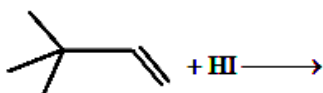
- (1) (i) \rightarrow (b), (ii) \rightarrow (c), (iii) \rightarrow (a), (iv) \rightarrow (d)
(2) (i) \rightarrow (a), (ii) \rightarrow (c), (iii) \rightarrow (b), (iv) \rightarrow (d)
(3) (i) \rightarrow (c), (ii) \rightarrow (b), (iii) \rightarrow (a), (iv) \rightarrow (d)
(4) (i) \rightarrow (c), (ii) \rightarrow (a), (iii) \rightarrow (b), (iv) \rightarrow (d)

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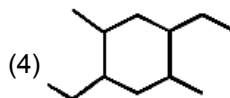
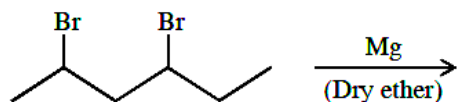
6. What is the major product of the following reaction?



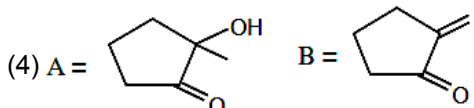
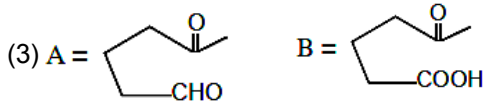
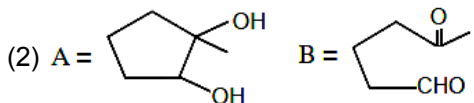
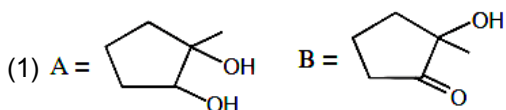
7. What is the major product of following reaction?



8. Identify the major product?

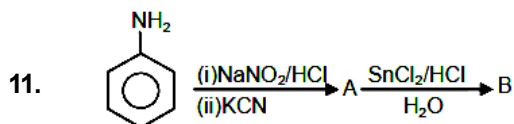


9. Product A and B are?

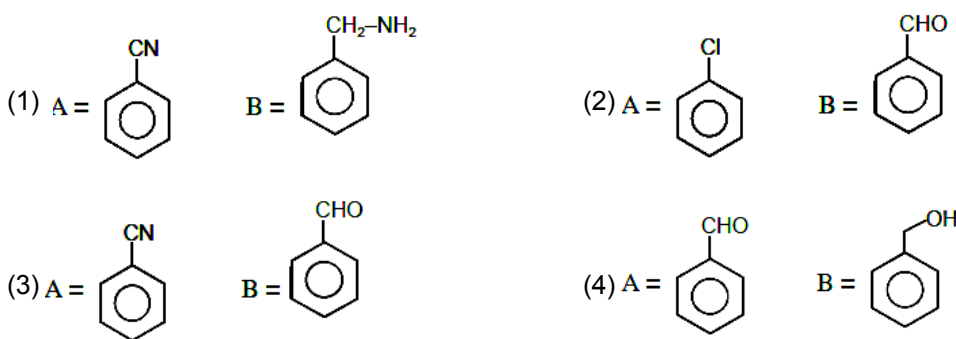


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10. $\text{CH}_3\text{-CH}_2\text{-CH}_3 \xrightarrow{(A)} \text{CH}_3\text{-CH}_2\text{-C(=O)-H}$
 Which reagent (A) is used for following given conversion?
 (1) $\text{Cu} / \Delta / \text{high pressure}$
 (2) Molybdenum oxide
 (3) Manganese acetate
 (4) Potassium permanganate



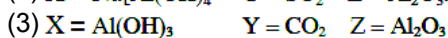
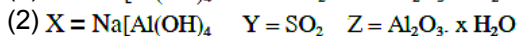
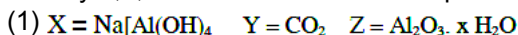
Find A and B



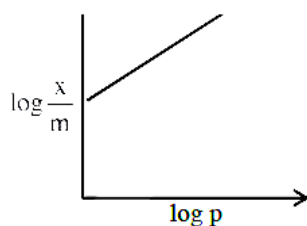
12. Which of the following have both the compound isostructural.
 (a) $\text{TiCl}_4, \text{SiCl}_4$ (b) $\text{SO}_4^{2-}, \text{CrO}_4^{2-}$ (c) $\text{NH}_3, \text{NO}_3^-$ (d) $\text{ClF}_3, \text{BCl}_3$
 (1) A, B (2) A, C (3) B, C (4) A, D
13. Which of the following ores are concentrated by cyanide of group IST element,
 (1) Sphalerite (2) Malachite (3) Calamine (4) Siderite
14. S-1 : Colourless cupric metaborate is converted into cuprous metaborate in luminous flame.
 S-2 : Cuprous metaborate is formed by reacting copper sulphate with boric anhydride heated in non luminous flame.
 (1) S_1 is true and S_2 is false (2) S_1 is false and S_2 is true
 (3) Both are false (4) Both are true.
15. (1) $\text{I}_2 + \text{H}_2\text{O}_2 + 2\text{OH}^- \longrightarrow 2\text{I}^- + 2\text{H}_2\text{O} + \text{O}_2$
 (2) $\text{H}_2\text{O}_2 + \text{HOCl} \longrightarrow \text{Cl}^- + \text{H}_3\text{O}^+ + \text{O}_2$
 (1) H_2O_2 is acting as oxidising agent in both the reaction
 (2) H_2O_2 is acting as reducing agent in both the reaction
 (3) H_2O_2 is acting as oxidising agent in reaction (1) and as reducing agent in reaction (2)
 (4) H_2O_2 is acting as reducing agent in reaction (1) and as oxidising agent in reaction (2)
16. $E_{M^{2+}/M}^\circ$ has positive value for which of the element of 3d transition series.

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17. $\text{Al} + \text{NaOH} \longrightarrow \text{X} \xrightarrow{\text{Y}_{(g)}} \text{Z}$
Identify X, Y, Z in the above reaction sequence



18. The slope of the straight line given in the following diagram for adsorption is



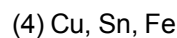
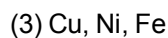
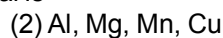
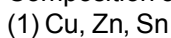
(1) $\frac{1}{n}$ (0 to 1)

(2) $\frac{1}{n}$ (0.1 to 0.5)

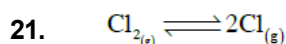
(3) $\log n$

(4) $\log \frac{1}{n}$

19. Composition of gun metal is



20. Arrange the following in the correct order of ionisation potential
Mg, Al, Si, P, S



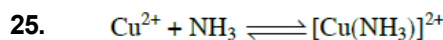
For the given reaction at equilibrium moles of $\text{Cl}_{2(g)}$ is equal to the moles of $\text{Cl}_{(g)}$ and equilibrium pressure is 1 atm. if K_p of this reaction is $x \times 10^{-1}$. Find x



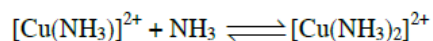
Find the value of c.

23. Calculate time taken in seconds for 40% completion of first order reaction if rate constant is $3.3 \times 10^{-4} \text{ sec}^{-1}$.

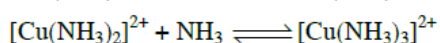
24. For a chemical reaction K_{eq} is 100 at 300K, the value of $\Delta_r G$ is $-xR$ Joule at 1 atm pressure the value of x. (Use $\ln 10 = 2.3$)



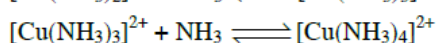
$K_1 = 10^4$



$K_2 = 1.58 \times 10^3$



$K_3 = 5 \times 10^2$



$K_4 = 10^2$

Dissociation constant of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is $x \times 10^{-12}$

Determine x

MOMENTUM

26. CH_2ClCOOH is dissolved in 500ml of H_2O solution and depression in freezing point of solution is 0.5°C . Find percentage dissociation.
 $(K_f)_{\text{H}_2\text{O}} = 1.86 \text{ k kg mole}^{-1}$
27. What is coordination number in Body centered cubic (BCC) arrangement of identical particles
28. Among the following compounds how many are amphoteric in nature
 $\text{Be}(\text{OH})_2, \text{BeO}, \text{Ba}(\text{OH})_2, \text{Sr}(\text{OH})_2$
29. 4.5 gm of solute having molar mass of 90 mg/mol is dissolved in water to make 250 ml solution. Calculate molarity of the solution
30. Mass of Li^{3+} is 8.33 times mass of proton Li^{3+} and proton are accelerated through same potential difference. Then ratio of deBroglie's wavelength of Li^{3+} to proton is $X \times 10^{-1}$. Find x

MOMENTUM

MATHEMATICS

(24 Feb 2021) Shift-1

- The locus of mid-point of the line segment joining focus of parabola $Y^2=4ax$ to a point m on it, is a parabola equation of whose directrix is
(1) $y = 0$ (2) $x = 0$ (3) $x = a$ (4) $y = a$
- There are 6 Indian 8 foreigners
Find number of committee form with atleast 2 Indians such that number of foreigners is twice number of Indians.
(1) 1625 (2) 1050 (3) 1400 (4) 575
- There are two positive number p and q such that $p + q = 2$ and $p^4 + q^4 = 272$. Find the quadrat equation whose roots are p and q .
(1) $x^2 - 2x + 2 = 0$ (2) $x^2 - 2x + 135 = 0$ (3) $x^2 - 2x + 16 = 0$ (4) $x^2 - 2x + 130 = 0$
- A fair die is thrown n times. The probability of getting an odd number twice is equal to that getting an even number thrice. The probability of getting an odd number, odd number of times is
(1) $\frac{1}{3}$ (2) $\frac{1}{6}$ (3) $\frac{1}{2}$ (4) $\frac{1}{8}$
- Population of a town at time t is given by the differential equation $\frac{dp(t)}{dt} = (0.5)P(t) - 450$. Also $P(0) = 850$ find the time when population of town becomes zero.
(1) $\ln 9$ (2) $3\ln 4$ (3) $2\ln 18$ (4) $\ln 18$
- Which of the following is tautology ?
(1) $A \wedge (A \rightarrow B) \rightarrow B$ (2) $B \rightarrow (A \wedge A \rightarrow B)$ (3) $A \wedge (A \vee B)$ (4) $(A \vee B) \wedge A$
- The value of $(-{}^{15}C_1 + 2 \cdot {}^{15}C_2 - 3{}^{15}C_3 + \dots - 15{}^{15}C_{15}) + ({}^{14}C_1 + {}^{14}C_3 + \dots + {}^{14}C_{11})$ is
(1) $2^{16} - 14$ (2) $2^{13} - 14$ (3) $2^{13} - 13$ (4) 2^{14}
- Two towers are 150m distance apart. Height of one tower is thrice the other tower. The angle elevation of top of tower from midpoint of their feets are complement to each other then height of smaller tower is
(1) $25\sqrt{3}$ m (2) $\frac{25}{\sqrt{3}}$ m (3) $75\sqrt{3}$ m (4) 25 m
- Tangent at point $P(t, t^3)$ of curve $y = x^3$ meets the curve again at Q then ordinate of point which divides PQ in 1 : 2 internally, is
(1) 0 (2) $2t^3$ (3) $-2t^3$ (4) $8t$
- Let $f(x) = \frac{4x^3 - 3x^2}{6} - 2 \sin x + (2x - 1) \cos x$ then $f(x)$
(1) decreases in $\left[\frac{1}{2}, \infty\right)$ (2) increases in $\left[\frac{1}{2}, \infty\right)$ (3) decreases in $[-\infty, \infty)$ (4) increases in $\left[-\infty, \frac{1}{2}\right)$
- The area bounded by region inside the circle $x^2 + y^2 = 36$ and outside the parabola $y^2 = 9x$ is
(1) $12\pi + 3\sqrt{3}$ (2) $36\pi + 3\sqrt{3}$ (3) $24\pi - 3\sqrt{3}$ (4) $24\pi - 3\sqrt{3}$

MOMENTUM

20. The values of k and m such that system of equations $3x + 2y - kz = 10$, $x - 2y + 3z = 3$, $x + 2y - 3z = 5m$ are inconsistent.

- (1) $k = 3$ and $m \neq \frac{7}{10}$ (2) $k = 3$ and $m = \frac{7}{10}$ (3) $k \neq 3$ and $m = \frac{7}{10}$ (4) $k = 2$ and $m \neq \frac{7}{10}$

21.
$$\tan \left(\lim_{x \rightarrow \infty} \sum_{r=1}^n \tan^{-1} \left(\frac{1}{1+r^2+r} \right) \right) =$$

22. Of the three independent events B_1, B_2 and B_3 , the probability that only B_1 occurs is α , only B_2 occurs is β and only B_3 occurs is γ . Let the probability p that none of events B_1, B_2 or B_3 occurs satisfy the equations $(\alpha - 2\beta)p = \alpha\beta$ and $(\beta - 3\gamma)p = 2\beta\gamma$. All the given probabilities are assumed to lie in the interval $(0, 1)$.

Then
$$\frac{\text{probability of occurrence of } B_1}{\text{probability of occurrence of } B_3} =$$

23. \vec{c} is coplanar with $\vec{a} = -\vec{i} + \vec{j} + \vec{k}$ & $\vec{b} = 2\vec{i} + \vec{k}$, $\vec{a} \cdot \vec{c} = 7$ & $\vec{c} \perp \vec{b}$. then the value of $2|\vec{a} + \vec{b} + \vec{c}|^2$ is.

24. One of the diameter of circle $C_1 : x^2 + y^2 - 2x - 6y + 6 = 0$ is chord of circle C_2 with centre $(2, 1)$ then the radius of C_2 is

25. Let $P = \begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{bmatrix}$, where $\alpha \in \mathbb{R}$. Suppose $Q = [q_{ij}]$ is a matrix such that $PQ = kI$, where $k \in \mathbb{R}$, $k \neq 0$ and

I is the identity matrix of order 3. If $q_{23} = -\frac{k}{8}$ and $\det(Q) = \frac{k^2}{2}$, then the value of $k^2 + \alpha^2$ is equal to

26. How many 3×3 matrices M with entries from $\{0, 1, 2\}$ are there, for which the sum of diagonal entries of $M^T M$ is 7?

27. $z + \alpha |z - 1| + 2i = 0; z \in \mathbb{C} \text{ \& } \alpha \in \mathbb{R}$, then the value of $4[(\alpha_{\max})^2 + (\alpha_{\min})^2]$ is

28. Let $A = \{x : x \text{ is 3 digit number}\}$

$B = \{x : x = 9K + 2, k \in I\}$

$C = \{x : x = 9K + \ell, k \in I, \ell \in I, 0 < \ell < 9\}$

If sum of elements in $A \cap (B \cup C)$ is 274×400 then ℓ is

29. The least value of α such that $\frac{4}{\sin x} + \frac{1}{1 - \sin x} = \alpha$ has at least one solution in $x \in \left(0, \frac{\pi}{2}\right)$

30.
$$\int_{-a}^a |x| + |x - 2| = 22, a > 2$$
 then the value of $\int_{-a}^a x + [x]$ is

(where $[.]$ represent greatest integer function)

MOMENTUM

ANSWER KEY (24 Feb 2021) Shift-1

PHYSICS

1. (4)	2. (1)	3. (3)	4. (3)	5. (1)	6. (3)	7. (1)
8. (1)	9. (1)	10. (1)	11. (1)	12. (2)	13. (1)	14. (2)
15. (2)	16. (1)	17. (1)	18. (1)	19. (1)	20. (1)	21. 440
22. 25 cm	23. 25	24. 1	25. 11250	26. 25600	27. 8	28. 15
29. 25	30. 2000					

CHEMISTRY

1.(4)	2.(1)	3.(1)	4.(1)	5.(3)	6.(1)	7.(3)
8.(2)	9.(1)	10.(2)	11.(3)	12.(1)	13.(1)	14.(3)
15.(2)	16.(Cu)	17.(1)	18.(1)	19.(1)	20. Al < Mg < Si < S < P	
21.(5)	22.(4)	23.1535.3	24.1380	25.1.26 (Nearest integer = 1)		26.(7.5)
27.(8)	28.(2)	29.0.2	30.2			

MATHEMATICS

1. (2)	2. (1)	3. (3)	4. (3)	5. (3)	6. (1)	7. (2)
8. (1)	9. (3)	10. (2)	11. (3)	12. (1)	13. (1)	14. (1)
15. (1)	16. (1)	17. (3)	18. (1)	19. (2)	20. (1)	21. 01.00
22. 6	23. 75.00	24. 3	25. 17	26. 540	27. 10	28. 5.00
29. 9.00	30. -3					