Be sure with

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IIT-JEE 2007 – Sample Test Paper

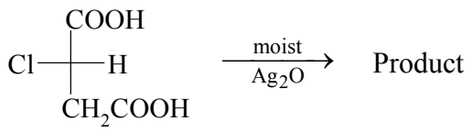
Chemistry

Read the following passages (A) and answer the multiple choice questions based on each passage.

A. The conversion of d–form of an optically active compound into ℓ – form of the same or of different compound or vice–versa is known as Walden inversion or optically inversion. The change in configuration depends upon the nature of the reagent. It has been observed that mild or weak reagent does not cause Walden inversion while strong reagents cause Walden inversion.

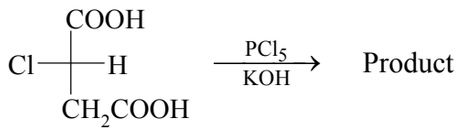
*The following questions **1** and **2** are based on the above passage **(A)**.*

1.



(A) No change in configuration
(B) Change in configuration
(C) No reaction
(D) None of these

2.



(A) No change in configuration
(B) Change in configuration
(C) No reaction
(D) None of these

3. Match the compounds (A) with their applications/colour in (B)

	A		**B**
I	Pb_3O_4	W	white lead
II	$(PbCO_3)_2.Pb(OH)_2$	X	rust proofing sheets
III	Ca_2PbO_4	Y	road signs and markings
IV	$PbCrO_4$	Z	red lead

Choose the correct alternate :

	I	**II**	**III**	**IV**
(A)	Y	Z	X	W
(B)	X	W	Y	Z
(C)	Z	W	X	Y
(D)	X	Y	W	Z

4. The ionization constant of HCN = 4×10^{-10}. The concentration of hydrogen ions in
I. 0.2 M solution of HCN
II. 0.2 M solution of HCN containing 1 mole/litre of KCN, are
(A) 8.9×10^{-6} and 8×10^{-11} g ion/*l*
(B) 8×10^{-11} and 8.9×10^{-6} g ion/*l*
(C) 8×10^{-1} and 5×10^{-1} g ion/*l*
(D) None of these

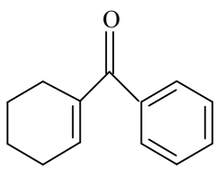
5. A solution contains Na_2CO_3 and $NaHCO_3$. 10 ml of the solution required 2.5 ml of 0.1 M H_2SO_4 for neutralization using phenolphthalein as indicator. Methyl orange is then added when a further 2.5 ml of 0.2 M H_2SO_4 was required. The amount of Na_2CO_3 and $NaHCO_3$ in 1 litre of the solution is
(A) 5.3 g and 4.2 g (B) 3.3 g and 6.2 g (C) 4.2 g and 5.3 g (D)6.2 g and 3.3 g

6. A hydrogen electrode placed in a buffer solution of CH_3COONa and CH_3COOH in the ratio x : y and y : x has electrode potential values, E_1 and E_2 volts respectively at 25^0C. The pK_a value of acetic acid is
(A) $(E_2 - E_1)/0.118$
(B) $-(E_1 + E_2)/0.118$
(C) $(E_1 + E_2)/0.118$
(D) $(E_1 - E_2) / 0.118$

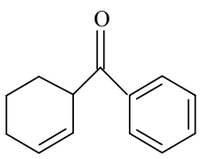
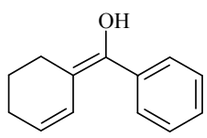
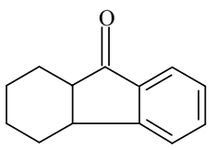
7. For a gas reaction at T(K) the rate is given by $\frac{-dP_A}{dt} = k'P_A^2$ atm/sec. If the rate equation is expressed as $r_A = \frac{-1}{V}\frac{dN_A}{dt} = kC_A$ mol/(litre-sec), the rate constant k is given by

(A) $k = k'$ (B) $k = k'/Rt$ (C) $k = k'(RT)$ (D) $k = k'(RT)^2$

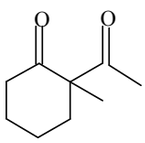
8.



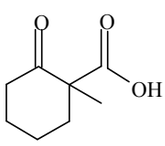
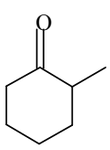
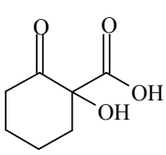
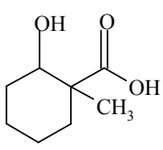
$\xrightarrow{H^+}$ (A) : (A)

(A)  (B)  (C)  (D) none of these

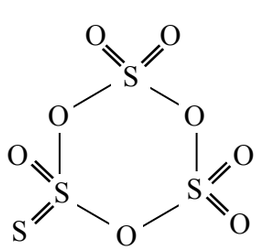
9.

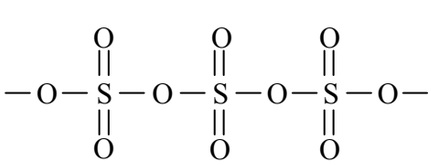


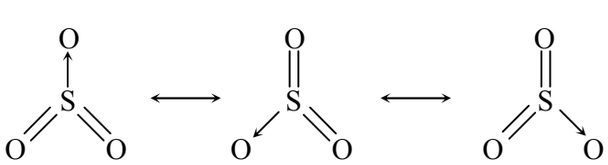
$\xrightarrow[(ii)\ H^+]{(i)\ KBrO_3.}$ (A) . Compound (A) is
(iii) Δ

(A)  (B)  (C)  (D) 

10. In solid state SO_3 may have structure (s)

(A) 

(B) 

(C) 

(D) All above

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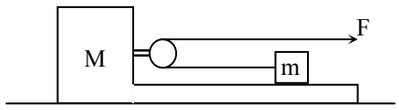
Physics

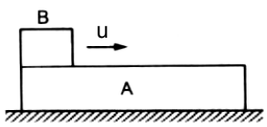
1. All contact surfaces shown are smooth and distance between the block and the pulley is ℓ at t = 0. Time taken by the block to reach the pulley will be:



(A) $\sqrt{\dfrac{Mm\ell}{(2m+M)F}}$ (B) $\sqrt{\dfrac{2Mm\ell}{(2m+M)F}}$

(C) $\sqrt{\dfrac{2Mm\ell}{(m+2M)F}}$ (D) $\sqrt{\dfrac{mM\ell}{(m+2M)F}}$

2. A long block 'A' is at rest on a smooth horizontal surface. A small block 'B', whose mass is half of 'A', is placed on 'A' at one end and projected along 'A' with some velocity 'u'. The coefficient of friction between the blocks is 'μ'.



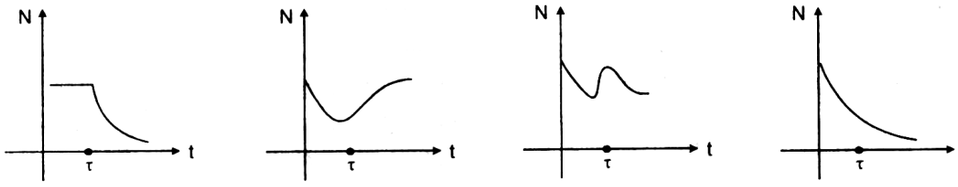
(A) The blocks will reach a final common velocity $\dfrac{u}{3}$.

(B) The work done against friction is two–thirds of the initial kinetic energy of 'B'.

(C) Before the blocks reach a common velocity, the acceleration of 'A' relative to 'B' is $\dfrac{2}{3}\mu g$.

(D) Before the blocks reach a common velocity the acceleration of 'A' relative to 'B' is $\dfrac{3}{2}\mu g$.

3. A radioactive sample consists of two distinct species having equal number of atoms initially. The mean life of one species is 'τ' and that of the other is 5τ. The decay product in both cases are stable. A plot is made of the total number of radioactive nuclei as a function of time. Which of the following figures best represents the form of this plot :



(A) (B) (C) (D)

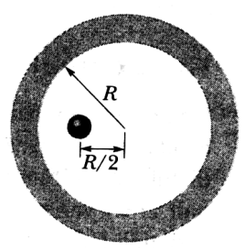
4. A small metal plate (work function W_0) is kept at a distance 'd' from a singly ionised fixed ion. A monochromatic light beam is incident on the metal plate and photoelectrons are emitted. The maximum wavelength of light so that the photo electrons may go round the ions along a circle is

(A) $\dfrac{8\pi\varepsilon_0 W_0 d + e^2}{8\pi h c \varepsilon_0 d}$ (B) $\dfrac{8\pi h c \varepsilon_0 d}{8\pi\varepsilon_0 W_0 d + e^2}$

(C) $\dfrac{2\left(\dfrac{hc}{W_0} - e^2\right)}{n}$ (D) $\dfrac{8\pi\varepsilon_0 d}{hce W_0}$

Paragraph Type Questions

Figure shows a cross section of a spherical metal shell of inner radius R. A point charge of –q is located at a distance R/2 from the centre of the shell. The shell is electrically neutral.

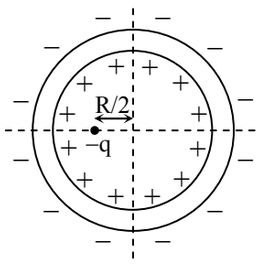


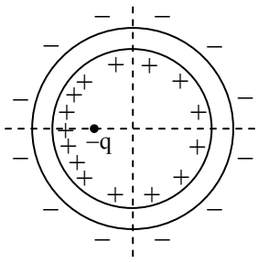
Using the above paragraph solve Q. 5 to 8.

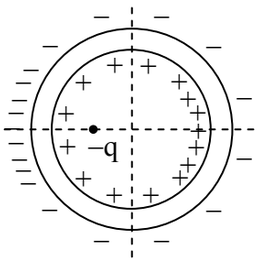
5. Charges induced on its inner and outer surface will be

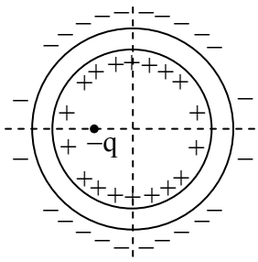
(A) –q/2, –q/2 (B) +q, –q/2 (C) +q, –q (D) +q/2, +q/2

6. Distribution of charges on inner and outer surface will be

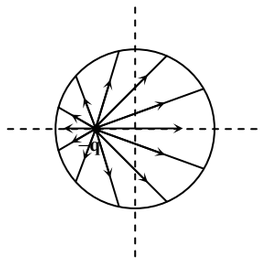
(A) 

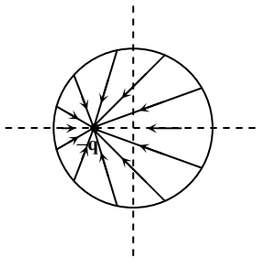
(B) 

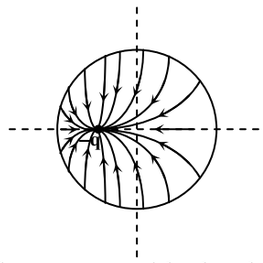
(C) 

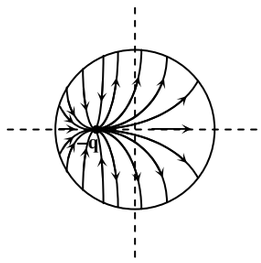
(D) 

7. Field pattern inside the shell will be

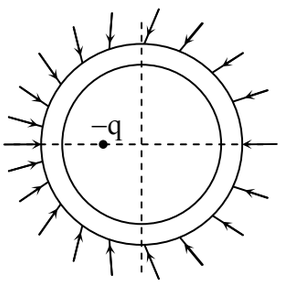
(A) 

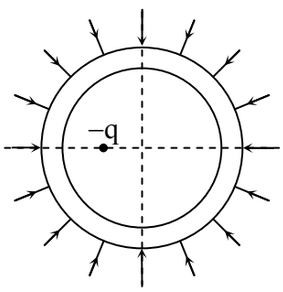
(B) 

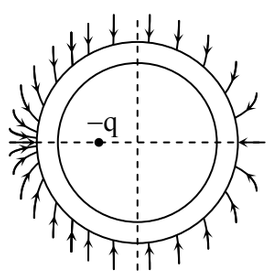
(C) 

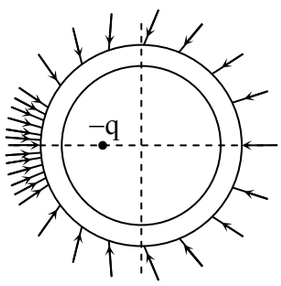
(D) 

8. Field pattern outside the shell will be

(A) 

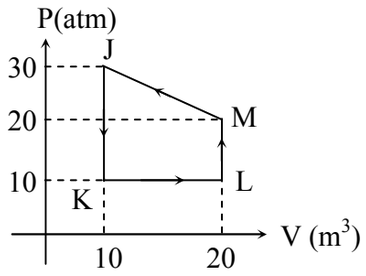
(B) 

(C) 

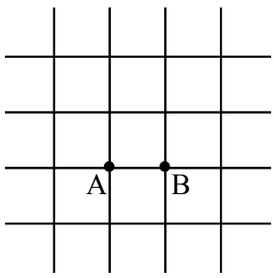
(D) 

9. Heat given to process is positive, match the following option of column I with the corresponding option of column II.

Column I	**Column II**
(A) JK	(P) $\Delta W > 0$
(B) KL	(Q) $\Delta Q < 0$
(C) LM	(R) $\Delta W < 0$
(D) MJ	(S) $\Delta Q > 0$



10. There is an infinite grid with square cells as shown in figure. The resistance of each wire between neighbouring junctions is R_0. Find the resistance of the whole grid between points A and B. (Assume $R_0 = 100\ \Omega$)



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Mathematics

1. If the imaginary part of $(2z + 1) / (iz + 1)$ is -2, then the locus of the point representing z in the complex plane is

(A) A circle (B) A straight line (C) A parabola (D) None of these

2. If $k \le \sin^{-1} x + \cos^{-1} x + \tan^{-1} x \le K$, then

(A) $k = \frac{\pi}{4}$, $K = \frac{3\pi}{4}$ (B) $k = 0$, $K = \pi$ (C) $k = \pi/2$, $K = \pi$ (D) none of these

3. If $f\left(\frac{1}{x}\right) + x^2 f(x) = 0$, $x > 0$ and $I = \int_{1/x}^{x} f(z)\, dz$, $\frac{1}{2} \le x \le 2$, then I is

(A) $f(2) - f(1/2)$ (B) $f(1/2) - f(2)$ (C) 0 (D) none of these

4. If a triangle ABC satisfies $(a + b)^2 = c^2 + ab$ and $\sin A + \sin B + \sin C = 1 + (\sqrt{3}/2)$, then the angles of the triangle are:

(A) 120°, 30°, 30° (B) 108°, 36°, 36° (C) 60°, 60°, 60° (D) 30°, 75°, 75°

5. If $f(x) = \begin{vmatrix} 1 & \cos x & 1-\cos x \\ 1+\sin x & \cos x & 1+\sin x-\cos x \\ \sin x & \sin x & 1 \end{vmatrix}$, then $\int_0^{\pi/2} f(x)\, dx$ is equal to

(A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) 0 (D) $-\frac{1}{2}$

6. Suppose p, q, $r \ne 0$ and system of equation $(p + a)x + by + cz = 0$
$ax + (q + b)y + cz = 0$
$ax + by + (r + c)z = 0$

has a non-trivial solution, then value of $\frac{a}{p} + \frac{b}{q} + \frac{c}{r}$ is

(A) -1 (B) 0 (C) 1 (D) 2

Using the following data solve Q. 7 and 9.

Most of the formulae related to circle, parabola, ellipse and hyperbola are expressed in terms of three usual notations,

i.e., $S = x^2 + y^2 + 2gx + 2fy + c$

$S_1 = x_1^2 + y_1^2 + 2gx_1 + 2fy_1 + c$

and $T = xx_1 + yy_1 + g(x + x_1) + f(y + y_1) + c$, in a circle $x^2 + y^2 + 2gx + 2fy + c = 0$.

The value of S_1 is obtained by substituting the coordinates of the point $P(x_1, y_1)$ in the given equation of the circle and the equation $T = 0$ is obtained by replacing $x^2 \to xx_1$, $y^2 \to yy_1$, $2x \to x + x_1$ and $2y \to y + y_1$.

Equations which can be expressed in terms of S, S_1 and T are :

i) Equation of tangent at $P(x_1, y_1) \equiv T = 0$
ii) Equation of chord of contact of tangents from $P(x_1, y_1) \equiv T = 0$
iii) Equation of chord with midpoint as $P(x_1, y_1) \equiv T = S_1$
iv) Equation of pair of tangents from $P(x_1, y_1) \equiv SS_1 = T^2$

7. The locus of the mid points of the chords of the parabola $y^2 = 4ax$ which subtend a right angle at the vertex of the parabola is :

(A) $y^2 - 4ax + 8a^2 = 0$ (B) $y^2 - 2ax - 8a^2 = 0$
(C) $y^2 - 4ax - 8a^2 = 0$ (D) $y^2 - 2ax + 8a^2 = 0$

8. If the straight line $x - 2y + 1 = 0$ intersects the circle $x^2 + y^2 = 25$ in points P and Q, then the coordinates of the point of intersection of tangents drawn at P and Q to the circle $x^2 + y^2 = 25$ are

(A) (25, 50) (B) (–25, –50) (C) (–25, 50) (D) (25, –50)

9. The solution of $\frac{x\,dy}{x^2+y^2}=\left(\frac{y}{x^2+y^2}-1\right)dx$ is

(A) $y = x \cot (c - x)$ (B) $\cos^{-1} y/x = -x + c$

(C) $y = x \tan (c - x)$ (D) $y^2/x^2 = x \tan (c - x)$

10. If $|z_1|=1, |z_2|=2, |z_3|=3$ and $|z_1+2z_2+3z_3|=6$ then $|z_2z_3+8z_3z_1+27z_1z_2|$ is equal to

(A) 6 (B) 36

(C) 216 (D) Data insufficient

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