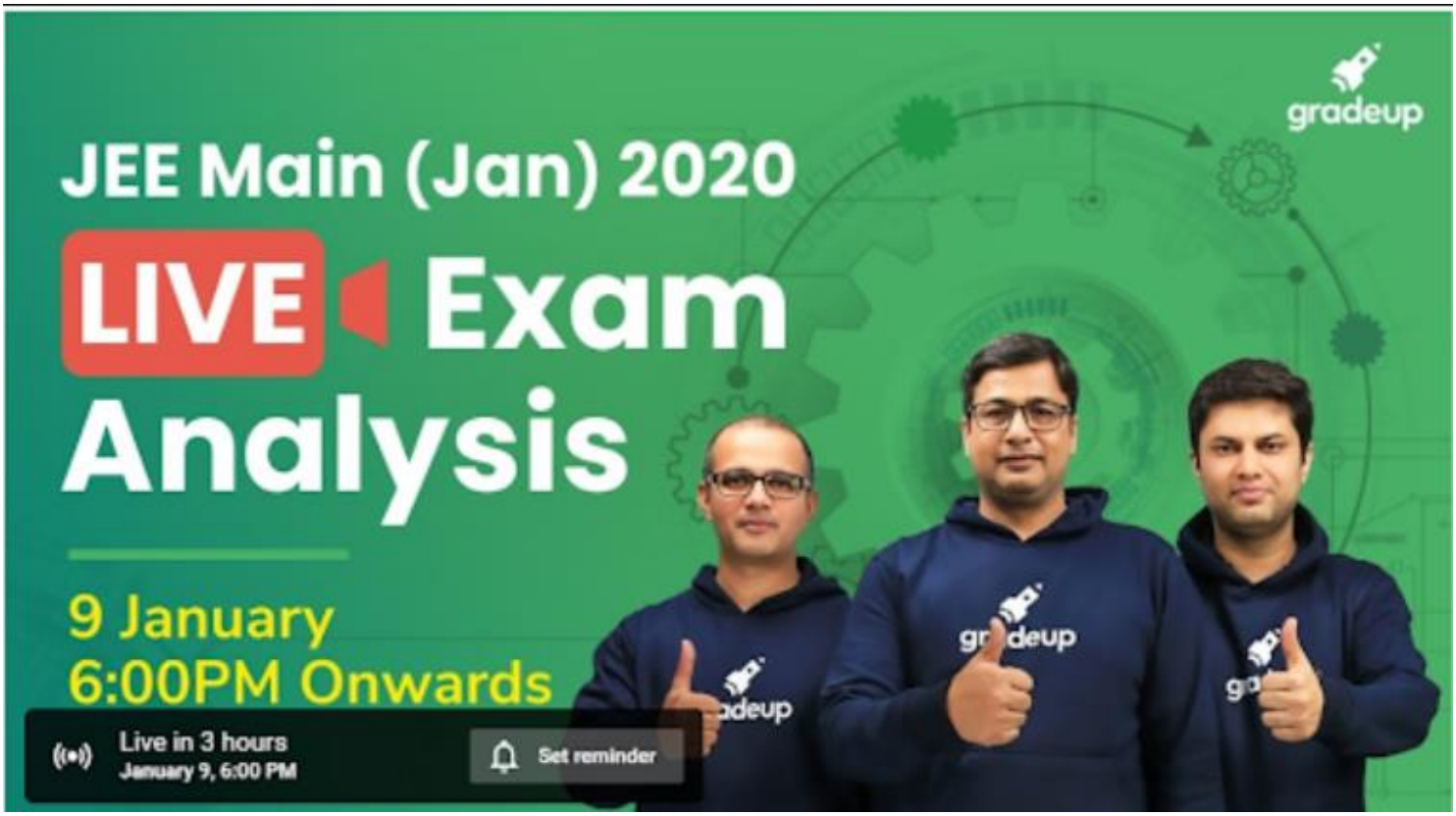
gradeup

JEE Main 2020

9 Jan | Shift 1

Memory-Based Questions



JEE-Main 2020 (9 Jan. 1st Shift)

Physics

1. Position of a particle as a function of time is given as $x^2 = at^2 + 2bt + c$, where a, b, c are constants. Acceleration of particle varies with x^{-n} then value of n is.

Ans. n = 3

Sol:

$x^2 = at^2 + 2bt + c$

$2xv = 2at + 2b$

$xv = at + b$

$v^2 + ax = a$

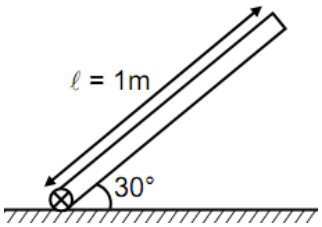
$$ax = a - \left(\frac{at+b}{x}\right)^2$$

$$a = \frac{a(at^2+2bt+c)-(at+b)^2}{x^3}$$

$$a = \frac{ac-b^2}{x^3}$$

$a \propto x^{-3}$

2. A rod of length 1 m is released from rest as shown in the figure below.



If ω of rod is √3 at the moment it hits the ground, then find n.

Ans. 15

Sol:

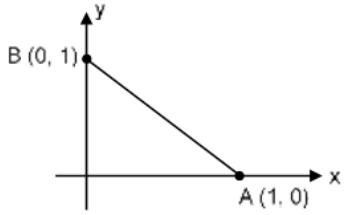
$$mg\frac{\ell}{2}\sin 30° = \frac{1}{2}\frac{m\ell^2}{3}\omega^2$$

Solving

$\omega^2 = 15$

$\omega = \sqrt{15}$

3. Particle moves from point A to point B along the line shown in figure under the action of force. $\vec{F} = -x\hat{i} + y\hat{j}$. Determine the work done on the particle by $\vec{F}$ in moving the particle from point A to point B.



A. 1J B. 4J

C. 6J D. 7J

Ans. A

Sol:

$$W = \int \vec{F}.d\vec{s}$$

$$= (-x\hat{i} + y\hat{j}).(dx\hat{i} + dy\hat{j})$$

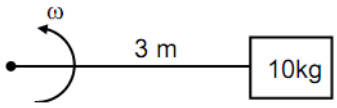
$$= \int_1^0 -xdx + \int_0^1 ydy$$

$$= -\frac{x^2}{2}\Big|_1^0 + \frac{y^2}{2}\Big|_0^1 = \left(0+\frac{1}{2}\right)+\left(\frac{1}{2}\right) = 1J$$

4. A wire of length ℓ = 3m and area of cross section 10^{-2} cm^2 and breaking stress $4.8 \times 10^{-7} N/m^2$ is attached with block of mass 10kg. Find the maximum possible value of angular velocity with which block can be moved in circle with string fixed at one end.

Ans. 4 rad/s

Sol:



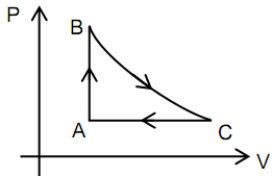
$$\frac{T}{A} = \sigma \quad \text{.....(1)}$$

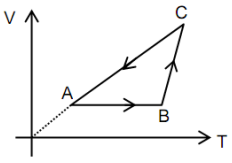
$T = m\omega^2\ell$ .....(2)

Solving

$\omega = 4$ rad/s

5. For the given P-V graph for an ideal gas, chose the correct V- T graph. Process BC is adiabatic.



A.


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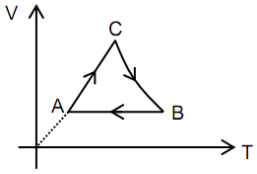

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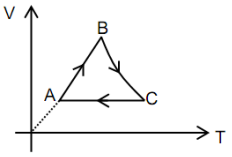
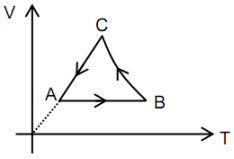


D.


Ans. D

Sol:

For process A – B ; Volume is constant ;
PV = nRT ; as P increases; T increases
For process B – C ;
PV^{γ} = Constant ;
$\Rightarrow$ $TV^{\gamma-1}$ = Constant
For process C – A ; pressure is constant
V = kT

6. If reversible voltage of 200 V is applied across an inductor, current in it reduces from 0.25A to 0A in 0.025ms. Find inductance of inductor (in mH).

Ans. 20

Sol:

$$200 = \frac{L(0.25)}{0.025}\times 10^{3}$$

$$\therefore \quad L = 200 \times 10^{-4}\ H$$

$$= 20\ mH$$

7. Given $\vec{p} = -\hat{i} - 3\hat{j} + 2\hat{k}$ and $\vec{r} = \hat{i} + 3\hat{j} + 5\hat{k}$. Find vector parallel to electric field at position $\vec{r}$ $\left[\text{Note that } \vec{p}.\vec{r} = 0\right]$

A. $\hat{i} + 3\hat{j} - 2\hat{k}$ B. $2\hat{i} + 5\hat{j} - 2\hat{k}$

C. $-3\hat{i} + \hat{j} - 2\hat{k}$ D. $\hat{i} + 2\hat{j} + 2\hat{k}$

Ans. A

Sol:

Since $\vec{p}.\vec{r} = 0$

$\vec{E}$ must be antiparallel to $\vec{p}$

So, $\vec{E} = -\lambda(\vec{p})$

where λ is a arbitrary positive constant

Now $\vec{A} = a\hat{i} + b\hat{j} + c\hat{k}$

$\vec{A} \,||\, \vec{E}$

$$\frac{a}{\lambda} = \frac{b}{3\lambda} = \frac{c}{-2\lambda} = k$$

So $\vec{A} = \lambda k(\hat{i} + 3\hat{j} - 2\hat{k})$

8. A particle of mass m is revolving around a planet in a circular orbit of radius R. At the instant the particle has velocity $\vec{V}$, another particle of mass $\frac{m}{2}$ moving at velocity $\frac{\vec{V}}{2}$ collides perfectly in-elastically with the first particle. The new path of the combined body will take is

A. Circular B. Elliptical

C. Straight line

D. Fall directly below on the ground

Ans. B

Sol:

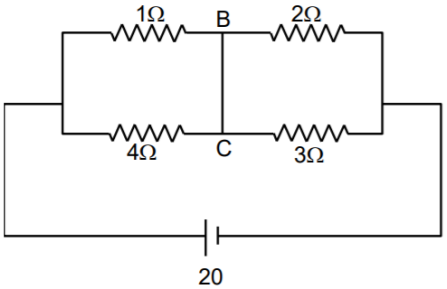
Conserving momentum:

$$\frac{m}{2}\frac{v}{2} + mv = \left(m + \frac{m}{2}\right)v_f$$

$$v_f = \frac{5mV}{4\times\frac{3m}{2}} = \frac{5V}{6}$$

$v_f < v_{orb}$ (= v) thus the combined mass will go on to an elliptical path.

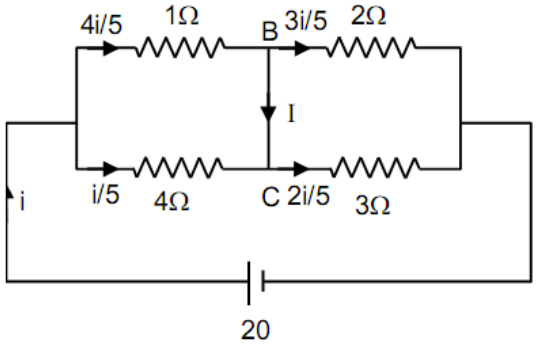
9. Find current in the wire BC.



A. 1.6A B. 2A

C. 2.4A D. 3A

Ans. B



$R_{eff} = \frac{4}{5} + \frac{6}{5} = 2\Omega$

$i = \frac{20}{2}$

$= 10A$

$I = \frac{4i}{5} - \frac{3i}{5} = +\frac{i}{5} = 2A$

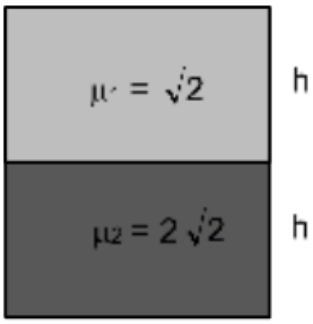
10. Two immiscible liquids of refractive index $\sqrt{2}$ and 2 $\sqrt{2}$ are filled with equal height h in a vessel. Then apparent depth of bottom surface of the container given that outside medium is air :

A. $\frac{3\sqrt{2}h}{4}$ B. $\frac{3h}{4}$

C. $\frac{3h}{2}$ D. $\frac{3h}{4\sqrt{2}}$

Ans. A

Sol:



$d = \frac{h}{\sqrt{2}} + \frac{h}{2\sqrt{2}}$

$\Rightarrow d = \frac{h}{\sqrt{2}} \times \frac{3}{2} = \frac{3\sqrt{2}h}{4}$

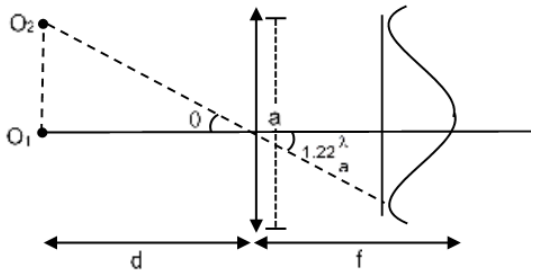
11. A telescope of aperture diameter 5m is used to observe the moon from the earth. Distance between the moon and earth is 4×10^5 km. Determine the minimum distance between two points on the moon's surface which can be resolved using this telescope. (Wave length of light is 5893 Å.

A. 60 m B. 20 m

C. 600 m D. 200 m

Ans. A

Sol:



$\theta = 1.22\frac{\lambda}{a}$

distance $= O_1O_2 = d\theta$

$= 1.22\frac{\lambda}{a}d$

distance $= O_1O_2 = \frac{1.22 \times 5893 \times 10^{-10} \times 4 \times 10^8}{5} \approx 57.5$ m

$\therefore$ answer from options = 60m

(minimum distance)

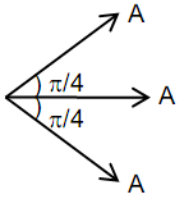
12. Three waves of same intensity (I_0) having initial phases $0, \frac{\pi}{4}, -\frac{\pi}{4}$ rad respectively interfere at a point. Find the resultant Intensity

A. I_0 B. 0

C. 5.8 I_0 D. 0.2 I_0

Ans. C

Sol:

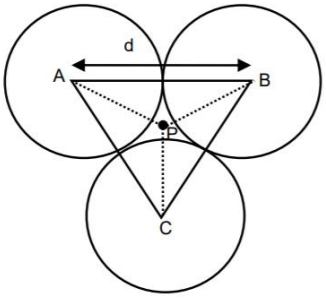


$$A_{res} = \left(\sqrt{2}+1\right)A$$

$$I_{res} = \left(\sqrt{2}+1\right)^2 I_0$$

$$= \left(3+2\sqrt{2}\right) I_0 = 5.8\ I_{0s}$$

13. Three identical solid spheres each having mass 'm' and diameter 'd' are touching each other as shown in figure. Calculate ratio of moment of inertia about an axis (perpendicular to plane of paper) passing through point P and B as shown in figure. Given P is centroid of triangle ABC.



A. 13 / 23 B. 11/19

C. 7/9 D. 13/11

Ans. A

Sol:

$$\text{M.I about P} = 3\left[\frac{2}{5}M\left(\frac{d}{2}\right)^2 + M\left(\frac{d}{\sqrt{3}}\right)^2\right] = \frac{13}{10}Md^2$$

$$\text{M.I about B} = 2\left[\frac{2}{5}M\left(\frac{d}{2}\right)^2 + M(d)^2\right] + \frac{2}{5}M\left(\frac{d}{2}\right)^2 = \frac{23}{10}Md^2$$

$$\text{Now ratio} = \frac{13}{23}$$

14. Consider an infinitely long current carrying cylindrical straight wire having radius 'a'. Then the ratio of magnetic field at distance $\frac{a}{3}$ and 2a from axis of wire is.

A. 3/5 B. 2/3

C. 1/2 D. 4/3

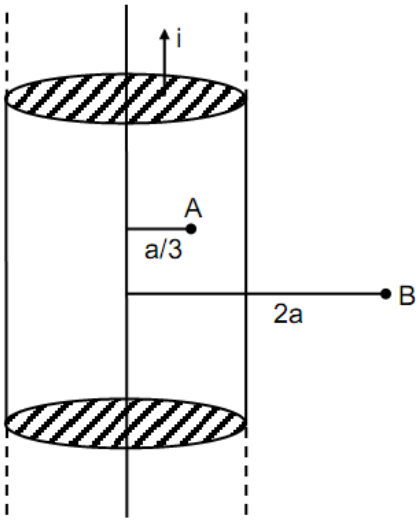
Ans. B

Sol:

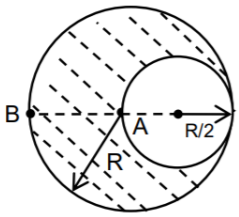
$$B_A = \frac{\mu_0 ir}{2\pi a^2} = \frac{\mu_0 i\frac{a}{3}}{2\pi a^2} = \frac{\mu_0 i}{\pi a^2}\frac{a}{6} = \frac{\mu_0 i}{6\pi a}$$

$$B_B = \frac{\mu_0 i}{2\pi(2a)}$$

$$\frac{B_A}{B_B} = \frac{4}{6} = \frac{2}{3}$$



15. A solid sphere having radius R and Uniform charge density ρ has a cavity of radius R/2 as shown in figure. Find the ratio of magnitude of electric field at point A and B i.e. $\left|\frac{E_A}{E_B}\right|$.



A. 18/19 B. 11/17

C. 9/17 D. 9/19

Ans. C

Sol:

For a solid sphere

$$E = \frac{\rho r}{3\varepsilon_0}$$

$$E_A = \frac{-\rho R}{2(3\varepsilon_0)}$$

$$|E_A| = \frac{\rho R}{6\varepsilon_0}$$

Electric field at point B = $E_B = E_{1A} + E_{2A}$

E_{1A} = Electric Field Due to solid sphere

of radius R = $\frac{\rho R}{3\varepsilon_0}$

$= -\frac{KQ' \times 4}{9R^2} = -\frac{\rho R}{54\varepsilon_0}$

$E_B = E_{1A} + E_{2A} = \frac{\rho R}{3\varepsilon_0} - \frac{\rho R}{54\varepsilon_0} = \frac{17\rho R}{54\varepsilon_0}$

$\frac{|E_A|}{|E_B|} = \frac{9}{17}$

16. Two electromagnetic waves are moving in free space whose electric field vectors are given by $\vec{E}_1 = E_0\hat{j}\cos(kx - \omega t)$ & $\vec{E}_2 = E_0\hat{k}\cos(ky - \omega t)$. A charge q is moving with velocity $\vec{v} = 0.8\,c\,\hat{j}$. Find the net Lorentz force on this charge at t = 0 and when it is at origin.

A. $qE_0(0.4\hat{i} + 0.2\hat{j} + 0.2\hat{k})$

B. $qE_0(0.8\hat{i} + \hat{j} + 0.2\hat{k})$

C. $qE_0(0.6\hat{i} + \hat{j} + 0.2\hat{k})$

D. $qE_0(0.8\hat{i} + \hat{j} + \hat{k})$

Ans. B

17. Two particles of same mass 'm' moving with velocities $\vec{v}_1 = v\hat{i}$ and $\vec{v}_2 = \frac{v}{2}\hat{i} + \frac{v}{2}\hat{j}$ collide in-elastically. Find the loss in kinetic energy.

A. $\frac{mv^2}{8}$ B. $\frac{5mv^2}{8}$

C. $\frac{mv^2}{4}$ D. $\frac{3mv^2}{8}$

Ans. A

Sol:

Conserving momentum

$mv\hat{i} + m\left(\frac{v}{2}\hat{i} + \frac{v}{2}\hat{j}\right) = 2m(v_1\hat{i} + v_2\hat{j})$

on solving

$v_1 = \frac{3v}{4}$ and $v_2 = \frac{v}{4}$

Change in K.E.

$\left[\frac{1}{2}mv^2 + \frac{1}{2}m\left(\frac{v}{2}\sqrt{2}\right)^2\right] - \left[\frac{1}{2}(2m)\left(\frac{9v^2}{16} + \frac{v^2}{16}\right)\right]$

$= \frac{3mv^2}{4} - \frac{5mv^2}{8} = \frac{mv^2}{8}$

18. Two ideal di-atomic gases A and B. A is rigid, B has an extra degree of freedom due to vibration. Mass of A is m and mass of B is $\frac{m}{4}$. The ratio of molar specific heat of A to B at constant volume is :

A. 7/9 B. 5/9

C. 5/11 D. 5/7

Ans. D

Sol:

Molar heat capacity of A at constant volume = $\frac{5R}{2}$

Molar heat capacity of B at constant volume = $\frac{7R}{2}$

Dividing both, $\frac{(C_v)_A}{(C_v)_B} = \frac{5}{7}$

19. The dimensional formula of $\sqrt{\frac{hc^5}{G}}$ is

A. $[ML^2T^{-3}]$ B. $[ML^2T^{-2}]$

C. $[ML^{-2}T^2]$ D. $[MLT^{-2}]$

Ans. B

Sol:

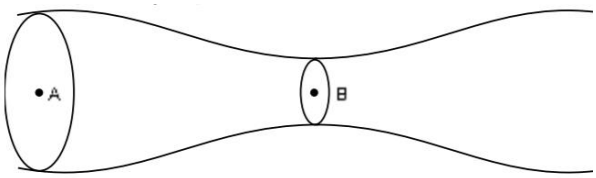
$[ML^2T^{-2}]$

$[hc] = [ML^3T^{-2}]$

$[c] = [LT^{-1}]$

$[G] = [M^{-1}L^3T^{-2}]$

20. An ideal liquid (water) flowing through a tube of non-uniform cross section area at A and B are 40 cm^2 and 20 cm^2 respectively. If pressure difference between A & B is 700 N/m^2 then volume flow rate is:



A. 2732 cm^3 /s B. 2142 cm^3 /s

C. 1832 cm^3 /s D. 3218 cm^3 /s

Ans. A

Sol:

using equation of continuity

$40\ V_A = 20\ V_B$

$\Rightarrow \quad 2V_A = V_B$

Using Bernoullies equation

$$P_A + \frac{1}{2}\rho V_A^2 = P_B + \frac{1}{2}\rho V_B^2$$

$$\Rightarrow \quad P_A - P_B = \frac{1}{2}\rho(V_B^2 - V_A^2)$$

$$\Rightarrow \quad \Delta P = \frac{1}{2}1000\left(V_B^2 - \frac{V_B^2}{4}\right)$$

$$\Rightarrow \quad \Delta P = 500 \times \frac{3V_B^2}{4}$$

$$\Rightarrow \quad V_B = \sqrt{\frac{(\Delta P)\times 4}{1500}} = \sqrt{\frac{(700)\times 4}{1500}}\ m/s$$

Volume flow rate = $20 \times 100 \times V_B = 2732\ cm^3/s$

21. A screw gauge advances by 3mm in 6 rotations. There are 50 divisions on circular scale. Find least count of screw gauge ?

A. 0.002 cm B. 0.001 cm

C. 0.01 cm D. 0.02 cm

Ans. B

Sol:

$$\text{Pitch} = \frac{3}{6} = 0.5\ mm$$

$$\text{L.C.} = \frac{0.5\ mm}{50} = \frac{1}{100}\ mm = 0.01\ mm = 0.001\ cm$$

22. Kinetic energy of the particle is E and it's De–Broglie wavelength is λ. On increasing it's KE by ΔE, it's new De–Broglie wavelength becomes $\frac{\lambda}{2}$. Then ΔE is

A. 3E B. E

C. 2E D. 4E

Ans. A

Sol:

$$\lambda = \frac{h}{\sqrt{2(KE)m}} \Rightarrow \lambda \propto \frac{1}{\sqrt{KE}}$$

$$\frac{\lambda}{\lambda/2} = \sqrt{\frac{KE_f}{KE_i}}$$

$4KE_i = KE_f$

$\Rightarrow \Delta E = 4KE_i - KE_i = 3KE = 3E$

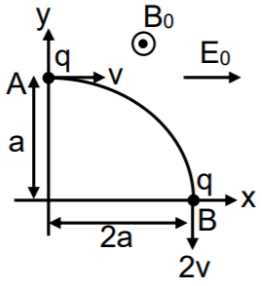
23. Photons of wavelength 6556 Å falls on a metal surface. If ejected electrons with maximum K.E. moves in magnetic field of 3×10^{-4} T in circular orbit of radius 10^{-2}m, then work function of metal surface is

A. 1.8 eV B. 0.8 eV

C. 1.1 eV D. 1.4 eV

Ans. C

24. Which of the following statements are correct for moving charge as shown in figure.



(A) Magnitude of electric field $E = \frac{3}{4}\left(\frac{mv^2}{qa}\right)$

(B) Rate of change of work done at point A is $\frac{3}{4}\frac{mv^3}{a}$

(C) Rate of change of work done by both fields at point B is zero.

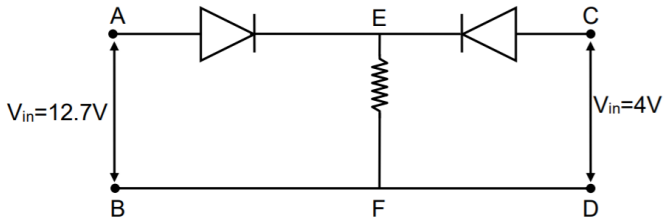
(D) Change in angular momentum is 2maV

A. A, B, C are correct B. A, B, C, D are correct

C. A, B are correct D. B, C, D are correct.

Ans. A

25. In the given circuit both diodes are ideal having zero forward resistance and built-in potential of 0.7 V. Find the potential of point E in volts.



Ans. 12

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Chemistry

1. Determine wavelength of electron in 4th Bohr's orbit?

A. 4 πa0 B. 2 πa0

C. 8 πa0 D. 6 πa0

Ans. C

2. Which of the following species have one unpaired electron each?

A. O_2, O_2^- B. O_2, O_2^+

C. O_2^+ , $O2^-$ D. O_2, O_2^{2-}

Ans. C

3. For Br2(*l*)

Enthalpy of atomisation = x kJ/mol

Bond dissociation enthalpy of bromine = y kJ/mole

Then

A. x > y

B. x < y

C. x = y

D. Relation does not exist

Ans. A

4. Which of the following oxides are acidic, Basic Amphoteric Respectively

A. MgO, P_4O_{10}, Al_2O_3

B. N_2O_3, Li_2O, Al_2O_3

C. SO_3, Al_2O_3, Na_2O

D. P_4O_{10}, Al_2O_3, MgO

Ans. B

5. Complex $Cr(H_2O)_6Cln$ shows geometrical isomerism and also reacts with $AgNO_3$ solution. Given : Spin only magnetic moment = 3.8 B.M. What is the IUPAC name of the complex.

A. Hexaaquachromium(III) chloride

B. Tetraaquadichloridochromium (III) chloride dihydrate

C. Hexaaquachromium(IV) chloride

D. Tetraaquadichloridochromium (IV) chloride dihydrate

Ans. B

6. The electronic configuration of bivalent Europium and trivalent cerium respectively is: (Atomic Number : Xe = 54, Ce = 58, Eu = 63)

A. $[Xe]4f^7$, $[Xe]4f^1$

B. $[Xe]4f^7\ 6s^2$, $[Xe]4f^1$

C. $[Xe]4f^76s^2$, $[Xe]4f^15d^16s^2$

D. [Xe]4f7 , $[Xe]4f^15d^16s^2$

Ans. A

7. Determine degree of hardness in term of ppm of $CaCO_3$ of 10^{-3} molar $MgSO_4$ (aq).

Ans. 100.00

8. Which of the following can not act as both oxidising and reducing agent ?

A. H_2SO_3 B. HNO_2

C. H_3PO_4 D. H_2O_2

Ans. C

9. $[PdFClBrI]^{2-}$ Number of Geometrical Isomers = n.

For $[Fe(CN)_6]^{n-6}$, Determine the spin only magnetic moment and CFSE (Ignore the pairing energy)

A. 1.73 B.M., $-2\Delta_0$ B. 2.84 B.M., $-1.6\Delta_0$

C. 0, $-1.6\Delta_0$ D. 5.92 B.M., $-2.4\Delta_0$

Ans. A.

10.

$A \longrightarrow B$ 700 K

$A \xrightarrow{C} B$ 500 K

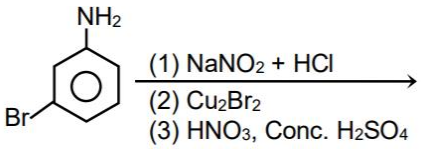
Rate of reaction in absence of catalyst at 700 K is same as in presence of catalyst at 500 K. If catalyst decreases activation energy barrier by 30 kJ/mole, determine activation energy in presence of catalyst. (Assume 'A' factor to be same in both cases)

A. 75 kJ B. 135 kJ

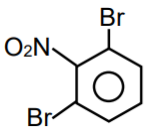
C. 105 kJ D. 125 kJ

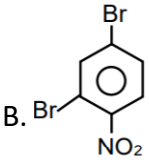
Ans. A

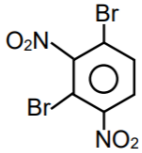
11.

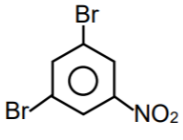


The major product for above sequence of reaction is:

A. 

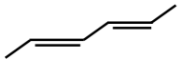
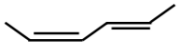
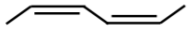
B. 

C. 

D. 

Ans. B

12. Which of the following is correct order for heat of combustion?

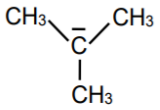
(A)  (B)  (C) 

A. C > B > A B. A > B > C

C. B > A > C D. C > A > B

Ans. A

13. Write the correct order of basicity.

(a) (b) (c)

$CH_2=CH-\bar{C}H_2$ $\bar{C}\equiv CH$

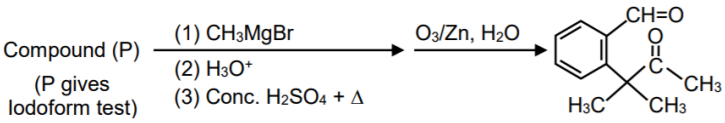
(d) (e)

A. a > b > d > e > c B. a > b > e > d > c

C. b > a > d > c > e D. c > e > d > b > a

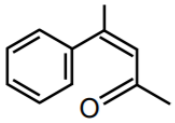
Ans. A

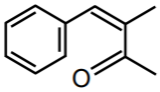
14.

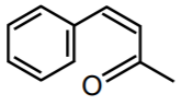


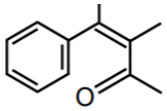
Predict the compound (P) on the basis of above sequence of the reactions?

Where compound (P) gives positive Iodoform test.

A. 

B. 

C. 

D. 

Ans. B

15. First Ionisation energy of Be is higher than that of Boron. Select the correct statements regarding this

(i) It is easier to extract electron from 2p orbital than 2s orbital

(ii) Penetration power of 2s orbital is greater than 2p orbital

(iii) Shielding of 2p electron by 2s electron

(iv) Radius of Boron atom is larger than that of Be

A. (i), (ii), (iii), (iv) B. (i), (iii), (iv)

C. (ii), (iii), (iv) D. (i), (ii), (iii)

Ans. D

16. Given a solution of HNO_3 of density 1.4 g/mL and 63% w/w. Determine molarity of HNO_3 solution.

Ans. 14.00

17. Ksp of $PbCl_2 = 1.6 \times 10^{-5}$

On mixing 300 mL, 0.134M $Pb(NO_3)_2$(aq.) + 100 mL, 0.4 M NaCl(aq.)

A. Q > Ksp B. Q < Ksp

C. Q = Ksp D. Relation does not exit

Ans. A

18. A substance 'X' having low melting point, does not conduct electricity in both solid and liquid state. 'X' can be :

A. Hg B. ZnS

C. SiC D. CCl_4

Ans. D

19. Determine the amount of NaCl to be dissolved in 600g H_2O to decrease the freezing point by 0.2°C

Given : k_f of $H_2O = 2$ k-m^{-1}

density of $H_2O(\ell) = 1$ g/ml

Ans. 01.76

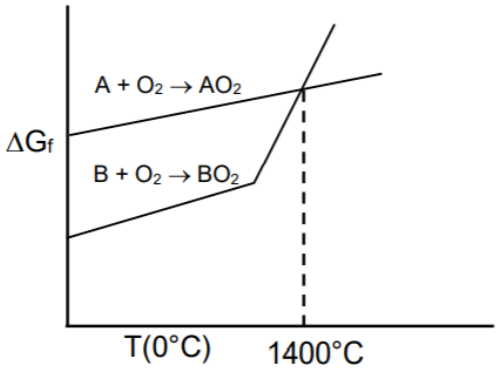
20. On passing a particular amount of electricity in $AgNO_3$ solution, 108 g of Ag is deposited. What will be the volume of O_2(g) in litre liberated at 1 bar, 273k by same quantity of electricity?

Ans. 05.68

21. Find percentage nitrogen by mass in Histamine?

Ans. 37.84

22. A can reduce BO2 under which conditions.

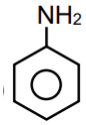


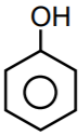
A. > 1400°C B. < 1400°C

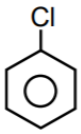
C. > 1200°C and < 1400°C D. < 1200°C

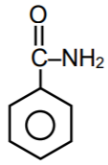
Ans. A

23. Which of the following can give highest yield in Friedel craft reaction?

A. 

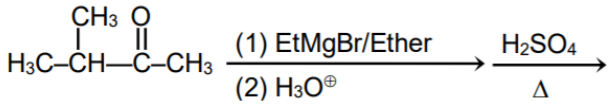
B. 

C. 

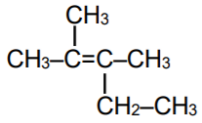
D. 

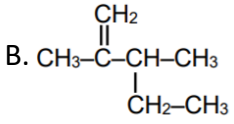
Ans. C

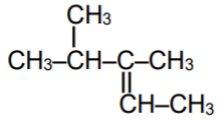
24.

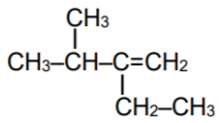


What will be the major product ?

A. 

B. 

C. 

D. 

Ans. A

25. A, B, C and D are four artificial sweetners.

(i) A & D give positive test with ninhydrin.

(ii) C form precipitate with $AgNO_3$ in the lassaigne extract of the sugar.

(iii) B & D give positive test with sodium nitroprusside.

Correct option is:

A. A – Saccharine, B – Aspartame, C – Sucralose, D – Alitame

B. A – Aspartame, B – Saccharine, C – Sucralose, D – Alitame

C. A – Saccharine, B – Aspartame, C – Alitame , D – Sucralose

D. A – Aspartame, B – Sucralose, C – Saccharine, D – Alitame

Ans. B

***

Maths

1. Find the number of solution of $\log_{\frac{1}{2}}\left(|\sin(x)|\right)=2-\log_{\frac{1}{2}}\left(|\cos(x)|\right)$, $x\in[0, 2\pi]$?

Ans. 8

2. If e_1 and e_2 are eccentricities of $\frac{x^2}{18}+\frac{y^2}{4}=1$ and $\frac{x^2}{9}-\frac{y^2}{4}=1$ respectively and if the point (e_1, e_2) lies on ellipse $15x^2 + 3y^2 = k$. Then find value of k

A. 14 B. 15

C. 16 D. 17

Ans. C

3. Find integration $\int\frac{dx}{(x-3)^{6/7}(x+4)^{8/7}}$

A. $49\left(\frac{x-3}{x+4}\right)^{1/7}+c$ B. $7\left(\frac{x-3}{x+4}\right)^{1/7}+c$

C. $49\left(\frac{x-3}{x+4}\right)^{6/7}+c$ D. $7\left(\frac{x+4}{x-3}\right)^{6/7}+c$

Ans. A

4. If $\left|\frac{z-i}{z+2i}\right|=1, |z|=\frac{5}{2}$ then value of $|z + 3i|$ is

A. $7/2$ B. $\sqrt{10}$

C. $\sqrt{5}$ D. $\sqrt{3}$

Ans. A

5. $2^{1/4}\cdot 4^{1/16}\cdot 8^{1/48}\ldots\ldots\ldots\ldots\infty =$

A. $\sqrt{2}$ B. 2

C. $2^{1/4}$ D. 1

Ans. 1

6. Value of

$$\cos^3\left(\frac{\pi}{8}\right)\cos\left(\frac{3\pi}{8}\right)+\sin^3\left(\frac{\pi}{8}\right)\sin\left(\frac{3\pi}{8}\right)$$

A. $\frac{1}{2\sqrt{2}}$ B. $\frac{1}{\sqrt{2}}$

C. $\frac{1}{2}$ D. $-\frac{1}{2}$

Ans. A

7. Find the value of $\int_0^{2\pi}\frac{x\sin^8 x}{\sin^8 x+\cos^8 x}$

A. π^2 B. $2\pi^2$

C. π D. 2π

Ans. A

8. If $f(x) = a + bx + cx^2$ where a, b, c $\in R$ then $\int_0^1 f(x)\,dx$ is

A. $\frac{1}{3}\left(f(1)+f(0)+2f\left(\frac{1}{2}\right)\right)$

B. $\frac{1}{6}\left(f(1)+f(0)+4f\left(\frac{1}{2}\right)\right)$

C. $\frac{1}{6}\left(f(1)+f(0)-4f\left(\frac{1}{2}\right)\right)$

D. $\frac{1}{6}\left(f(1)-f(0)-4f\left(\frac{1}{2}\right)\right)$

Ans. B

9. If number of 5digit numbers which can be formed without repeating any digit while tenth place of all of the numbers must be 2 is 336 k find value of k

A. 8 B. 7

C. 6 D. 5

Ans. A

10. A (3,–1), B(1,3), C(2,4) are vertices of ΔABC if D is centroid of ΔABC and P is point of intersection of lines x + 3y – 1 = 0 and 3x – y + 1 = 0 then which of the following points lies on line joining D and P

A. (–9, –7) B. (–9, –6)

C. (9,6) D. (9, -6)

Ans. B

11. If f(x) is twice differentiable and continuous function in $x \in [a,b]$ also f'(x) > 0 and f" (x) < 0 and C $\in (a,b)$ then $\frac{f(c)-f(a)}{f(b)-f(c)}$ is greater than

A. $\frac{b-c}{c-a}$ B. 1

C. $\frac{a+b}{b-c}$ D. $\frac{c-a}{b-c}$

Ans. D

Sol. Lets use LMVT for $x \in [a,c]$

$\frac{f(c)-f(a)}{c-a} = f'(\alpha)$, $\alpha \in (a,c)$

also use LMVT for $x \in [c,b]$

$\frac{f(b)-f(c)}{b-c} = f'(\beta)$, $\beta \in (c,b)$

$\because f''(x) < 0 \Rightarrow f'(x)$ is decreasing

$f'(\alpha) > f'(\beta)$

$\frac{f(c)-f(a)}{c-a} > \frac{f(b)-f(c)}{b-c}$

$\frac{f(c)-f(a)}{f(b)-f(c)} > \frac{c-a}{b-c}$ ($\because f(x)$ is increasing)

12. If Plane

$x + 4y - 2z = 1$

$x + 7y - 5z = \beta$

$x + 5y + \alpha z = 5$

intersects in a line (R × R × R) then $\alpha + \beta$ is equal to

A. 0 B. 10

C. -10 D. 2

Ans. B

Sol. $\Delta = 0 \Rightarrow \begin{vmatrix} 1 & 4 & -2 \\ 1 & 7 & -5 \\ 1 & 5 & \alpha \end{vmatrix} = 0$

$(7\alpha + 25) - (4\alpha + 10) + (-20 + 14) = 0$

$3\alpha + 9 = 0 \Rightarrow \alpha = -3$

Also तथा $D_z = 0 \Rightarrow \begin{vmatrix} 1 & 4 & 1 \\ 1 & 7 & \beta \\ 1 & 5 & 5 \end{vmatrix} = 0$

$1(35 - 5\beta) - (15) + 1\,(4\beta - 7) = 0$

$\beta = 13$

13. For observations x_i given $\sum_{i=1}^{10}(x_i - 5) = 10$ and $\sum_{i=1}^{10}(x_i - 5)^2 = 40$. If mean and variance of observations $(x_1 - 3), (x_2 - 3)\ldots\ldots(x_{10} - 3)$ is λ & μ respectively then ordered pair (λ, μ) is

A. (3, 3) B. (1, 3)

C. (3, 1) D. (1, 1)

Ans. A

Sol. Mean $(x_i - 5) = \frac{\sum(x_i - 5)}{10} = 1$

$\therefore \lambda = \{\text{mean } (x_i - 5)\} + 2 = 3$

$\mu = \text{var}(x_i - 5) = \frac{\sum(x_i-5)^2}{10} - \frac{\sum(x_i-5)}{10} = 3$

14. In a bag there are 20 cards 10 names A and another 10 names B. Cards are drawn randomly one by one with replacement then find probability that second A comes before third B.

A. $\frac{13}{16}$ B. $\frac{11}{16}$

C. $\frac{7}{16}$ D. $\frac{9}{16}$

Ans. B

15. The negation of '$\sqrt{5}$ is an integer or 5 is an irrational number' is

A. $\sqrt{5}$ is an integer and 5 is not an irrational Number

B. $\sqrt{5}$ is not an integer and 5 is an irrational Number

C. $\sqrt{5}$ is not an integer or 5 is not an irrational Number

D. $\sqrt{5}$ is not an integer and 5 is not an irrational Number

Ans. D

16. If a circle touches y-axis at (0, 4) and passes through (2, 0) then which of the following can not be the tangent to the circle

A. $3x + 4y - 6 = 0$ B. $3x + 4y - 24 = 0$

C. $4x - 3y - 17 = 0$ D. $4x + 3y - 6 = 0$

Ans. A

17. If $f'(x) = \tan^{-1}(\sec x + \tan x)$, $x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$ and $f(0) = 0$ then the value of $f(1)$ is

A. $\frac{\pi+1}{4}$ B. $\frac{\pi-1}{4}$

C. $\frac{\pi+1}{2}$ D. 0

Ans. A

18. A sphere of 10cm radius has a uniform thickness of ice around it. Ice is melting at rate $50cm^3$ /min when thickness is 5cm then rate of change of thickness

A. $\frac{1}{36\pi}$ B. $\frac{1}{18\pi}$

C. $\frac{1}{9\pi}$ D. $\frac{1}{12\pi}$

Ans. B

19. Find number of real roots of equation $e^{4x} + e^{3x} - 4e^{2x} + e^x + 1 = 0$ is

A. 1 B. 2

C. 3 D. 4

Ans. A

20. If $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 3 & 4 \\ 1 & -1 & 3 \end{bmatrix}$, B = adj(A) and C = 3A then $\frac{|adjB|}{|C|}$ is

A. 8 B. 4

C. 2 D. 16

Ans. A

21. $(1+x)\frac{dy}{dx} = \left((1+x)^2 + (y-3)\right)$, If y(2) = 0 then y(3) =?

Ans. 3

22. $$f(x) = \begin{cases} \frac{\sin(a+2)x + \sin x}{x}; & x < 0 \\ b \quad ; & x = 0 \\ \frac{(x+3x^2)^{\frac{1}{3}} - x^{\frac{1}{3}}}{x^{\frac{4}{3}}}; & x > 0 \end{cases}$$

Function is continuous at x = 0, find a + 2b.

Ans. 0

23. Find the coefficient of x^4 in $(1 + x + x^2)^{10}$

Ans. 615

24.

If $\vec{P} = (a + 1)\hat{i} + a\hat{j} + a\hat{k}$

$\vec{Q} = a\hat{i} + (a + 1)\hat{j} + a\hat{k}$

$\vec{R} = a\hat{i} + a\hat{j} + (a + 1)\hat{k}$

and $\vec{P}$, $\vec{Q}$, $\vec{R}$ are coplanar vectors and $3(\vec{P}.\vec{Q})^2 - \lambda\left|\vec{R}\times\vec{Q}\right|^2 = 0$ then value of λ is

Ans. 1

25. If points A (2, 4, 0), B (3, 1, 8), C (3, 1, –3), D (7, –3, 4) are four points then projection of line segment AB on line CD.

Ans. 8

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