PDF

Vedantu
Learn LIVE Online

Eklavya 2021

ONE BOW GURU MANTRA GOAL

Get a Chance to Learn from **India's Best Teachers** & **Crack JEE ADVANCED 2021**

Vedantu's Eklavya 2021 is a Specialized Program for JEE ADVANCED, designed and headed by Co-Founder, IIT alumnus and Master Teacher Anand Prakash. Get mentored by **Top JEE Experts**, who have produced JEE Advanced **AIR 1, 2, 4, 7**, & many more.

Anand Prakash

Co-Founder, Vedantu
IIT- Roorkee

Vedantu
Learn LIVE Online

Our Previous EKLAVYANs & Their Achievements

Student Name	Main Rank →	Advanced Rank
Chirag Jain	731	41
Prakhar Agrawal	445	177
Tanmay Gangwar	2133	227
Aditya Kukreja	1772	635
Eknoor Singh	3574	1243
Aditya Gupta	14275	1326

547 JEE Advanced Selections in 2020

JOIN NOW

Vedantu

Study Materials

- JEE Main & Advanced – Free Study Material
- NEET UG – Free Study Material
- NCERT Solutions for Class 1 to 12
- NCERT Books PDF for Class 1 to 12
- ICSE & ISC Free Study Material
- Free Study Material for Kids Learning (Grade 1 to 5)
- Olympiad Free Study Material
- Reference Books (RS Aggarwal, RD Sharma, HC Verma, Lakhmir Singh, Exemplar and More)
- Previous Year Question Paper CBSE & State Boards
- Sample Papers
- Access All Free Study Material Here

Vedantu Innovations Pvt. Ltd.
Score high with a personal teacher, Learn LIVE Online!
www.vedantu.com

JEE-Main-31-08-2021-Shift-1 (Memory Based)

PHYSICS

Question: Match the following column and select the correct option

Column I	Column II
(a) Torque	(P) $M^1L^2T^0$
(b) Tension	(Q) $M^1L^0T^{-2}$
(c) Moment of inertia	(R) $M^1L^1T^{-2}$
(d) Surface tension	(S) $M^1L^2T^{-2}$

Options:

(a) a-S, b-P, c-R, d-Q

(b) a-S, b-R, c-P, d-Q

(c) a-R, b-Q, c-S, d-P

(d) a-Q, b-P, c-R, d-S

Answer: (b)

Solution:

Torque: $[\tau]=[F][r]=MLT^{-2}L=M'L^2T^{-2}$

Tension: $[F]=M^1L^1T^{-2}$

Moment of Inertia: $[I]=[M]\left[r^2\right]=M'L^2T^0$

Surface Tension: $[T]=\dfrac{[F]}{[\ell]}=\dfrac{MLT^{-2}}{L}=M^1L^0T^{-2}$

a-S, b-R, c-P, d-Q

Question: A helicopter flying with horizontal velocity ' V ' at a height ' h ' drops a particle to a man on the ground. How far the helicopter should be from the man so that particle reaches the man.

Options:

(a) $h\sqrt{1+\dfrac{V^2}{gh}}$

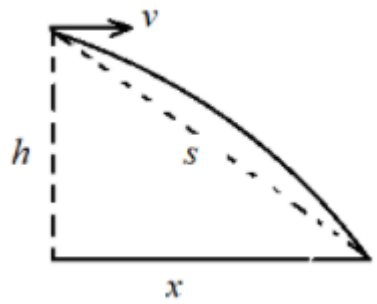
(b) $h\sqrt{1+\dfrac{V^2}{2gh}}$

(c) $\sqrt{h}\sqrt{1+\dfrac{2V^2}{gh}}$

(d) $h\sqrt{1+\dfrac{V^2}{4gh}}$

Answer: (c)

Solution:



$$h=\frac{1}{2}gT^2 \Rightarrow T=\sqrt{\frac{2h}{g}}$$

$$x=vT=v\sqrt{\frac{2h}{g}}$$

$$s=\sqrt{h^2+x^2}=\sqrt{h^2+v^2\left(\frac{2h}{g}\right)}=h\sqrt{1+\frac{2v^2}{gh}}$$

Question: If the mass of the earth is 'm_1'mass of moon is 'm_2'and their radius are 'R_1'and 'R_2' respectively. The distance between their centers is R'. There is a particle placed in middle of earth & moon. Find the escape velocity of particle.

Options:

(a) $2\sqrt{\frac{G\left(m_1+m_2\right)}{R}}$

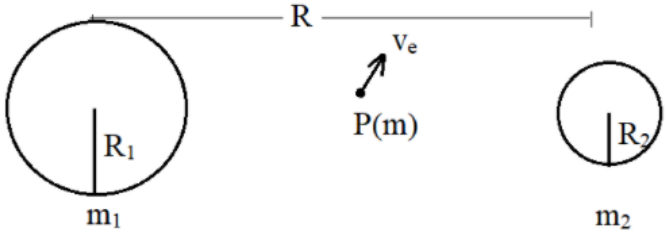
(b) $4\sqrt{\frac{G\left(m_1+m_2\right)}{R}}$

(c) $\sqrt{\frac{G\left(m_1+m_2\right)}{2R}}$

(d) $\sqrt{\frac{G\left(m_1+m_2\right)}{R}}$

Answer: (a)

Solution:



Initial energy $=\frac{1}{2}mv_c^2-\frac{Gm_1m}{R/2}-\frac{Gm_2m}{R/2}$

For escaping, initial energy ≥ 0

$$\frac{1}{2}mv_e^2 \geq \frac{2Gm}{R}(m_1+m_2)$$

$$v_e^2 \geq \frac{4G}{R}(m_1+m_2)$$

$$v_e \geq 2\sqrt{\frac{G(m_1+m_2)}{R}}$$

Question: Efficiency of a Carnot engine is $\frac{1}{4}$. Now temperature of sink is reduced to $58^\circ C$ then efficiency is doubled. Find the initial temperature of sink.

Options:

(a) $116^\circ C$

(b) $223.5^\circ C$

(c) $496.5^\circ C$

(d) $400K$

Answer: (b)

Solution:

New temp of sink = 58°C = 331 K

$$\frac{1}{2}=1-\frac{331}{T_{\text{source}}} \Rightarrow T_{\text{source}}=662K$$

$$\frac{1}{4}=1-\frac{T_{\text{sink}}}{662} \Rightarrow T_{\text{sink}}=662\times\frac{3}{4}=496.5K=223.5^\circ C$$

Question: When a sphere is taken to bottom of sea of depth d, It contracts by 0.5 %. The bulk modulus of elasticity of the material of sphere is $9.8\times10^8\ \frac{N}{m^2}$, Find the depth d.

Answer: 500 m

Solution:

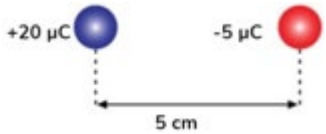
$$B=\frac{-\Delta P}{\Delta V/V}$$

$$\frac{\Delta V}{V}=-\frac{0.5}{100}$$

$$\Delta P=\rho g(\Delta h)=1000\times9.8\times d$$

$$B=\frac{-\Delta P}{\Delta V/V} \Rightarrow 9.8\times10^8=\frac{1000\times9.8\times d}{0.5\times100} \Rightarrow d=500m$$

Question: Two fixed charges are as shown. Where should the third charge be placed so that its in equilibrium?



Options:

(a) 2.5 cm to left of $-5\mu C$

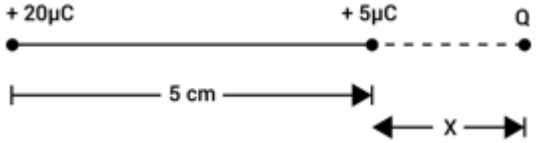
(b) 10 cm to left of $+20\mu C$

(c) 5 cm to right of $-5\mu C$

(d) 10 cm to right of $-5\mu C$

Answer: (c)

Solution:



$F_1 \rightarrow$ force on Q due to $-5\mu C$

$F_2 \rightarrow$ force on Q due to $+2\mu C$

$Q \rightarrow$ +ve (assumed

and assume all charges are point charge)

$$k \cdot \frac{20\mu C \times Q}{\left(\frac{5}{100}+x\right)^2} = k \cdot \frac{(5\mu C)Q}{x^2}$$

$$x^2 \times \frac{20}{5} = \left(\frac{5}{100}+x\right)^2$$

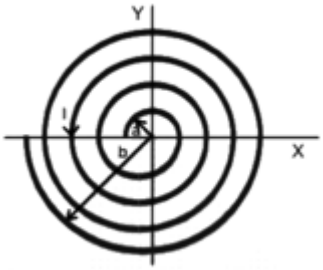
$$4x^2 = \left(\frac{5}{100}+x\right)^2$$

$$2x = \frac{5}{100}+x$$

$$x = \frac{5}{100}m$$

$x = 5$cm right of $-5\mu C$

Question: A long insulated copper wire is closely wound as a spiral of 'N' turns. The spiral has inner radius 'a' and outer radius 'b'. The spiral lies in the XY plane and a steady current 'I' flows through the wire. The Z-component of the magnetic field at the centre of the spiral is



Options:

(a) $\frac{\mu_0 NI}{2(b-a)}\ln\left(\frac{b}{a}\right)$

(b) $\frac{\mu_0 NI}{2(b-a)}\ln\left(\frac{b+a}{b-a}\right)$

(c) $\frac{\mu_0 NI}{2b}\ln\left(\frac{b}{a}\right)$

(d) $\frac{\mu_0 NI}{2b}\ln\left(\frac{b+a}{b-a}\right)$

Answer: (a)

Solution:

Let us consider an elementary ring of radius r and thickness dr in which current I is flowing.

Number of turns in this elementary ring $dN = \frac{N}{b-a}dr$

Thus magnetic field at the center O due to this ring $dB = \frac{\mu_0 IdN}{2r}$

We get $dB = \frac{\mu_0 INDr}{2(b-a)r}$

Net magnetic field at center of spiral $B = \int_a^b \frac{\mu_0 IN}{2(b-a)}\frac{dr}{r}$

$\therefore B = \frac{\mu_0 IN}{2(b-a)}\int_a^b \frac{dr}{r}$

Or $B = \frac{\mu_0 IN}{2(b-a)} \times \ln r\Big|_a^b$

Or $B = \frac{\mu_0 IN}{2(b-a)} \times \ln\frac{b}{a}$

Question: A real object is placed at focus of concave lens. Focal length of concave lens is f. Find magnification and location of image.

Options:

(a) $m = +\frac{1}{2}$, Image is at $\frac{f}{2}$ from optical center and at same side as of object

(b) $m = -\frac{1}{2}$, Image is at $\frac{f}{2}$ from optical center and at same side as of object

(c) $m = +\frac{1}{2}$, Image is at $\frac{f}{2}$ from optical center and at other side as of object

(d) $m = -\frac{1}{2}$, Image is $\frac{f}{2}$ from optical center and at other side as of object

Answer: (a)

Solution:

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

Focal length of concave lens is -ve by convention

$u=-f$ and $f=-f$

$$-\frac{1}{f}=\frac{1}{v}-\frac{1}{-f}$$

$$-\frac{2}{f}=\frac{1}{v}$$

$$v=-\frac{f}{2}$$

-ve indicate image formed at same side where object is placed

$$-\frac{1}{f}=\frac{1}{v}-\frac{1}{-f}$$

$$-\frac{2}{f}=\frac{1}{v}$$

$$m=\frac{v}{u}=\frac{-\frac{f}{2}}{-f}=\frac{1}{2}$$

Question: Choose the incorrect formula from the following-

Options:

(a) $h=\frac{2r\cos\theta}{r\rho g}$

(b) work $=r\theta$

(c) $\frac{\Delta V}{\Delta t}=\frac{\pi R^4\left(P_1-P_2\right)}{8\eta_2 L}$

(d) $\left(P+\frac{an^2}{V^2}\right)\left(V-nb\right)=nRT$

Answer: (c)

Solution:

Correct relation of Poiseuille formula is

$$\frac{\Delta V}{\Delta t}=\frac{\pi R^4\left(P_1-P_2\right)}{8\eta L}$$

Hence option c is the correct answer.

Question: A square loop has 3Ω resistor on each side. This square loop is now bent in a circular loop, find the equivalent resistance across diametrically opposite ends

Options:

(a) 3Ω

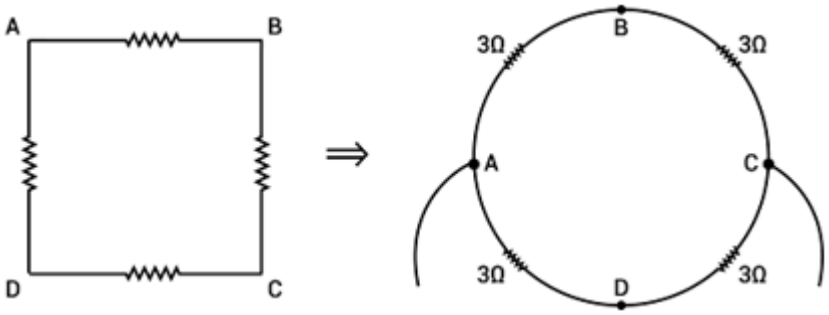
(b) 12Ω

(c) 6Ω

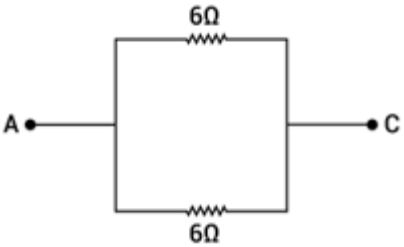
(d) 1.5Ω

Answer: (a)

Solution:

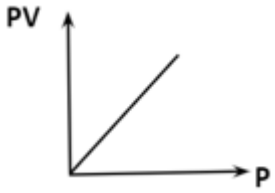


Resistor between AB and BC are in series and AD and CD are also in series

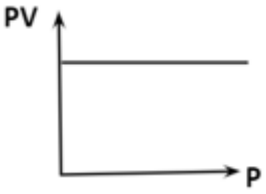


Both 6Ω resistors are in parallel.
The equivalent resistance is 3Ω

Question: For an isothermal process, select the correct option:-
Options:
(a)



(b)



(c)

(d) None of these
Answer: (b)
Solution:
For Isothermal process $\Delta T = 0$
PV =constant
B is the correct option

Question: A particle of mass 'M' is moving with a speed of 'V'. It collides with another particle of mass 'm'. After collision they are going at an angle of 'θ_1' and 'θ_2' respectively.

For what value of $\frac{M}{m}$, θ_1 and θ_2 will be equal. (Assume elastic collision)

Options:

(a) $4\sin^2\theta - 1$

(b) $4\cos^2\theta - 1$

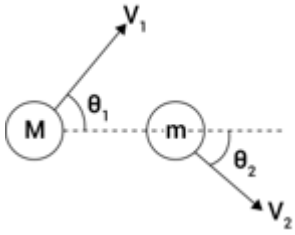
(c) $4\cos ec^2\theta - 1$

(d) $4\sec^2\theta - 1$

Answer: (b)

Solution:

Before collision



After collision

Applying conservation of momentum in x-direction.

$MV = MV_1\cos\theta_1 + mV_2\cos\theta_2$

From question $\theta_1 = \theta_2 = \theta$

$MV = MV_1\cos\theta + mV_2\cos\theta$

$MV = \left(MV_1 + mV_2\right)\cos\theta \ldots (\mathrm{i})$

Applying conservation of momentum in y-direction

$\theta_1 = \theta_2 = \theta$

$M\times 0 + m\times 0 = MV_1\sin\theta - mV_2\sin\theta$

$V_2 = \frac{M}{m}V_1 \ldots (\mathrm{ii})$

Applying conservation of energy.

$\frac{1}{2}MV^2 = \frac{1}{2}MV_1^2 + \frac{1}{2}mV_2^2$

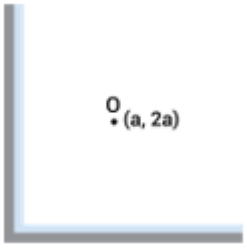
$\frac{1}{2}MV^2 = \frac{1}{2}MV_1^2 + \frac{1}{2}m\frac{M^2V_1^2}{m^2}$

$\frac{1}{2}MV^2 = \frac{1}{2}MV^2\left(1+\frac{M}{m}\right)$

$$V^2 = \frac{V^2}{4\cos^2\theta}\left(1+\frac{M}{m}\right)$$

$$\frac{M}{m} = 4\cos^2\theta - 1$$

Question: Find the shortest distance between the image? $\left(\sqrt{5} \simeq 2.3\right)$



Options:

(a) 4.6 a

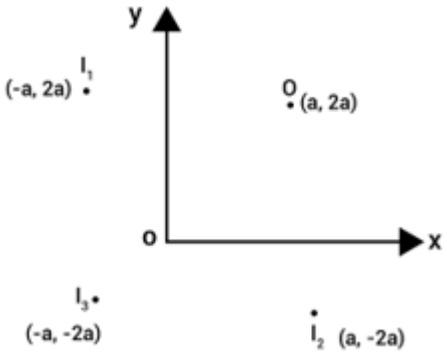
(b) 2.3 a

(c) $2\sqrt{10}a$

(d) 2 a

Answer: (d)

Solution:



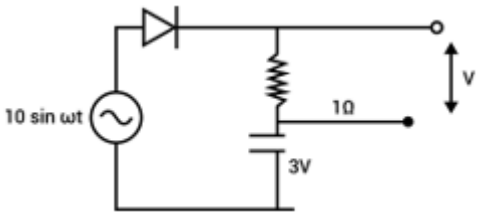
Shortest distance between the images

$$= \sqrt{\left(2a-(-2a)\right)^2 + (a-a)^2}$$

$$= \sqrt{(4a)^2 + 0^2}$$

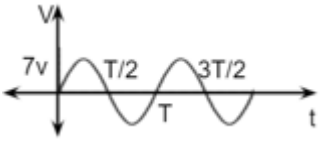
$$= 4a$$

Question: Which of the following is a correct V-t graph for given for given circuit? Use $\left(T = \frac{2\pi}{\omega}\right)$ Assume diode to be ideal.

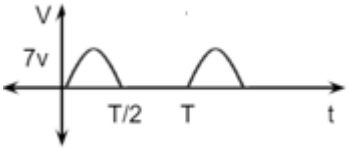


Options:

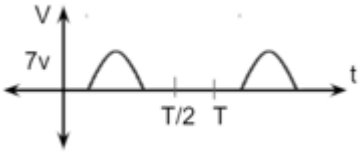
(a)



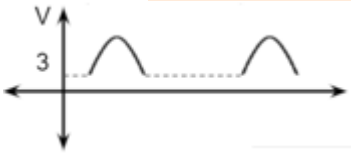
(b)



(c)



(d)



Answer: (c)

Solution:

t = 0 to T/2 diode is forward bias for

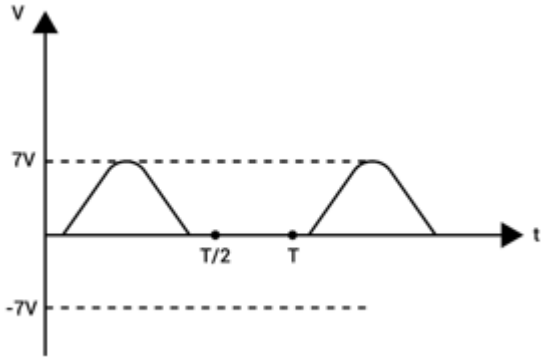
$$0 < t < \frac{\sin^{-1}(0.3)}{\omega}, V_{out} = 0$$

$$\frac{\sin^{-1}(0.3)}{\omega} < t < \frac{T}{2} - \frac{\sin^{-1}(0.3)}{\omega}, V_{out} = 10\sin\omega t - 3$$

$$V_{\max} = 7V$$

For $t = \frac{T}{2}$ to T, Diode is reverse bias.

$$V_{out} = 0$$



Question: A wire of mass per unit length $\left(9\times10^{-4}kg/m\right)$ having tension 900 N is fixed at both ends. What is the length of the wire, if one of the resonating frequency is 500 Hz and the next is 550 Hz.

Options:

(a) 10 m

(b) 20 m

(c) 5 m

(d) 50 m

Answer: (a)

Solution:

$\mu = 9\times10^{-4}kg/m$

$f_n = 500Hz$

$f_{n+1} = 550Hz$

$T = 900N$

$$f_n = \frac{n}{2L}\sqrt{\frac{T}{\mu}} \quad \ldots(\text{i})$$

$$f_{n+1} = \frac{n+1}{2L}\sqrt{\frac{T}{\mu}} = \frac{n}{2L}\sqrt{\frac{T}{\mu}} + \frac{1}{2L}\sqrt{\frac{T}{\mu}} \quad \ldots(\text{ii})$$

From equation (i) and (ii)

$$f_{n+1} = f_n + \frac{1}{2L}\sqrt{\frac{T}{\mu}}$$

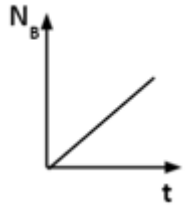
$$550 = 500 + \frac{1}{2L}\sqrt{\frac{900}{9\times10^{-4}}}$$

$$L = \frac{1}{50\times2}\times1000 = 10\text{m}$$

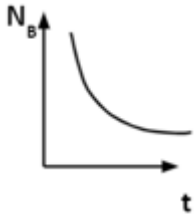
Question: A radioactive sample “A” decays to “B” and finally decays to “C”. Plot the graph between no of molecule left of B with respect to time.

Options:

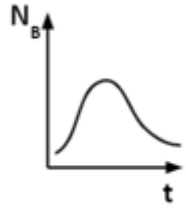
(a)



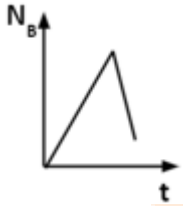
(b)



(c)



(d)



Answer: (c)

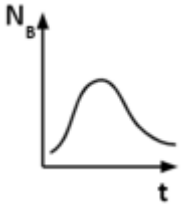
Solution:

$$A \xrightarrow{\lambda_A} B \xrightarrow{\lambda_B} C$$

$$N_B = \frac{\lambda_A}{\lambda_B - \lambda_A} N_{A_0} \left(e^{-\lambda_A t} - e^{-\lambda_B t} \right)$$

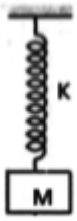
$$N_B = K \left(e^{-\lambda_A t} - e^{-\lambda_B t} \right)$$

$$K = \frac{\lambda_A}{\lambda_B - \lambda_A} N_{A_0}$$



Correct answer is C.

Question: Spring mass block is shown here. Mass m is stretched to x distance below equilibrium point and is released from here at t = 0. Find the time instant when kinetic energy and potential energy is same.



Options:

(a) $\frac{\pi}{2}\sqrt{\frac{m}{k}}$

(b) $\pi\sqrt{\frac{m}{k}}$

(c) $\frac{\pi}{4}\sqrt{\frac{m}{k}}$

(d) $\frac{\pi}{8}\sqrt{\frac{m}{k}}$

Answer: (c)

Solution:

$y = a\sin\omega t$ ---- equation of S.H.M

K.E = P.E

$$\frac{1}{2}mu^2 = \frac{1}{2}kx^2$$

$$\frac{1}{2}m\omega^2\left(a^2 - x^2\right) = \frac{1}{2}m\omega^2x^2$$

$$a^2 - x^2 = x^2$$

$$x = \frac{a}{\sqrt{2}}$$

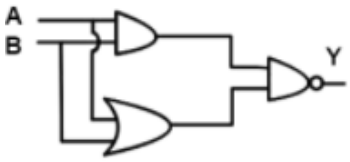
$$\frac{a}{\sqrt{2}} = a\sin\omega t$$

$$\omega t = \frac{\pi}{4}$$

$$t = \frac{\pi}{4\omega}$$

$$t = \frac{\pi}{4}\sqrt{\frac{m}{k}}$$

Question: For the inputs of A & B shown, what would be the truth table of the logic gates shown?



A	B	Y
0	0	?
0	1	?
1	0	?
1	1	?

Options:

(a)

Y
1
1
1
1

(b)

Y
0
0
0
1

(c)

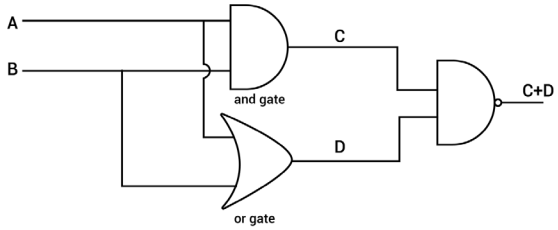
Y
0
1
1
1

(d)

Y
1
1
1
0

Answer: (d)

Solution:



A	B	C	D	$C+D$	$\overline{C+D}$
0	0	0	0	0	1
0	1	0	1	0	1
1	0	0	1	0	1
1	1	1	1	1	0

Question: A particle is moving in a horizontal circular motion of radius R with constant speed V, then the angular momentum of particle about the axis passing through centre is

Options:

(a) Constant

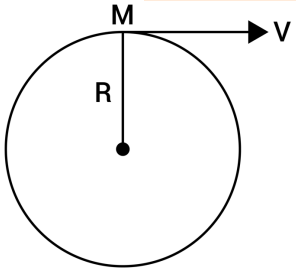
(b) Magnitude is varying

(c) Direction is varying

(d) Both magnitude and direction are varying

Answer: (a)

Solution:



Angular momentum $= m\left(\vec{r} \times \vec{v}\right)$

$\Rightarrow$ Here direction of angular momentum is perpendicular to the plane of r end v.

So it will remain constant.

$\Rightarrow$ Magnitude of velocity is not changing so magnitude of angular momentum will also remain constant.

Question: A proton and an electron have same de broglie wavelength. Kinetic energy of proton is k_p and of electron is k_e. Also momentum of proton is p_p and of electron is p_e. Which of the following options is correct?

Options:

(a) $p_p = p_e, k_p > k_e$

(b) $p_p = p_e, k_p = k_e$

(c) $p_p = p_e, k_p < k_e$

(d) $p_p < p_e, k_p = k_e$

Answer: (c)

Solution:

Kinetic energy of particle of mass m having momentum p is,

$$K \cdot E = \frac{1}{2}\frac{p^2}{m}$$

$$\Rightarrow p = \sqrt{2mK}$$

De-Broglie wavelength, $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}}$

$$p = \frac{h}{\lambda} \ldots (i)$$

and,

$$K = \frac{h^2}{2m\lambda^2} \ldots (ii)$$

If λ is constant, then from equation (i), p= constant.

i.e., $m_p v_p = m_e v_e$

$$\frac{v_p}{v_e} = \frac{m_e}{m_p} < 1 \text{ or}$$

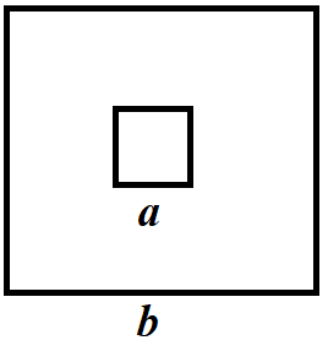
$$v_p < v_e$$

If λ is constant, then from (ii), $K \propto \frac{1}{m}$

$$\frac{K_p}{K_e} = \frac{m_e}{m_p} < 1$$

$$K_p < K_e$$

Question: If b>>a and both loops are in the same plane, find the mutual induction between them?



Options:

(a) $\frac{2\sqrt{2}\mu_0 a^2}{b}$

(b) $\frac{2\sqrt{2}\mu_0 a^2}{\pi b}$

(c) $\frac{\sqrt{2}\mu_0 a^2}{\pi b}$

(d) $\frac{2\mu_0 a^2}{\pi b}$

Answer: (b)

Solution:

$$\mu = \frac{\phi}{i} = \frac{\frac{4\mu_0 i}{4\pi\left(\frac{b}{2}\right)} \cdot \left(\frac{2}{\sqrt{2}}\right) a^2}{i}$$

$$= \frac{2\sqrt{2}\mu_0 a^2}{\pi b}$$

Question: $\frac{dp}{dv} = -ap$ at $P = P_0, V = 0$. Find maximum temperature of the body.

Options:

(a) $\frac{p_0}{naRe}$

(b) $\frac{p_0 a}{nR}$

(c) 0

(d) ∞

Answer: (a)

Solution:

$$\frac{dp}{dv} = -ap$$

$$\frac{dp}{p} = -adv$$

$$\ln\left(\frac{p}{p_0}\right) = -av$$

$$P = P_0 e^{-av}$$

$$PV = nRT$$

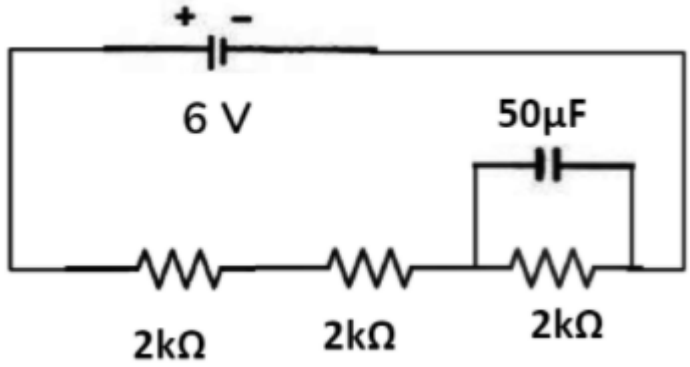
$$P_0 v e^{-aV} = nRT$$

$$\frac{dT}{dv} = 0$$

By solving we get

$$T = \frac{P_0}{naRe}$$

Question: In the circuit shown below, find the charge on the left plate of the capacitor at steady state



Options:

(a) 0.2 mC

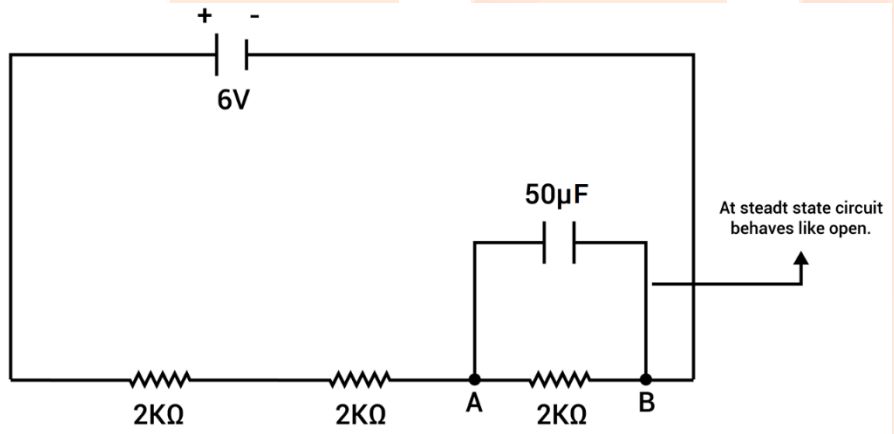
(b) 1 mC

(c) 0.1 mC

(d) 2 mC

Answer: (c)

Solution:



$6=(i)(R) \Rightarrow 6=(i)\left(6\times10^{3}\right) \Rightarrow i=10^{-3}\,A$

$V_{AB}=10^{-3}\times2\times10^{3}=2V$

$\Rightarrow Q=(C)(V)$

$Q=50\times10^{-6}\times2=100\times10^{-6} \Rightarrow 10^{-4} \quad 10^{-1}\times10^{-3}$

Q=0.1 m C

JEE-Main-31-08-2021-Shift-1 (Memory Based)

CHEMISTRY

Question: The major component of portland cement is

Options:

(a) MgO

(b) CaO

(c) SiO_2

(d) Al_2O_3

Answer: (b)

Solution: CaO present in 50-60% oxide.

Question: Novolac is a polymer of :

Options:

(a) o methyl hydroxyphenol

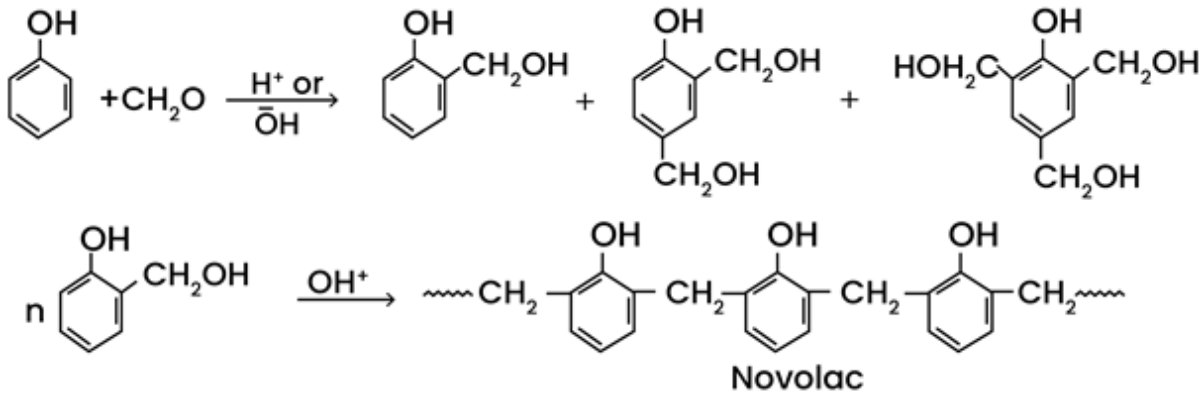
(b) Phenol + formaldehyde

(c) 1, 3 butadiene + styrene

(d) None of these

Answer: (b)

Solution:



Question: Number of hydrogen bonds in $CuSO_4.5H_2O$

Options:

(a) 4

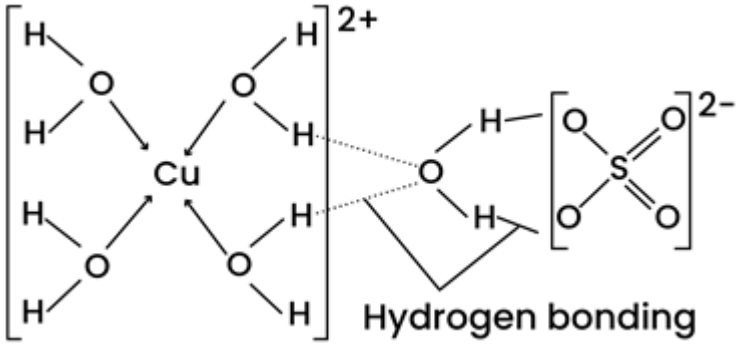
(b) 6

(c) 8

(d) 2

Answer: (a)

Solution: Number of hydrogen bonds in $CuSO_4.5H_2O$ four hydrogen bond is present



Question: Which lanthanoid shows +2 oxidation state?

Options:

(a) La

(b) Yb

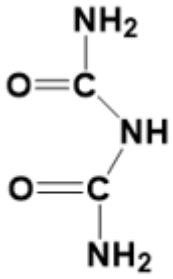
(c) Ce

(d) Nd

Answer: (b)

Solution: $Yb^{2+} = 4F^{14}$

Question: The denticity of organic ligand Biuret is:



Biuret

Options:

(a) Monodentate

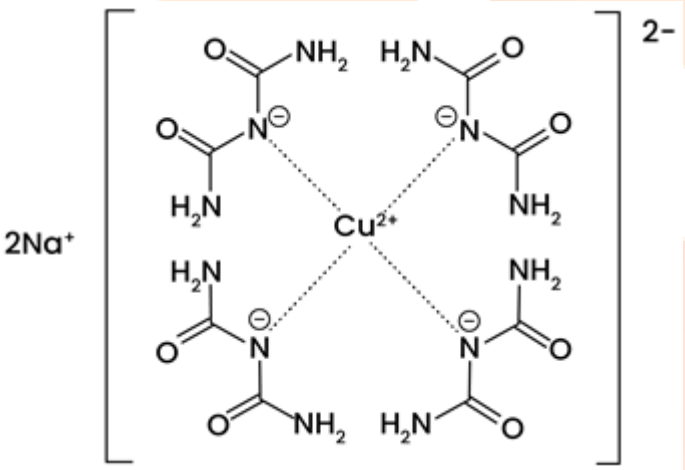
(b) Bidentate

(c) Hexadentate

(d) Tetradentate

Answer: (a)

Solution:



Question: Dichromate ion has:

Options:

(a) Both linear and symmetrical Cr O Cr bond

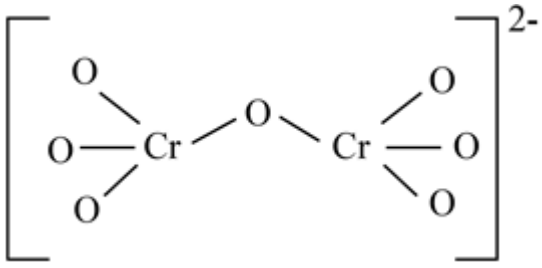
(b) Both non linear and unsymmetrical Cr O Cr bond

(c) Symmetrical and non linear Cr O Cr bond

(d) Unsymmetrical and linear Cr O Cr bond

Answer: (c)

Solution: Dichromate ion has Symmetrical and non linear Cr O Cr bond



Question: In Germanium, number of fully filled orbitals with $m_l = 0$:

Options:

(a) 7

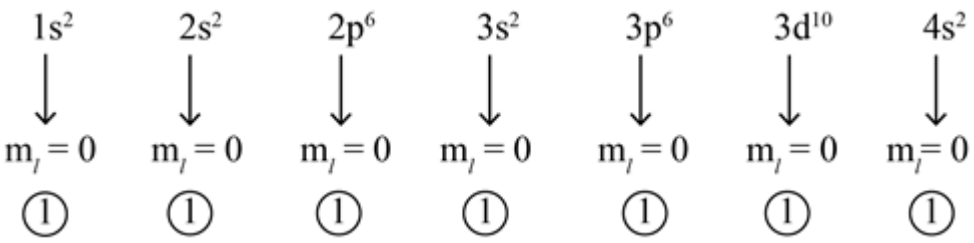
(b) 5

(c) 4

(d) 3

Answer: (a)

Solution:



Question: Assertion: Propene $\xrightarrow[H_2O]{Br_2}$ 1-Bromopropan-2-ol

Reason: Reaction follows Markovnikov's addition

Options:

(a) A and R are correct and R is the correct explanation of A

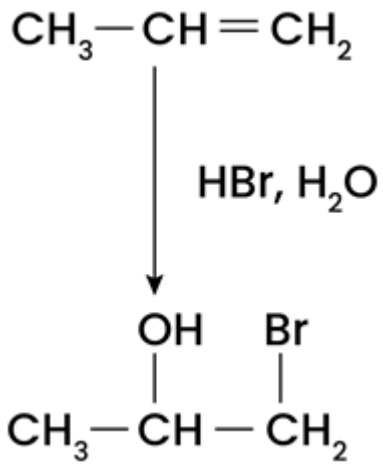
(b) A and R are correct and R is not the correct explanation of A

(c) Both A and R are incorrect

(d) A is correct, R is incorrect

Answer: (a)

Solution:



Question: BOD value of clean and polluted water:

Options:

(a) Greater than 10 ppm; less than 5 ppm

(b) Greater than 17 ppm; less than 11 ppm

(c) Lesser than 7 ppm; greater than 7 ppm

(d) Lesser than 5 ppm; greater than 17 ppm

Answer: (d)

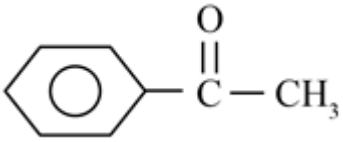
Solution: Clean water has BOD less than 5 ppm, where polluted water has BOD greater than 17 ppm

Question: $CH_3COOH \xrightarrow{SOCl_2} A \xrightarrow[AlCl_3]{Benzene} B \xrightarrow{HCN} A$

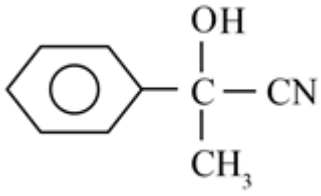
Find 'C'

Options:

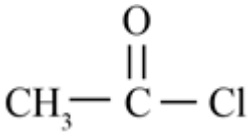
(a)



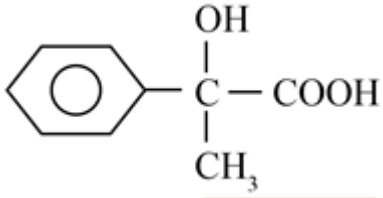
(b)



(c)

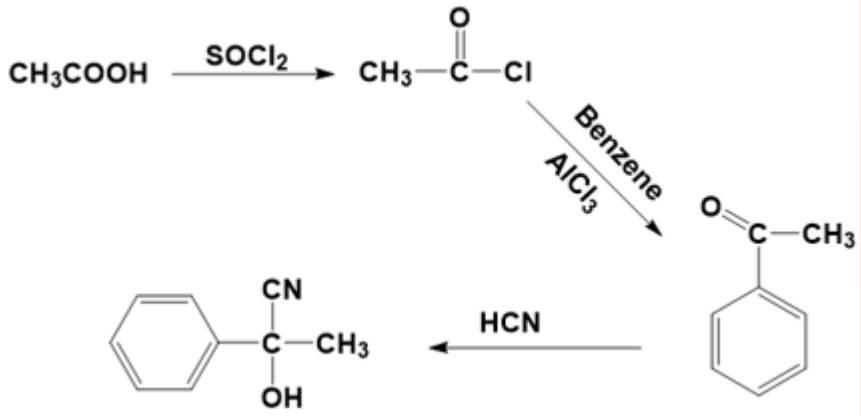


(d)



Answer: (b)

Solution:



Question: Which have β C_1-C_4 glycosidic linkage?

Options:

(a) Amylose

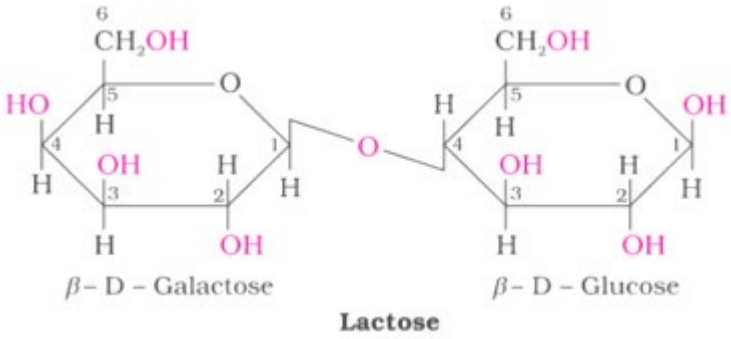
(b) Maltose

(c) Lactose

(d) Sucrose

Answer: (c)

Solution:



Lactose

Question: S1: Syngas is produced by gasification of coal.

S2: Syngas produces CO, CO_2, H_2 are in the ratio of 1 : 1 : 1

Options:

(a) Both S1 and S2 are correct

(b) Both S1 and S2 are incorrect

(c) S1 is correct, S2 is incorrect

(d) S1 is incorrect, S2 is correct

Answer: (c)

Solution: Syngas produced by coal gasification generally is a mixture of 30-60% CO, 25-30% H_2, 5-15% of CO_2, 0-5% CH_4

Question: Assertion: On moving left to right along period in periodic table metallic nature decreases and non metallic nature increases.

Reason: On moving left to right, ionization energy increases, electron gain enthalpy decreases.

Options:

(a) A and R are correct and R is the correct explanation of A

(b) A and R are correct and R is not the correct explanation of A

(c) A is incorrect, R is correct

(d) A is correct, R is incorrect

Answer: (d)

Solution: On moving left to right along period in periodic table metallic nature decreases and non metallic nature increases, On moving left to right along period in periodic table ionisation enthalpy and electron gain enthalpy both increases (in general).

Question: Assertion: Propanol and propanone can be separated by simple distillation

Reason: The boiling point difference between two liquids should be greater than 20 degree for simple distillation.

Options:

(a) A and R are correct and R is the correct explanation of A

(b) A and R are correct and R is not the correct explanation of A

(c) A is incorrect, R is correct

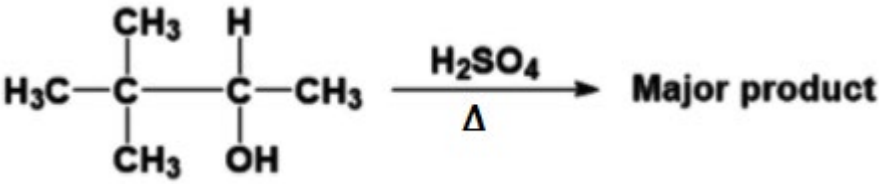
(d) A is correct, R is incorrect

Answer: (a)

Solution: Propanol boiling point = 97°C

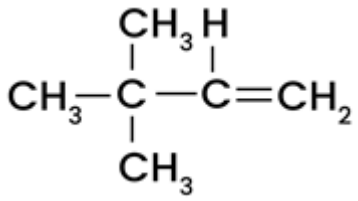
Propanone boiling point = 56°C

Question:

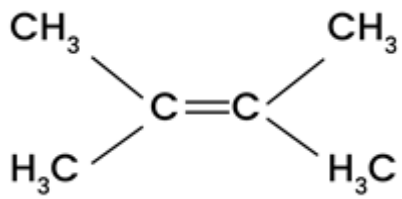


Options:

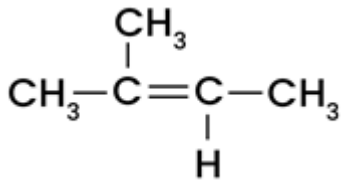
(a)



(b)



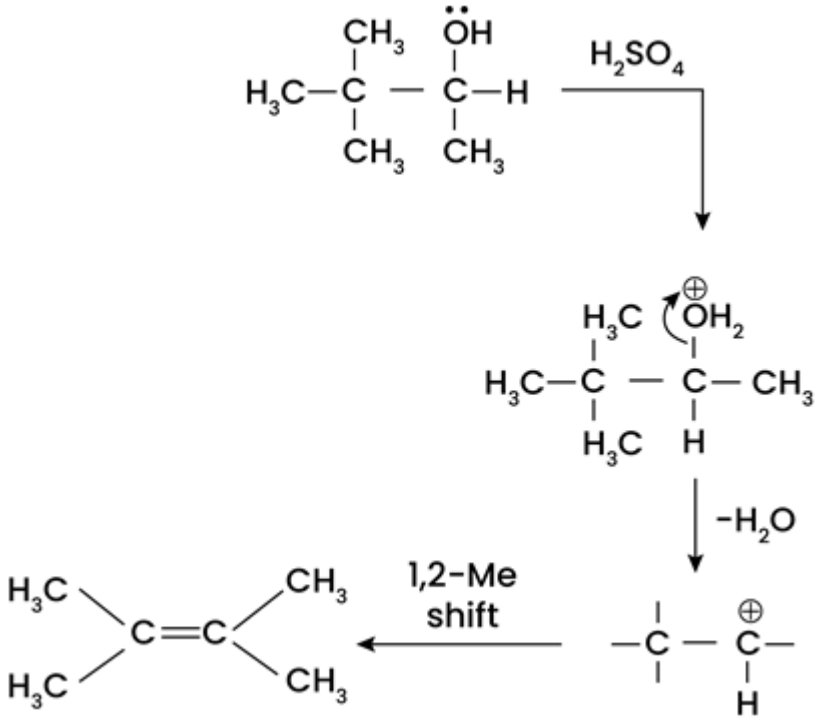
(c)



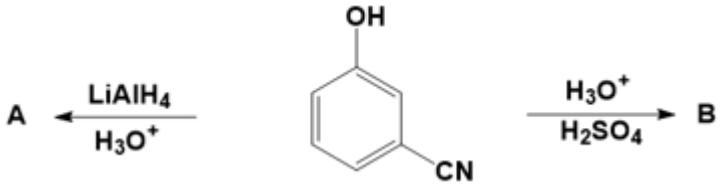
(d) None of these

Answer: (b)

Solution:



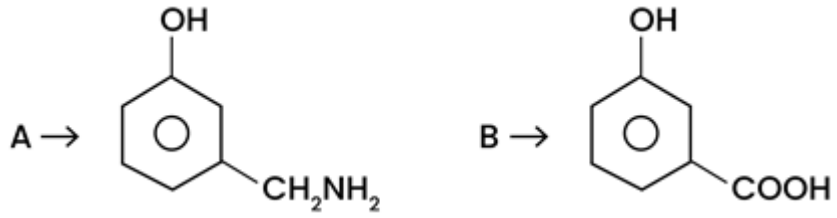
Question:



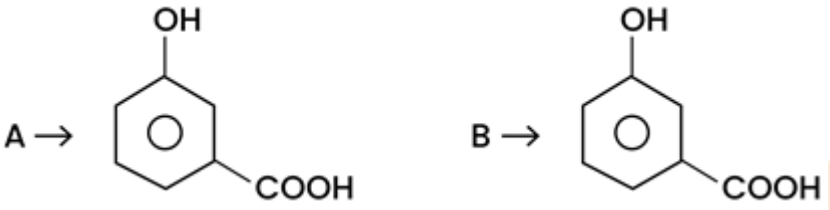
Major products A and B are:

Options:

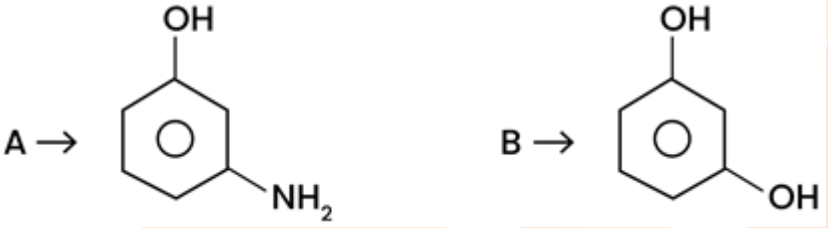
(a)



(b)



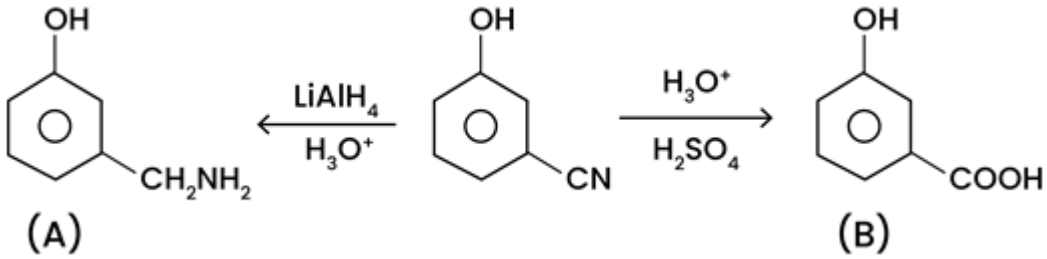
(c)



(d) None of these

Answer: (a)

Solution:



Question: Solubility of a salt A_2B_3 is x, K_{sp} of salt is $k(x)^5$ Find k.

Options:

(a) 72

(b) 69

(c) 108

(d) 52

Answer: (c)

Solution:

$A_2B_3 \rightarrow \underset{2s}{2A^{+3}} + \underset{3s}{3B^{-2}}$

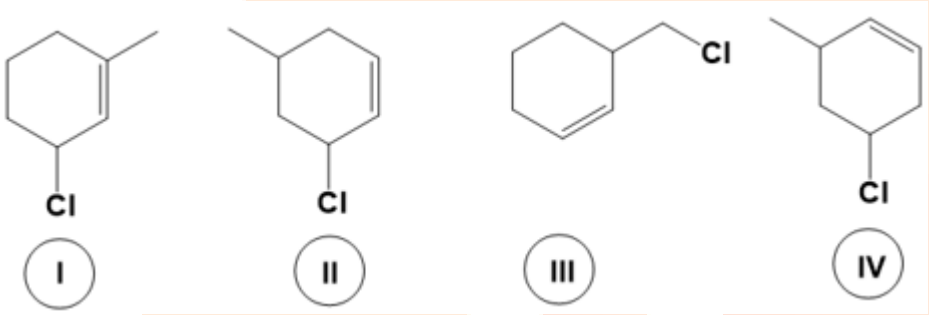
$K_{sp} = (2s)^2 (3s)^3 = 108\ s^5$

Solubility = x

$108\ x^5$

k = 108

Question: Arrange the reactivity order of the following in acetone and KI



Options:

(a) II > I > III > IV

(b) III > II > I > IV

(c) IV > III > I > II

(d) II > I > VI > III

Answer: (a)

Solution: S_N2 II > I > III > IV

Question: Find the ratio of $t_{75\%}$ and $t_{50\%}$ of first order reaction.

Options:

(a) 1

(b) 2

(c) 1.5

(d) 2.5

Answer: (b)

Solution:

$t_{75\%} = t \times t_{50\%}$

$\frac{t_{75\%}}{t_{50\%}} = \frac{2}{1}$

Question: Which of the following aqueous solution of same concentration has highest depression in freezing point?

Options:

(a) Glycine

(b) Glycerol

(c) $KHSO_4$

(d) Glucose

Answer: (c)

Solution: $\Delta T_F = i \times K_F \times m$

For $KHSO_4$

$i = 2,$ for K^+, HSO_4^-

So, $\Delta T_F \propto i$

Question: Number of halogen atom in halic acid (V) is:

Answer: 1.00

Solution: Halic (v) acid (Halic acid) – $HOClO_2$ (chloric acid), $HOBrO_2$ (bromic acid), $HOlO_2$ (iodic acid)

Question: Which of the following can convert Nitrobenzene to aniline?

Sn + HCl

Sn + NH_4OH

H_2/Pd

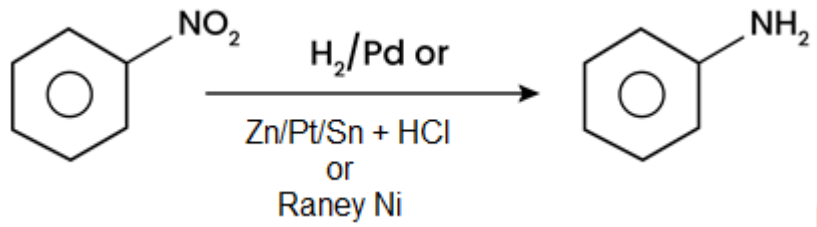
Raney Ni

Pt/HCl

Zn/HCl

Answer: 5.00

Solution:



JEE-Main-31-08-2021-Shift-1 (Memory Based)

MATHEMATICS

Question: $\frac{3}{1^2 2^2}+\frac{5}{2^2 3^2}+\frac{7}{3^2 4^2}$ ..... up to ten terms.

Options:

(a)

(b)

(c)

(d)

Answer: ()

Solution:

$$\frac{3}{1^2 2^2}+\frac{5}{2^2 3^2}+\frac{7}{3^2 4^2} .....$$

$$=\sum_{r=1}^{10}\frac{2r+1}{r^2(r+1)^2}=\sum_{r=1}^{10}\frac{(r+1)^2-r^2}{r^2(r+1)^2}$$

$$=\sum_{r=1}^{10}\left(\frac{1}{r^2}-\frac{1}{(r+1)^2}\right)$$

$$=1-\frac{1}{11^2}=\frac{120}{121}$$

Question: $\sum_{r=1}^{10}\frac{2r+1}{r^2(r+1)^2}=?$

Answer: $\frac{120}{121}$

Solution:

$$\sum_{r=1}^{10}\frac{(2r+1)}{r^2(-r+1)^2}$$

$$=\sum_{r=1}^{10}\frac{1}{r^2}-\frac{1}{(r+1)^2}$$

$$=1-\frac{1}{11^2}=\frac{120}{121}$$

Question: Vertex & focus of a parabola lie on x-axis & their distance from (0, 0) are 's' and 'r' respectively, then find length of LR

Options:

(a) $(s-r)\times 4$

(b) $|s-r|\times 4$

(c)

(d)

Answer: (b)

Solution:

LLR = 4(distance between vertex and focus)

$=4|s-r|$

Question: How many words can be made by rearranging letters of VOWEL such that all consonants are not together.

Answer: 84

Solution:

No. of ways = $5!-3!\cdot 3!$

$=120-36$

$=84$

Question: Find mean of first 10 terms: $7\times 8, 10\times 10, 13\times 12, \ldots,$

Answer: 398

Solution:

$$S=7\times 8+10\times 10+13\times 12+\ldots$$
$$=\sum_{n=1}^{10}(4+3n)(6+2n)$$
$$=\sum_{n=1}^{10}6n^2+26n+24$$
$$=(10\times 11\times 21)+13\times 10\times 11+240$$
$$=3980$$
$$\therefore \text{ Mean } =\frac{3980}{10}=398$$

Question: A pole divided into 3 : 7 by a mark on it, lower part is small, this pole subtends equal angle with a point on ground at a distance 18m from pole, find the height of pole.

Options:

(a)
(b)
(c)
(d)

Answer: $12\sqrt{10}$

Solution:

$$\tan\alpha = \frac{3h}{180} = \frac{h}{60}$$

$$\tan 2\alpha = \frac{h}{18} = \frac{\frac{h}{30}}{1-\frac{h^2}{3600}}$$

$$1-\frac{h^2}{3600} = \frac{3}{5}$$

$$\frac{h^2}{3600} = 1-\frac{3}{5} = \frac{2}{5}$$

$$h^2 = 1440$$

$$h = 12\sqrt{10}$$

Question: $\lim_{x\to 0}\frac{\sin^2\left(\pi\cos^4 x\right)}{x^4}$

Options:

(a) π^2
(b) $4\pi^2$
(c) $2\pi^2$
(d)

Answer: (b)

Solution:

$$\lim_{x\to 0}\frac{\sin^2\left(\pi\cos^4 x\right)}{x^4}$$

$$= \lim_{x\to 0}\frac{\sin^2\left(x\left(1-\sin^2 x\right)^2\right)}{x^4}$$

$$= \lim_{x\to 0}\frac{\sin^2\left(x\left(1+\sin^4 x-2\sin^2 x\right)\right)}{x^4}$$

$$= \lim_{x\to 0} \frac{\sin^2\left(x\left(\sin^4 x - 2\sin^2 x\right)\right)}{x^4}$$

$$= \lim_{x\to 0} \pi^2 \frac{\sin^2\left(\pi\left(\sin^4 x - 2\sin^2 x\right)\right)}{\left(x\left(\sin^4 x - 2\sin^2 x\right)\right)^2} \cdot \left(\frac{\sin^4 x - 2\sin^2 x}{x^2}\right)^2$$

$$= \pi^2 (0-2)^2$$

$$= 4\pi^2$$

Question: $I = \int_{\frac{-1}{2}}^{1} \left([2x] + |x|\right) dx$. Find value of $8I$.

Answer: 7.00

Solution:

$$I = \int_{\frac{1}{2}}^{1} \left([2x] - |x|\right) dx$$

$$= \int_{-\frac{1}{2}}^{0} [2x]\,dx + \int_{0}^{\frac{1}{2}} [2x]\,dx + \int_{\frac{1}{2}}^{1} [2x]\,dx + \int_{-\frac{1}{2}}^{0} x\,dx - \int_{0}^{1} x\,dx$$

$$= \int_{-\frac{1}{2}}^{0} -dx + 0 + \int_{-\frac{1}{2}}^{1} 2\,dx + \frac{x^2}{2}\Big|_{-\frac{1}{2}}^{0} - \frac{x^2}{2}\Big|_{0}^{1}$$

$$= x\Big|_{-\frac{1}{2}}^{0} + 2x\Big|_{\frac{1}{2}}^{1} + 0 - \frac{1}{8} - \left(\frac{1}{2}\right)$$

$$= 0 + \frac{1}{2} + 2 - 1 - \frac{1}{8} - \frac{1}{2}$$

$$= \frac{7}{8}$$

$$8I = 7$$

Question: $\int \frac{dx}{4\sqrt{(x-1)^3 (x+2)^5}} =$

Answer: $\frac{4}{3}\left[\frac{x-1}{x+2}\right]^{\frac{1}{4}}$

Solution:

$$I=\int\frac{dx}{\sqrt{(x-1)^3(x+2)^5}}$$

$$=\int\frac{1}{(x-1)^{\frac{3}{4}}(x+2)^{\frac{5}{4}}}dx$$

$$=\int\frac{dx}{(x-1)^2\left(\frac{x+2}{x-1}\right)^{\frac{5}{4}}}$$

Let $\frac{x+2}{x-1}=t$

$$\Rightarrow\frac{(x-1)-(x+2)}{(x-1)^2}dx=dt$$

$$\Rightarrow\frac{-3dx}{(x-1)^2}=dt$$

$$\Rightarrow I=\frac{-1}{3}\int\frac{dt}{t^{\frac{5}{4}}}$$

$$=\frac{-1}{3}\int t^{\frac{-3}{4}}dt$$

$$=\frac{-1}{3}\frac{t^{-\frac{1}{4}}}{-\frac{1}{4}}+C$$

$$=\frac{4}{3}\left[\frac{x-1}{x+2}\right]^{\frac{1}{4}}+C$$

Question: $e^{4x}+2e^{3x}-e^{x}-6=0$ find no. of solutions

Answer: 1.00

Solution:

$e^{4x}+2e^{3x}-e^{x}-6=0$

Let $e^x = t$

$t^4 + 2t^3 - t = 6$

Let $f(t) = t^4 + 2t^3 - t$

For $t > 0$,

$f(t) = 6$ has only one solution

Question: If the term independent of 'x', in the expansion of $\left(2x + \frac{1}{4x^2}\right)^{12}$ is $\frac{(3)^6}{(4)^4} \times k$ then

$k = ?$

Answer:

Solution:

$T_{r+1} = {}^{12}C_r (2x)^r \left(\frac{1}{4x^2}\right)^{12-r}$

$= {}^{12}C_r (2)^{3r-24} \cdot (x)^{3r-24}$

For term independent of x,

$3r - 24 = 0 \Rightarrow r = 8$

$\therefore T_9 = {}^{12}C_8 = 495$

$\therefore 495 = \frac{3^6}{4^4} \times k$

$\Rightarrow k = 55 \times \left(\frac{4}{3}\right)^4$

Question: $\left|2\bar{a} + 3\bar{b}\right| = \left|3\bar{a} + 2\bar{b}\right|$

$\bar{a}\bar{b} = 60°$

$\left|\frac{1}{8} \times \bar{a}\right| = 1 \quad \bar{b} = ?$

Options:

(a) $A = \{|x - y| \geq 1;\ x,\ y \in R\}$

(b) $B = \{|x| + |y| \geq 1;\ x,\ y \in R\}$

(c)

(d)

Answer: ()

Solution:

$\left|2\bar{a} + 3\bar{b}\right| = \left|3\bar{a} + 2\bar{b}\right|$

$\Rightarrow \left|2\bar{a} + 3\bar{b}\right|^2 = \left|3\bar{a} + 2\bar{b}\right|^2$

$\Rightarrow 4|\overline{a}|^2+9|\overline{b}|^2+12\overline{a}\cdot\overline{b}=9|\overline{a}|^2=4|\overline{b}|^2+12\overline{a}\cdot\overline{b}$

$\Rightarrow 5|\overline{b}|^2=5|\overline{a}|^2$

$\Rightarrow |a|=|b|=8$

Vedantu
LIVE ONLINE TUTORING

Thank You
for downloading the PDF

FREE LIVE ONLINE

MASTER CLASSES
FREE Webinars by Expert Teachers

Vedantu
FREE MASTER CLASS SERIES

- For **Grades 6-12th** targeting **JEE, CBSE,** ICSE & much more
- **Free 60 Minutes Live Interactive** classes everyday
- Learn from the **Master Teachers** - India's best

Register for **FREE**

Limited Seats!