

JEE-Main-29-07-2022-Shift-2 (Memory Based)

Physics

Question: Two plate have charge q_1, q_2 ($q_1 > q_2$) they are used to make capacitor. Find potential difference?

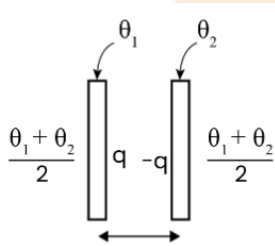
Options:

- (a) $q_1 + q_2 / C$
- (b) $(q_1 - q_2) / 2C$
- (c) $q_1 - q_2 / C$
- (d) $q_1 + q_2 / 2C$

Answer: (b)

Solution:

$$q = \frac{\theta_1 - \theta_2}{2}$$



$$v = \frac{q}{c} = \frac{\theta_1 - \theta_2}{2c}$$

Question: Linear momentum is increased by 20% then increase in kinetic energy?

Options:

- (a) 40%
- (b) 44%
- (c) 50%
- (d) 60%

Answer: (b)

Solution:

$$\frac{\Delta k}{k_i} = \frac{k_f - k_i}{k_i}$$

$$= \frac{\frac{P_f^2}{2m}}{\frac{P_i^2}{2m}} = 1$$

$$= \left(\frac{P_f}{P_i} \right)^2 - 1(1.2)^2 - 1 = 1.44$$

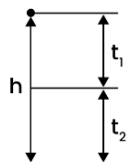
Question: What is ratio of time t_1 and t_2 if t_1 is time travelled from highest point to half of distance and t_2 the remaining half distance.

Options:

- (a) $t_1 = \sqrt{2}t_2$
- (b) $t_1 = (\sqrt{2} - 1)t_2$
- (c) $t_1 = (\sqrt{2} + 1)t_2$
- (d) $t_2 = (\sqrt{2} - 1)t_1$

Answer: (d)

Solution:



$$\frac{h}{2} = \frac{1}{2}gt_1^2 \dots(1)$$

$$h = \frac{1}{2}g(t_1 + t_2)^2 \dots(2)$$

$$2 = \frac{1}{\frac{1}{2}} = \left(\frac{t_1 + t_2}{t_1} \right)^2 \Rightarrow 1 + \frac{t_2}{t_1} = \sqrt{2} \Rightarrow \frac{t_2}{t_1} = (\sqrt{2} - 1)$$

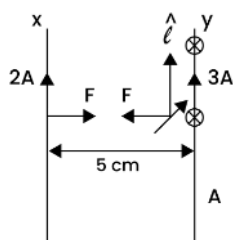
Question: A current carrying wire x of 50 cm carrying current 2A is parallel to another wire y of length 5m and 3A current, has separation of 2m find force on wire y due to x.

Options:

- (a) 1.4×10^{-5} N towards x
- (b) 1.3×10^{-5} N towards y
- (c) 1.4×10^{-5} N towards y
- (d) 1.2×10^{-5} N towards x

Answer: (d)

Solution:



$$F = \left(\frac{\mu_0 i_1 i_2}{2\pi d} \right) l$$

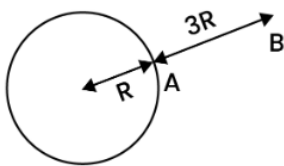
Question: Gravitation ka tha ki 1g ki body ko 3R from surface leke gye toh gain in potential energy?

Options:

- (a) 48 mJ
- (b) 24 mJ
- (c) 30 mJ
- (d) 26 mJ

Answer: (a)

Solution:



$$\begin{aligned} \Delta U &= U_B - U_A \\ &= -\frac{GMm}{4R} + \frac{GMm}{R} \\ \frac{GMm}{R} \frac{3}{4} &= \left(\frac{Gm}{R^2} \right) mR \times \frac{3}{4} \\ &= 10 \times 1 \times 6400 \times 10 \times \frac{3}{4} \end{aligned}$$

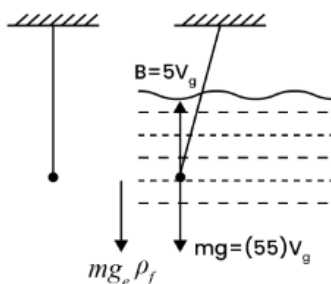
Question: Time period of pendulum 10s. Its relative density is 5 it is immersed in water. If new time period is $5\sqrt{x}$ s. Find x.

Options:

- (a) 5
- (b) 3
- (c) 2
- (d) 4

Answer: (a)

Solution:



$$T' = 2\pi \sqrt{\frac{l}{g_{eff}}}$$

$$= 2\pi \sqrt{\frac{l}{g}}$$

$$= 10 \times \frac{\sqrt{5}}{2}$$

$$= 5$$

$$10s = T = 2\pi \sqrt{\frac{l}{g}}$$

$$mg_{eff} = m\rho - B$$

$$= 4\rho v_g$$

$$g_{eff} = \frac{4}{5}g$$

Question: If α particle and proton are accelerated from same potential difference then the ratio of their linear momenta.

Options:

(a) $2\sqrt{2} : 1$

(b) $2\sqrt{2} : 3$

(c) $\sqrt{2} : 1$

(d) $\sqrt{2} : 2$

Answer: (a)

Solution:

$$P = \sqrt{2mK} = \sqrt{2qV}$$

$$\frac{P_\alpha}{P_p} = \sqrt{\frac{4m}{m} \times \frac{2e}{e}} = 2\sqrt{2} : 1$$

Question: Light ray from air enters a medium with 45° angle and it deviates 15° from its original path. Find the refractive index of the medium.

Options:

(a) 2.314

(b) 1.414

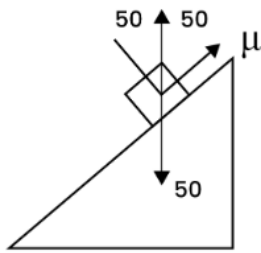
(c) 1.314

(d) 1.333

Answer: (b)

Solution:

Solution:



Question: Match the following

A – Torque, 1 – Nms^{-1}

B – Stress, 2 – Jkg^{-1}

C – Latent, 3 – Nm

D- Power, 4 – Nm^{-2}

Options:

(a) A→1, B→4, C→3, D→2

(b) A→3, B→4, C→2, D→1

(c) A→1, B→3, C→2, D→4

(d) A→2, B→1, C→4, D→3

Answer: (b)

Solution:

A→3, B→4, C→2, D→1

Question: Assertion: Constantan and manganin are used in resistance coil.

Reason: their temperature coefficient of resistance is low

Options:

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) If assertion is true, but reason is false.

(d) If both the assertion and reason are false.

Answer: (a)

Solution:

$$\alpha \approx 0$$

$$R = R_0 (1 + \alpha \Delta T)$$

JEE-Main-29-07-2022-Shift-2 (Memory Based)

Chemistry

Question: Which of the following is not a natural polymer?

Options:

- (a) Protein
- (b) Rayon
- (c) Starch
- (d) Rubber

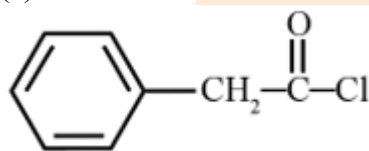
Answer: (b)

Solution: Rayon is a synthetic polymer.

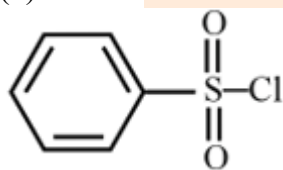
Question: Hinsberg's reagent is-

Options:

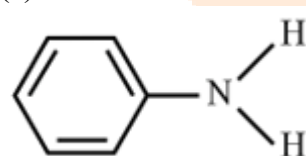
(a)



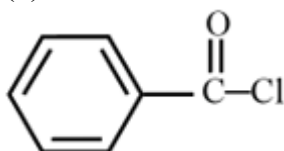
(b)



(c)

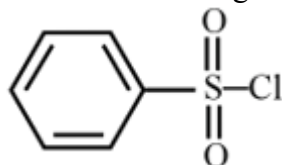


(d)



Answer: (b)

Solution: Hinsberg's reagent is benzenesulphonyl chloride



Question: In portland cement what enhances the setting time?

Options:

- (a) $\text{CaSO}_4, \frac{1}{2}\text{H}_2\text{O}$
- (b) $\text{CaSO}_4, 2\text{H}_2\text{O}$
- (c) CaCO_3
- (d) CaSO_4

Answer: (b)

Solution: Gypsum ($\text{CaSO}_4, 2\text{H}_2\text{O}$) is usually added to prevent early hardening and increase the setting time

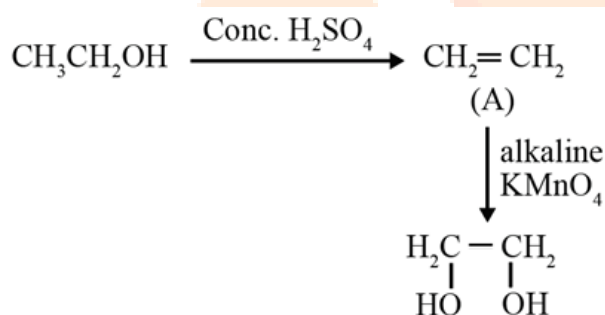
Question: Ethanol on reaction with conc. H_2SO_4 gives A, which on further reaction with Baeyer's reagent will give:

Options:

- (a) Ethane-1,2-diol
- (b) Formaldehyde
- (c) Formic acid
- (d) Ethanoic acid

Answer: (a)

Solution:



Question: The sum of oxidation state (magnitude only) and coordination number of cobalt in $\text{Na}[\text{Co}(\text{bpy})\text{Cl}_4]$

Options:

- (a) 3
- (b) 6
- (c) 9
- (d) 5

Answer: (c)

Solution: Oxidation number = $x - 4 + 1 = 0$

$$x = 3$$

Coordination number = 6

$$\text{Sum} = 3 + 6 = 9$$

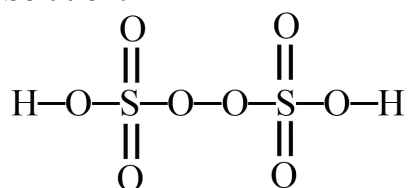
Question: Which of the following compound has O–O linkage

Options:

- (a) H_2SO_4
- (b) $\text{H}_2\text{S}_2\text{O}_8$
- (c) $\text{H}_2\text{S}_2\text{O}_7$
- (d) H_2SO_3

Answer: (b)

Solution:



Question: 200 ml of 0.01 M of HCl and 400 ml of 0.01 M of H₂SO₄ are mixed. What is the final pH?

Options:

- (a) 2
- (b) 1
- (c) 3
- (d) 4

Answer: (a)

Solution:

$$[\text{H}^+] = \frac{2\text{mmol} + 8\text{mmol}}{600} = \frac{1}{60}$$

$$\text{pH} = -\log[\text{H}^+]$$

$$= -\log \frac{1}{60}$$

$$\text{pH} = 1.77 \approx 2$$

Question: Which of the following ions has lowest value of hydration enthalpy in magnitude?

Options:

- (a) Cr²⁺
- (b) Mn²⁺
- (c) Fe²⁺
- (d) Co²⁺

Answer: (b)

Solution: Hydration enthalpy order $\text{Co}^{2+} > \text{Fe}^{2+} > \text{Cr}^{2+} > \text{Mn}^{2+}$

Therefore, Mn²⁺ has largest hydration enthalpy

Question: $\text{HNO}_3 + \text{KCl} \rightarrow \text{KNO}_3 + \text{Cl}_2 + \text{NOCl} + \text{H}_2\text{O}$. Find amount of HNO₃ required to make 110 g KNO₃

Options:

- (a) 91.5g
- (b) 56.4g
- (c) 14.7g
- (d) 67.2g

Answer: (a)

Solution: $4\text{HNO}_3 + 3\text{KCl} \rightarrow 3\text{KNO}_3 + \text{Cl}_2 + \text{NOCl} + 2\text{H}_2\text{O}$

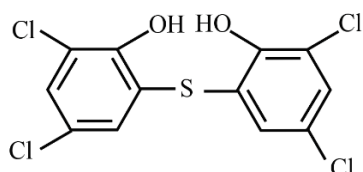
3 × 101 g of KNO₃ – 4 × 63 g of HNO₃

$$110 \text{ g of KNO}_3 - \frac{4 \times 63 \times 110}{3 \times 101} = 91.5 \text{ g}$$

Question: Number of chlorine atoms in Bithionol is

Answer: 4.00

Solution:



Question: How many among the following are sp^3d^2 hybridised?

BrF_5 , $[ICl_4]^-$, ICl_3 , ICl_5 , SF_6 , PCl_5

Answer: 4.00

Solution:

$$BrF_5 = \frac{1}{2}(7 + 5) = 6 = sp^2d^2$$

$$[ICl_4]^- = \frac{1}{2}(7 + 4 + 1) = 6 = sp^3d^2$$

$$ICl_5 = \frac{1}{2}(7 + 5) = 6 = sp^3d^2$$

$$SF_6 = \frac{1}{2}(6 + 6) = 6 = sp^3d^2$$

Question: Weight of O_2 is x gram and for Ne is 200 g. Total pressure is 25 bar and Partial pressure of Ne 20 bar Find x =?

Answer: 80.00

Solution:

$$P_{Ne} = x_{Ne} P_{total}$$

$$x_{Ne} = \frac{20}{25} = \frac{4}{5}$$

$$x_{Ne} = \frac{\frac{200}{20}}{\frac{200}{20} + \frac{x}{32}} = \frac{4}{5}$$

$$\frac{10}{10 + \frac{x}{32}} = \frac{4}{5}$$

$$50 = 40 + \frac{x}{8}$$

$$x = 80 \text{ g}$$

JEE-Main-29-07-2022-Shift-2 (Memory Based)

MATHEMATICS

Question: The value of $\sum_{r=1}^{20} (r^2 + 1) \cdot r!$ is:

Options:

- (a) $22! - 2 \cdot (20)!$
- (b) $(22)! - 2(21)!$
- (c) $(22)!$
- (d) $2(21)!$

Answer: (b)

Solution:

$$\begin{aligned} \sum_{r=1}^{20} (r^2 + 1)r! &= \sum_{r=1}^{20} ((r+1)(r+2) - 3(r+1) + 2)r! \\ &= \sum_{r=1}^{20} ((r+2)! - 3(r+1)! + 2r!) \\ &= \sum_{r=1}^{20} ((r+2)! - (r+1)!) - 2 \sum_{r=1}^{20} ((r+1)! - r!) \\ &= (22! - 2!) - 2(21! - 1!) \\ &= 22! - 2 \times 2! - 2 + 2 \\ &= (22)! - 2(21)! \end{aligned}$$

Question: If $|\vec{a}||\vec{b}||\vec{c}| = 14$ and $(\vec{a} \times \vec{b}) \cdot (\vec{b} \times \vec{c}) + (\vec{b} \times \vec{c}) \cdot (\vec{c} \times \vec{a}) + (\vec{c} \times \vec{a}) \cdot (\vec{a} \times \vec{b}) = 168$ and $\vec{a}, \vec{b}, \vec{c}$ are coplanar, concurrent and make equal angles with each other, then $|\vec{a}| + |\vec{b}| + |\vec{c}|$ is equal to:

Options:

- (a) 14
- (b) 16
- (c) 10
- (d) 12

Answer: (b)

Solution:

$\because \vec{a}, \vec{b}, \vec{c}$ are coplanar and make equal angle with each other (say θ)

So, $\theta = 60^\circ$

$$(\vec{a} \times \vec{b}) \cdot (\vec{b} \times \vec{c}) = |\vec{a} \times \vec{b}| |\vec{b} \times \vec{c}| \quad (\text{a } \vec{a} \times \vec{b} \text{ and } \vec{b} \times \vec{c} \text{ will be parallel})$$

$$= |\vec{a}| |\vec{b}|^2 |\vec{c}| \sin^2 \theta = 14 \sin^2 \theta |\vec{b}|$$

$$\text{So, } 14 \times \frac{3}{4} (|\vec{a}| + |\vec{b}| + |\vec{c}|) = 168$$

$$\Rightarrow |\vec{a}| + |\vec{b}| + |\vec{c}| = 16$$

Question: A perpendicular drawn from $(1, 2, 3)$ to the plane $x + 2y + z = 14$ and intersect plane at Q . R be a point on plane such that PR makes an angle 60° with the plane, then area of ΔPQR is:

Options:

(a) $\sqrt{3}$ sq. units

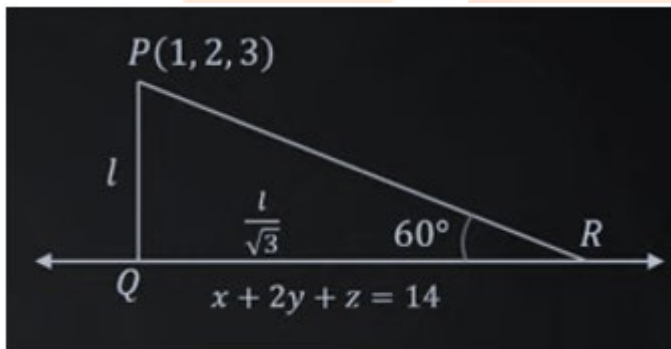
(b) 3 sq. units

(c) $\frac{\sqrt{3}}{2}$ sq. units

(d) 4 sq. units

Answer: (a)

Solution:



$$\therefore QR = PQ \cdot \cot 60^\circ = \frac{l}{\sqrt{3}}$$

$$\text{Also, } l = \left| \frac{1 + 4 + 3 - 14}{\sqrt{1 + 4 + 1}} \right| = \sqrt{6}$$

$$\text{Area of } \Delta PQR = \frac{1}{2} \cdot l \cdot \frac{l}{\sqrt{3}} = \frac{6}{2\sqrt{3}} = \sqrt{3}$$

Question: The number of solution of the equation $2 \cos \left(\frac{x^2 + x}{6} \right) = 4^x + 4^{-x}$ is/are:

Options:

(a) 1

(b) 0

(c) 3

(d) Infinite

Answer: (a)

Solution:

$$2 \cos\left(\frac{x^2 + x}{6}\right) = 4^x + 4^{-x}$$

Equality holds when $4^x + 4^{-x} = 2$ and $\cos\left(\frac{x^2 + x}{6}\right) = 1$

$$4^x + 4^{-x} = 2 \text{ gives } x = 0 \text{ for which } \cos\left(\frac{x^2 + x}{6}\right) = 1$$

So, there exist only one solution $x = 0$.

Question: Let \vec{a}, \vec{b} are two vectors and $\vec{a} \cdot \vec{b} = 3$, $|\vec{a} \times \vec{b}|^2 = 75$, and $|\vec{a} + \vec{b}|^2 = |\vec{a}|^2 + 2|\vec{b}|^2$, then $|\vec{a}|^2$ is equal to ____.

Answer: 14.00

Solution:

$$|\vec{a} + \vec{b}|^2 = |\vec{a}|^2 + 2\vec{a} \cdot \vec{b} + |\vec{b}|^2 = |\vec{a}|^2 + 2|\vec{b}|^2$$

$$\Rightarrow |\vec{b}|^2 = 2(\vec{a} \cdot \vec{b}) = 6$$

Also,

$$\Rightarrow |\vec{a} + \vec{b}|^2 + |\vec{a} \cdot \vec{b}|^2 = |\vec{a}|^2 |\vec{b}|^2$$

$$\Rightarrow 75 + 9 = 6|\vec{a}|^2$$

$$\Rightarrow |\vec{a}|^2 = \frac{84}{6} = 14$$

Question: If sum and product of mean and variance in a binomial distribution are 82.5 and 1350 respectively, then n is equal to ____.
(where n is number of trial in binomial distribution).

Answer: 96.00

Solution:

\therefore Mean and variance are the roots of

$$x^2 - 82.5x + 1350 = 0$$

So, mean = $np = 60$

and variance = $npq = 22.5$

$$\Rightarrow q = \frac{22.5}{60} = \frac{3}{8}$$

$$\text{So, } p = \frac{5}{8} \text{ and } n = \frac{60}{\frac{5}{8}} = 96$$

Question: The number of numbers lying between 1024 and 23146 which are divisible by 55 and made from 2, 3, 4, 5, 6 without repetition, is ____.

Answer: 6.00

Solution:

We will solve this in two cases:

Case I:

When number has 4 digits (say \overline{abcd})

Here d is fixed as 5.

So, a, b, c can be

$(6, 4, 3), (3, 4, 6), (2, 3, 6), (6, 3, 2), (3, 2, 4)$ or $(4, 2, 3)$ only

Number of numbers possible = 6

Case II:

When number has 5 digits.

No such number is possible because even last number formed is greater than 23146.

Total number of such number = 6

