

JEE MAINS TEST - 14 (05-02-2024) (#1367)

Total Marks: 300

Total Duration: 180 minutes

Instructions

1. The question paper consists of **'90'** objective-type questions. There are **'30'** questions each in **Mathematics, Physics and Chemistry** respectively in **2 Sections (A) & (B)**. **Section 'A' contains 20 MCQ (One correct option type) questions and all are mandatory. Section 'B' contains 10 (Numerical value type) questions, only '5' is to be attempted.**

2. The test is of **3** hours duration, and this test contains **90** questions. Each question carries **4** marks. For each correct response, the candidate will get **4** marks. For each incorrect response, **one** mark will be deducted from the total scores. The maximum marks are **300**.

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Section: Physics Section - A

Marks per question: 4

20 of 20 question(s) in this section will be shown to examinee

Examinee should answer all 20 question(s) in this section

This section has negative marking for incorrect answer(s). 25% marks will be deducted for every incorrect answer.

Q1 Difficulty Level: Easy

Knowledge Level: K1

A pan is going down along y-axis with it's position changing with time as $y(t) = \sqrt{2}(\sin \omega t + \cos \omega t)$.

A mass $M = 5\text{kg}$ is placed on the pan at $t = 0$. Find the minimum value of ' ω_{\min} ' for which mass leaves the contact with the pan and also calculate the time 't' for which this happen for the first time. (Take $g = 10 \text{ m/s}^2$)

$\omega_{\min} = 1 \text{ rad/sec} \ \& \ t = \frac{22}{28} \text{ sec}$

$\omega_{\min} = \frac{22}{28} \ \& \ t = 1 \text{ sec}$

$\omega_{\min} = \sqrt{5} \ \& \ t = \frac{22}{28\sqrt{5}} \text{ sec}$

$\omega_{\min} = \frac{22}{28\sqrt{5}} \ \& \ t = \sqrt{5} \text{ sec}$

Q2 Difficulty Level: Easy

Knowledge Level: K1

A uniform rod of mass $m = 4m$ and length ℓ is kept on a frictionless surface in xy plane such that one end of the rod is at origin and its principle axis is coinciding with x -axis. A mass m moving with velocity v making an angle $\theta = \frac{\pi}{4}$ with the principle axis of the rod collides with one end of the rod and sticks to it. The angular speed of the rod + mass system just after the collision is

- $\frac{3v}{7\sqrt{2}\ell}$
- $\frac{3\sqrt{2}v}{7\ell}$
- $\frac{3v}{4\sqrt{2}\ell}$
- $\frac{3v}{7\ell}$

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Q3 Difficulty Level: Easy

Knowledge Level: K1

Consider a solid sphere of radius R and mass density $\rho(r) = \rho_0 \left(1 - \frac{r^2}{R^2}\right)$, $0 < r \leq R$. The minimum density of a liquid in which it will float is

- $\frac{\rho_0}{5}$
- $\frac{2\rho_0}{5}$
- $\frac{2\rho_0}{3}$
- $\frac{\rho_0}{3}$

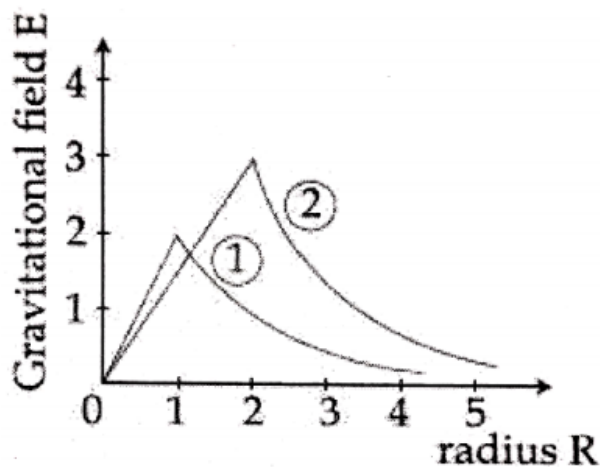
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Q4 Difficulty Level: Easy

Knowledge Level: K1

Consider two solid spheres of radii $R_1 = 1\text{m}$, $R_2 = 2\text{m}$ and masses M_1 and M_2 , respectively. The gravitational field due to sphere (1) and (2) are shown. The value of

$\frac{M_1}{M_2}$ is:



- $\frac{1}{2}$
- $\frac{1}{3}$
- $\frac{1}{6}$
- $\frac{2}{3}$

Q5 Difficulty Level: Easy

Knowledge Level: K1

A particle of mass m is dropped from a height h above the ground. At the same time another particle of same mass is thrown vertically upwards from the ground with a speed of $\sqrt{2gh}$. If they collide head-on completely inelastically, the time taken for the combined mass to reach the ground, in units

of $\sqrt{\frac{h}{g}}$ is :

$\frac{1}{2}$

$\sqrt{\frac{1}{2}}$

$\sqrt{\frac{3}{4}}$

$\sqrt{\frac{3}{2}}$

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Q6 Difficulty Level: Easy

Knowledge Level: K1

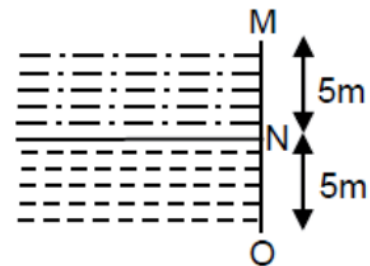
A particle moves such that its position vector $\vec{r}(t) = \cos \omega t \hat{i} + \sin \omega t \hat{j}$ where ω is a constant and t is time. Then which of the following statements is true for the velocity $\vec{v}(t)$ and acceleration $\vec{a}(t)$ of the particle:

- \vec{v} is perpendicular to \vec{r} and \vec{a} is directed towards the origin.
- \vec{v} and \vec{a} both are parallel to \vec{r}
- \vec{v} is perpendicular to \vec{r} and \vec{a} is directed away from the origin.
- \vec{v} and \vec{a} both are perpendicular to \vec{r}

Q7 Difficulty Level: Easy

Knowledge Level: K1

Two liquids of densities ρ_1 and ρ_2 ($\rho_2 = 2\rho_1$) are filled up behind a square wall of inside 10 m as shown in figure. Each liquid has a height of 5 m. The ratio of the forces due to these liquids exerted on upper part MN to that at the lower part NO is (Assume that the liquids are not mixing):

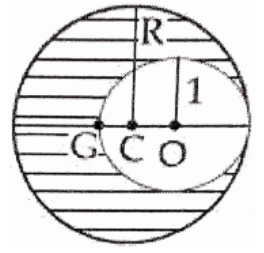


- 1/2
- 1/4
- 2/3
- 1/3

Q8 Difficulty Level: Easy

Knowledge Level: K1

As shown in figure when a spherical cavity (centered at O) of radius 1 is cut out of a uniform sphere of radius R (centred at C), the centre of mass of remaining (shaded) part of sphere is at G, i.e. on the surface of the cavity. R can be determined by the equation:



- $(R^2 + R - 1) (2 - R) = 1$
- $(R^2 + R + 1) (2 - R) = 1$
- $(R^2 - R + 1) (2 - R) = 1$
- $(R^2 - R - 1) (2 - R) = 1$

Q9 Difficulty Level: Easy

Knowledge Level: K1

If Y, K and η are the value of Young's modulus, bulk modulus of rigidity of any material respectively. Choose the correct relation for these parameters

- $Y = \frac{9K\eta}{2\eta + 3K} \text{N/m}^2$
- $K = \frac{Y\eta}{9\eta - 3Y} \text{N/m}^2$
- $\eta = \frac{3YK}{9K + Y} \text{N/m}^2$
- $Y = \frac{9K\eta}{3K - \eta} \text{N/m}^2$

Q10 Difficulty Level: Easy

Knowledge Level: K1

A satellite of mass m is launched vertically upwards with an initial speed u from the surface of the earth. After it reaches height R ($R =$ radius of the earth), it ejects a rocket of mass $\frac{m}{10}$ so that subsequently the satellite moves in a circular orbit. The kinetic energy of the rocket is (G is the gravitational constant ; M is the mass of the earth)

$\frac{m}{20} \left(u - \sqrt{\frac{2GM}{3R}} \right)^2$

$\frac{3m}{8} \left(u + \sqrt{\frac{5GM}{6R}} \right)^2$

$\frac{m}{20} \left(u^2 - \frac{113}{200} \frac{GM}{R} \right)$

$5m \left(u^2 - \frac{119}{200} \frac{GM}{R} \right)$

Q11 Difficulty Level: Easy

Knowledge Level: K1

The length of metallic wire is l_1 when tension in it is T_1 . It is l_2 when the tension is T_2 . The original length of the wire will be :

$\frac{T_2 l_1 + T_1 l_2}{T_1 + T_2}$

$\frac{T_1 l_1 - T_2 l_2}{T_2 - T_1}$

$\frac{T_2 l_1 - T_1 l_2}{T_2 - T_1}$

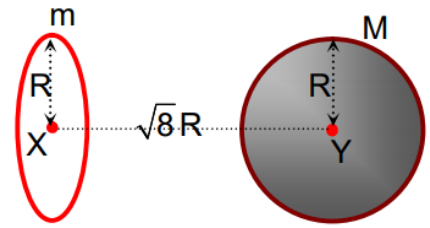
$\frac{l_1 + l_2}{2}$

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Q12 Difficulty Level: Easy

Knowledge Level: K1

Find the gravitational force of attraction between the ring and sphere as shown in the diagram, where the plane of the ring is perpendicular to the line joining the centres. If $\sqrt{8} R$ is the distance between the centres of a ring (of mass 'm') and a sphere (mass 'M') where both have equal radius 'R'.



- $\frac{\sqrt{8}}{9} \cdot \frac{GmM}{R}$
- $\frac{1}{3\sqrt{8}} \cdot \frac{GMm}{R^2}$
- $\frac{\sqrt{8}}{27} \cdot \frac{GmM}{R^2}$
- $\frac{2\sqrt{2}}{3} \cdot \frac{GMm}{R^2}$

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Q13 Difficulty Level: Easy

Knowledge Level: K1

A particle is moving with uniform speed along the circumference of a circle of radius R under the action of a central fictitious force F which is inversely proportional to R^3 . Its time period of revolution will be given by:

- $T \propto R^{\frac{3}{2}}$
- $T \propto R^{\frac{5}{2}}$
- $T \propto R^{\frac{4}{3}}$
- $T \propto R^2$

Q14 Difficulty Level: Easy

Knowledge Level: K1

Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A : Body 'P' having mass M moving with speed 'u' has head – on collision elastically with another body 'Q' having mass 'm' initially at rest. If $m \ll M$, Body 'Q' will have a maximum speed equal to '2u' after collision.

Reason R : During elastic collision, the momentum and kinetic energy are both conserved. In the light of the above statements, choose the most appropriate answer from the options given below:

- A** is correct but **R** is not correct.
- A** is not correct but **R** is correct.
- Both **A** and **R** are correct and **R** is the correct explanation of **A**.
- Both **A** and **R** correct but **R** is **NOT** the correct explanation of **A**.

Q15 Difficulty Level: Easy

Knowledge Level: K1

A large number of water drops, each of radius r , combine to have a drop of radius R . If the surface tension is T and mechanical equivalent of heat is J , the rise in heat energy per unit volume will be:

- $\frac{3T}{J} \left(\frac{1}{r} - \frac{1}{R} \right)$
- $\frac{2T}{rJ}$
- $\frac{3T}{rJ}$
- $\frac{2T}{J} \left(\frac{1}{r} - \frac{1}{R} \right)$

Q16 Difficulty Level: Easy

Knowledge Level: K1

Four identical solid spheres each of mass ' m ' and radius ' a ' are placed with their centres on the four corners of a square of side ' b '. The moment of inertia of the system about side of square where the axis of rotation is parallel to the plane of the square is :

- $\frac{4}{5} ma^2$
- $\frac{4}{5} ma^2 + 2mb^2$
- $\frac{8}{5} ma^2 + 2mb^2$
- $\frac{8}{5} ma^2 + mb^2$

Q17 Difficulty Level: Easy

Knowledge Level: K1

A planet revolving in elliptical orbit has :

- (A) a constant velocity of revolution.
 - (B) has the least velocity when it is nearest to the sun.
 - (C) its areal velocity is directly proportional to its velocity.
 - (D) areal velocity is inversely proportional to its velocity.
 - (E) To follow a trajectory such that the areal velocity is constant.
- Choose the correct answer from the options given below:

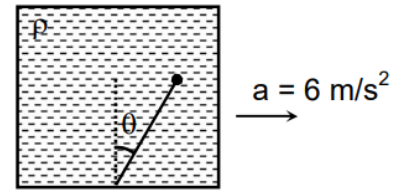
- C only
- A only
- D only
- E only

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Q18 Difficulty Level: Easy

Knowledge Level: K1

In an ideal liquid of density ' ρ ', a small spherical ball of density $\frac{\rho}{5}$ is tied to a string which is connected to the bottom of a container as shown. If the container is having a horizontal acceleration of 6 m/s^2 , then the angle made by the string with the vertical is: (Take $g = 10 \text{ m/s}^2$)



- $\tan^{-1}\left(\frac{3}{5}\right)$
- $\tan^{-1}\left(\frac{4}{5}\right)$
- $\frac{\pi}{4}$
- $\tan^{-1}(5)$

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Q19 Difficulty Level: Easy

Knowledge Level: K1

An object of mass m is projected with a momentum p at an angle with the horizontal such that its maximum height (H) is half of its Range (R). Minimum kinetic energy of the particle in its path will be

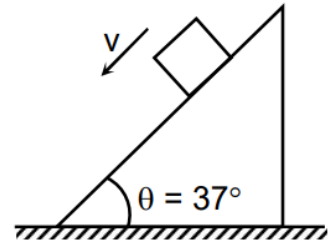
- $\frac{p^2}{8m}$
- $\frac{3p^2}{4m}$
- $\frac{p^2}{10m}$
- $\frac{p^2}{5m}$

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Q20 Difficulty Level: Easy

Knowledge Level: K1

A cubical block of side 'a' and density ' ρ ' slides down a fixed inclined plane of inclination $\theta = 37^\circ$ with a constant velocity v as shown. There is a thin film of viscous liquid of thickness 't' between the inclined plane and the block. Then the coefficient of viscosity of the liquid will be



- $\frac{3\rho agt}{5v}$
- $\frac{4\rho agt}{5v}$
- $\frac{\rho agt}{v}$
- $\frac{5\rho agt}{3v}$

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Section: Physics Section - B

Marks per question: 4

10 of 10 question(s) in this section will be shown to examinee

Examinee should answer any 5 question(s) out of the 10 question(s) shown

This section has negative marking for incorrect answer(s). 25% marks will be deducted for every incorrect answer.

Q1 Difficulty Level: Easy

Knowledge Level: K1

A uniform thin bar of mass 6 kg and length 24 meter is bent to make an equilateral hexagon. The moment of inertia about an axis passing through the centre of mass and perpendicular to the plane of hexagon is..... $\times 10^{-1}$ kg m².

SNo	Blank	Answers
1	Integers	i. 8

Q2 Difficulty Level: Easy

Knowledge Level: K1

The potential energy (U) of a diatomic molecule is a function dependent on r (interatomic distance)

$$\text{as } U = \frac{\alpha}{r^{10}} - \frac{\beta}{r^5} - 3$$

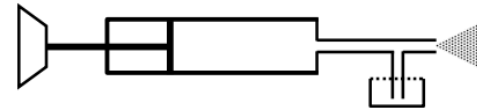
Where, α and β are positive constants. The equilibrium between two atoms will be $\left(\frac{2\alpha}{\beta}\right)^{\frac{a}{b}}$, where a

=

SNo	Blank	Answers
1	Integers	i. 1

Q3 Difficulty Level: Easy**Knowledge Level: K1**

A spray gun is shown in the figure where a piston pushes air out of a nozzle. A thin tube of uniform cross section is connected to the nozzle. The other end of the tube is in a small liquid container. As the piston pushes air through the nozzle, the liquid from the container rises into the nozzle and is sprayed out. For the spray gun shown, the radii of the piston and the nozzle are 20 mm and 1 mm respectively. The upper end of the container is open to the atmosphere. If the piston is pushed at a speed of 5 mms^{-1} , the air comes out of the nozzle with a speed of



SNo	Blank	Answers
1	Integers	i. 2

Q4 Difficulty Level: Easy**Knowledge Level: K1**

The initial velocity v_i required to project a body vertically upward from the surface of the earth to reach a height of $10R$, where R is the radius of the earth, may be described in terms of escape velocity v_e such that $v_i = \sqrt{\frac{x}{y}} \times v_e$. The value of x will be.....

SNo	Blank	Answers
1	Integers	i. 10

Q5 Difficulty Level: Easy

Knowledge Level: K1

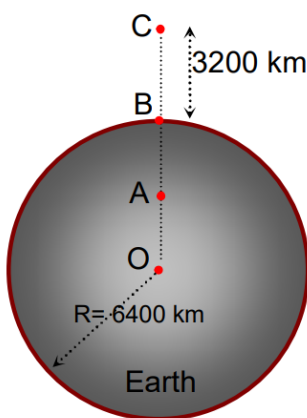
If $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$, the angle between \vec{P} and \vec{Q} is θ ($0^\circ < \theta < 360^\circ$). The value of ' θ ' will be

SNo	Blank	Answers
1	Integers	i. 180

Q6 Difficulty Level: Easy

Knowledge Level: K1

In the reported figure of earth, the value of acceleration due to gravity is same at point A and C but it is smaller than that of its value at point B (surface of the earth). The value of OA : AB will be x : y. The value of x is.....

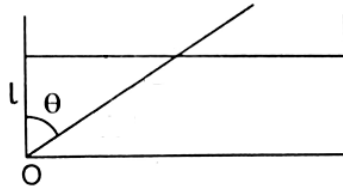


SNo	Blank	Answers
1	Integers	i. 4

Q7 Difficulty Level: Easy**Knowledge Level: K1**

A wooden plank of length 1 m and uniform cross section is hinged at one end to the bottom of a tank as shown in figure. The tank is filled with water up to a height of 0.5 m. The specific gravity of the plank is 0.5. Find the angle θ that the plank makes with the vertical in the equilibrium position.

(Exclude the case $\theta = 0$.)



SNo	Blank	Answers
1	Integers	i. 45

Q8 Difficulty Level: Easy**Knowledge Level: K1**

A large wooden plate of area 10 m^2 floating on the surface of a river is made to move horizontally with a speed of 2 m s^{-1} by applying a tangential force. If the river is 1 m deep and the water in contact with the bed is stationary. If F be the tangential force needed to keep the plate moving. Calculate $100 \times F = \underline{\hspace{2cm}}$ N. Coefficient of viscosity of water at the temperature of the river = 10^{-3} poise.

SNo	Blank	Answers
1	Integers	i. 2

Q9 Difficulty Level: Easy**Knowledge Level: K1**

A steel rod has a radius of 20mm and a length of 2.0m. A force of 62.8kN stretches it along its length. Young's modulus of steel is $2.0 \times 10^{11} \text{N/m}^2$. The longitudinal strain produced in the wire is _____ $\times 10^{-5}$

SNo	Blank	Answers
1	Integers	i. 25

Q10 Difficulty Level: Easy**Knowledge Level: K1**

An air bubble of diameter 6mm rises steadily through a solution of density 1750kg/m^3 at the rate of 0.35cm/s. The co-efficient of viscosity of the solution (neglect density of air) is _____ Pas (given, $g = 10 \text{ms}^{-2}$).

SNo	Blank	Answers
1	Integers	i. 10

Section: Chemistry - Section A

Marks per question: 4

20 of 20 question(s) in this section will be shown to examinee

Examinee should answer all 20 question(s) in this section

This section has negative marking for incorrect answer(s). 25% marks will be deducted for every incorrect answer.

Q1 Difficulty Level: Easy

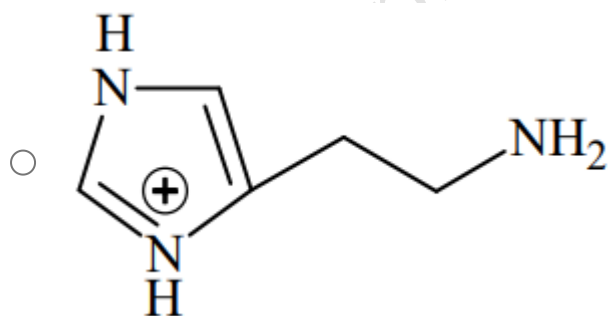
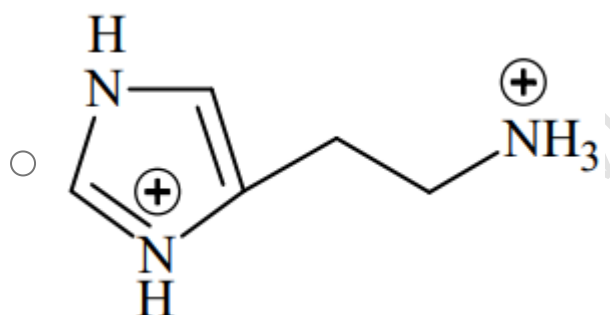
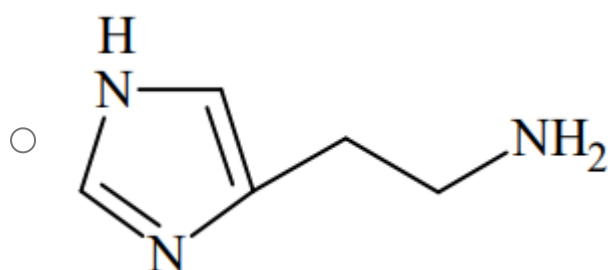
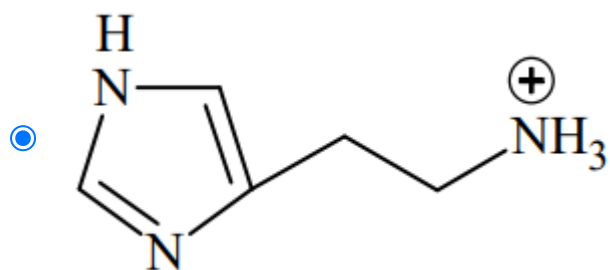
Knowledge Level: K1

Which of the following compounds are homologous to each other ?

- Phenol and Benzyl alcohol
- Propane nitrile and Acetonitrile
- Methoxyethane and Butanol
- Acetic acid and Ethanoic acid

Q2 Difficulty Level: Easy

Knowledge Level: K1

The predominant form of histamine present in human blood is (pK_a , Histidine = 6.0)

Q3 Difficulty Level: Easy

Knowledge Level: K1

An aqueous solution contains an unknown concentration of Ba^{2+} . When 50 mL of a 1 M solution of Na_2SO_4 is added, BaSO_4 just begins to precipitate. The final volume is 500 mL. The solubility product of BaSO_4 is 1×10^{-10} . What is the original concentration of Ba^{2+} ?

- $1.0 \times 10^{-10} \text{ M}$
- $5 \times 10^{-9} \text{ M}$
- $2 \times 10^{-9} \text{ M}$
- $1.1 \times 10^{-9} \text{ M}$

Q4 Difficulty Level: Easy

Knowledge Level: K1

The ratio of mass percent of C and H of an organic compound ($\text{C}_x\text{H}_y\text{O}_z$) is 6 : 1. If one molecule of the above compound ($\text{C}_x\text{H}_y\text{O}_z$) contains half as much oxygen as required to burn one molecule of compound C_xH_y completely to CO_2 and H_2O . The empirical formula of compound $\text{C}_x\text{H}_y\text{O}_z$ is

- $\text{C}_2\text{H}_4\text{O}_3$
- $\text{C}_3\text{H}_6\text{O}_3$
- $\text{C}_2\text{H}_4\text{O}$
- $\text{C}_3\text{H}_4\text{O}_2$

Q5 Difficulty Level: Easy

Knowledge Level: K1

Which of the following compound contain only super primary carbon atom ?

- Dimethyl ether
- Ethyl methyl ether
- Acetaldehyde
- Acetone

Q6 Difficulty Level: Easy

Knowledge Level: K1

Which of the following are Lewis acids?

- BCl_3 and AlCl_3
- PH_3 and BCl_3
- AlCl_3 and SiCl_4
- PH_3 and SiCl_4

Q7 Difficulty Level: Easy

Knowledge Level: K1

According to molecular orbital theory, which of the following will not be a viable molecule?

- H_2^{2-}
- He_2^{2+}
- He_2^+
- H_2^-

Q8 Difficulty Level: Easy

Knowledge Level: K1

Which of the following compounds contain(s) no covalent bond(s)?
 KCl , PH_3 , O_2 , B_2H_6 , H_2SO_4

- KCl , B_2H_6
- KCl , B_2H_6 , PH_3
- KCl , H_2SO_4
- KCl

Q9 Difficulty Level: Easy

Knowledge Level: K1

Total number of lone pair of electrons in I_3^- ion is

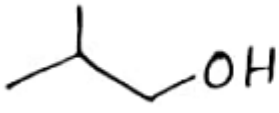
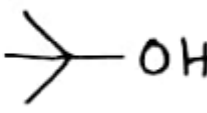
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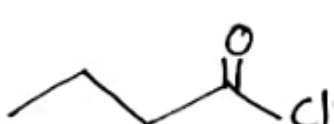
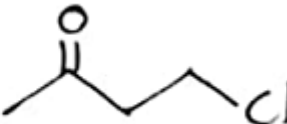
Q10 Difficulty Level: Easy

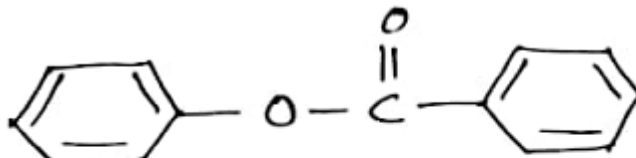
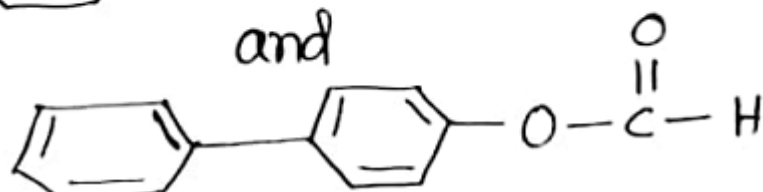
Knowledge Level: K1

Which of the following compounds are not positional isomers?

- $H_3C - \underset{\substack{| \\ CH_3}}{CH} - \underset{\substack{| \\ CH_3}}{CH} - CH_2 - CH_3$ and $H_3C - \overset{\substack{CH_3 \\ |}}{C} - CH_2 - CH_2 - CH_3$

-  and 

-  and 

-  and 

Q11 Difficulty Level: Easy

Knowledge Level: K1

The radius of the second Bohr orbit for hydrogen atom is:

(Planck's Const. $h = 6.6262 \times 10^{-34}$ Js; mass of electron $= 9.1091 \times 10^{-31}$ kg; charge of electron $e = 1.60210 \times 10^{-19}$ C; permittivity of vacuum $\epsilon_0 = 8.854185 \times 10^{-12}$ kg⁻¹ m⁻³ A²)

- 4.76 Å
- 0.529 Å
- 2.12 Å
- 1.65 Å

Q12 Difficulty Level: Easy

Knowledge Level: K1

The group having isoelectronic species is:

- O^- , F^- , Na , Mg^{+}
- O^{2-} , F^- , Na , Mg^{2+}
- O^- , F^- , Na^+ , Mg^{2+}
- O^{2-} , F^- , Na^+ , Mg^{2+}

Q13 Difficulty Level: Easy

Knowledge Level: K1

pK_a of a weak acid (HA) and pK_b of a weak base (BOH) are 3.2 and 3.4, respectively. The pH of their salt (AB) solution is:

- 6.9
- 7.0
- 1.0
- 7.2

Q14 Difficulty Level: Easy

Knowledge Level: K1

On treatment of 100 mL of 0.1 M solution of $\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$ with excess AgNO_3 ; 1.2×10^{22} ions are precipitated. The complex is:

- $[\text{Co}(\text{H}_2\text{O})_3 \text{Cl}_3] \cdot 3\text{H}_2\text{O}$
- $[\text{Co}(\text{H}_2\text{O})_6] \text{Cl}_3$
- $[\text{Co}(\text{H}_2\text{O})_5 \text{Cl}] \text{Cl}_2 \cdot \text{H}_2\text{O}$
- $[\text{Co}(\text{H}_2\text{O})_4 \text{Cl}_2] \text{Cl} \cdot 2\text{H}_2\text{O}$

Q15 Difficulty Level: Easy

Knowledge Level: K1

Among the following the dissociation constant is highest for

- C_6H_5OH
- $C_6H_5CH_2OH$
- $CH_3C \equiv CH$
- $CH_3NH_3^+Cl^-$

Q16 Difficulty Level: Easy

Knowledge Level: K1

The most abundant elements by mass in the body of a healthy human adult are: Oxygen (61.4%); Carbon (22.9%), Hydrogen (10.0%); and Nitrogen (2.6%). The weight which a 75 kg person would gain if all 1H atoms are replaced by 2H atoms is:

- 37.5 kg
- 7.5 kg
- 10 kg
- 15 kg

Q17 Difficulty Level: Easy

Knowledge Level: K1

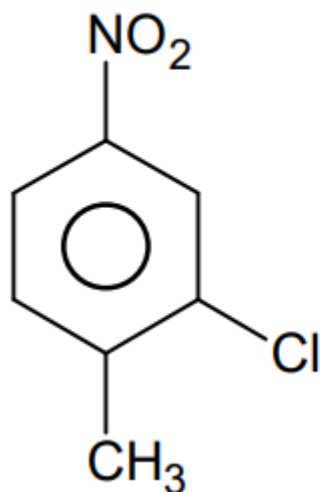
1 gram of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186 mole of CO_2 . The molar mass of M_2CO_3 in $g\ mol^{-1}$ is:

- 84.3
- 118.6
- 11.86
- 1186

Q18 Difficulty Level: Easy

Knowledge Level: K1

The correct IUPAC name of the following compound is

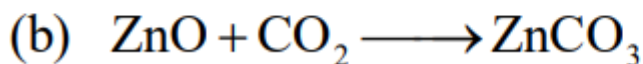
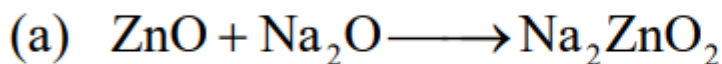


- 5-chloro-4-methyl-1-nitrobenzene
- 2-methyl-5-nitro-1-chlorobenzene
- 3-chloro-4-methyl-1-nitrobenzene
- 2-chloro-1-methyl-4-nitrobenzene

Q19 Difficulty Level: Easy

Knowledge Level: K1

In the following reactions, ZnO is respectively acting as a/an:



- base and base
- acid and acid
- acid and base
- base and acid

Q20 Difficulty Level: Easy

Knowledge Level: K1

An alkali is titrated against an acid with methyl orange as indicator, which of the following is a correct combination?

- | | | | |
|----------------------------------|-------------|-------------|-----------------------|
| <input type="radio"/> | Base | Acid | End point |
| | Strong | Strong | Pink to colourless |
| <input type="radio"/> | Base | Acid | End point |
| | Weak | Strong | Colourless to pink |
| <input type="radio"/> | Base | Acid | End point |
| | Strong | Strong | Pinkish red to yellow |
| <input checked="" type="radio"/> | Base | Acid | End point |
| | Weak | Strong | Yellow to pinkish red |

Section: Chemistry - Section B

Marks per question: 4

10 of 10 question(s) in this section will be shown to examinee

Examinee should answer any 5 question(s) out of the 10 question(s) shown

This section has negative marking for incorrect answer(s). 25% marks will be deducted for every incorrect answer.

Q1 Difficulty Level: Easy

Knowledge Level: K1

If the solubility product of AB_2 is $3.20 \times 10^{-11} M^3$, then the solubility of AB_2 in pure water is _____ $\times 10^{-4} \text{ mol L}^{-1}$. [Assuming that neither kind of ion reacts with water]

SNo	Blank	Answers
1	Integers	i. 2

Q2 Difficulty Level: Easy

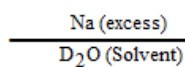
Knowledge Level: K1

The atomic number of Unnilunium is _____.

SNo	Blank	Answers
1	Integers	i. 101

Q3 Difficulty Level: Easy

Knowledge Level: K1



P Number of replaceable hydrogen by isotopes = x

SNo	Blank	Answers
1	Integers	i. 6

Q4 Difficulty Level: Easy

Knowledge Level: K1

A_3B_2 is a sparingly soluble salt of molar mass M (g mol^{-1}) and solubility x g L^{-1} . The solubility product satisfies $K_{\text{sp}} = a \left(\frac{x}{M} \right)^5$. The value of a is _____.

SNo	Blank	Answers
1	Integers	i. 108

Q5 Difficulty Level: Easy

Knowledge Level: K1

The total number of cyclic isomers possible for a hydrocarbon with the molecular formula C_4H_6 is _____.

SNo	Blank	Answers
1	Integers	i. 5

Q6 Difficulty Level: Easy

Knowledge Level: K1

The molarity of the solution prepared by dissolving 6.3 g of oxalic acid ($\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$) in 250 ml of water in mol L^{-1} is $x \times 10^{-2}$. The value of x is _____. (Nearest integer)
[Atomic mass : H : 1.0, C : 12.0, O : 16.0]

SNo	Blank	Answers
1	Integers	i. 20

Q7 Difficulty Level: Easy

Knowledge Level: K1

The number of hydrogen bonded water molecule(s) associated with stoichiometry $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ _____

SNo	Blank	Answers
1	Integers	i. 1

Q8 Difficulty Level: Easy

Knowledge Level: K1

Ge (Z = 32) in its ground state electronic configuration has x completely filled orbitals with $m_l = 0$. The value of x is _____.

SNo	Blank	Answers
1	Integers	i. 7

Q9 Difficulty Level: Easy

Knowledge Level: K1

The solubility product of PbI_2 is 8.0×10^{-9} . The solubility of lead iodide in 0.1 molar solution of lead nitrate is $x \times 10^{-6}$ mol / L. The value of x is (Rounded off to the nearest integer)
[Given $\sqrt{2} = 1.41$]

SNo	Blank	Answers
1	Integers	i. 141

Q10 Difficulty Level: Easy

Knowledge Level: K1

How many structural isomers of tertiary amines corresponding to molecular formula $\text{C}_6\text{H}_{15}\text{N}$ are possible?

SNo	Blank	Answers
1	Integers	i. 7

Section: Mathematics Section - A**Marks per question: 4****20 of 20 question(s) in this section will be shown to examinee****Examinee should answer all 20 question(s) in this section****This section has negative marking for incorrect answer(s). 25% marks will be deducted for every incorrect answer.****Q1 Difficulty Level: Easy****Knowledge Level: K1**

If a , b and c are in G.P. such that x and y are the arithmetic means between a , b and b , c , respectively, then

$\frac{a}{x} + \frac{c}{y}$ is equal to

- 0
- 1
- 2
- $1/2$

Q2 Difficulty Level: Easy**Knowledge Level: K1**

Let $A = (0, 4)$ and $B = (2 \cos \theta, 2 \sin \theta)$, for some θ . Let P divide the line segment AB in the ratio $2 : 1$ internally. The locus of P is

- Circle
- Ellipse
- Parabola
- Hyperbola

Q3 Difficulty Level: Easy

Knowledge Level: K1

If A.M. and H.M. of two numbers are 27 and 12, respectively, then G.M. of the two numbers will

- 9
- 18
- 24
- 36

Q4 Difficulty Level: Easy

Knowledge Level: K1

For a real variable $a > 1$, consider the points $A_k = (ka, a^k)$, $k = 1, 2, \dots, n$ in Cartesian plane. If α and β represent respectively the arithmetic mean of x- coordinates and the geometric mean of y coordinates of these points, then the locus of the point $P (\alpha, \beta)$ is

- $ny = \left(\frac{2x}{n}\right)^{n^2+1}$
- $y^2 = \left(\frac{2x}{n+1}\right)^{n+1}$
- $y = \left(\frac{2x}{n+1}\right)^n$
- $y = n(n+1)(x - (n+1))$

Q5 Difficulty Level: Easy

Knowledge Level: K1

There is a certain sequence of positive real numbers. Beginning from the third term, each term of the sequence is the sum of all the previous terms. The seventh term is equal to 1000 and the first term is equal to 1. The second term of this sequence is equal to

- 246
- $123/2$
- $123/4$
- 124

Q6 Difficulty Level: Easy

Knowledge Level: K1

What is the locus of a point which is equidistant from the point $(m + n, n - m)$ and the point $(m - n, n + m)$

- $mx = ny$
- $nx = -my$
- $nx = my$
- $mx = -ny$

Q7 Difficulty Level: Easy

Knowledge Level: K1

The cycloid through the origin, generated by a circle of radius r rolling over the x -axis on the positive side ($y \geq 0$), consists of the points (x, y) , with

$$x = r(t - \sin t)$$

$$y = r(1 - \cos t)$$

Then the locus of the cycloid will be

- $x = r \cos^{-1} \left(1 - \frac{y}{r} \right) - \sqrt{y(2r - y)}$
- $y = r \cos^{-1} \left(1 - \frac{x}{r} \right) - \sqrt{y(2r - x)}$
- $x = r(\sin y + \cos y)$
- $y = r(\sin x + \cos x)$

Q8 Difficulty Level: Easy

Knowledge Level: K1

A point moves such that its distance from the point $(4, 0)$ is half that of its distance from the line $x = 19$.
The locus of the point is

- $3x^2 + 4y^2 = 192$
- $4x^2 + 3y^2 = 192$
- $x^2 + y^2 = 192$
- None of these

Q9 Difficulty Level: Easy

Knowledge Level: K1

If $3^{(\log_3 7)^x} = 7^{(\log_7 3)^x}$, then value of x will be

- 1/2
- 1/4
- 1/3
- 1

Q10 Difficulty Level: Easy

Knowledge Level: K1

If $\cos 6\theta + \cos 4\theta + \cos 2\theta + 1 = 0$, where $0 < \theta < 180^\circ$, then θ

- $30^\circ, 45^\circ$
- $45^\circ, 90^\circ$
- $135^\circ, 150^\circ$
- $30^\circ, 45^\circ, 90^\circ, 135^\circ, 150^\circ$

Q11 Difficulty Level: Easy

Knowledge Level: K1

Solution of $\left|x + \frac{1}{x}\right| < 4$ is

- $(2 - \sqrt{3}, 2 + \sqrt{3}) \cup (-2 - \sqrt{3}, -2 + \sqrt{3})$
- $R - (2 - \sqrt{3}, 2 + \sqrt{3})$
- $R - (-2 - \sqrt{3}, -2 + \sqrt{3})$
- None of these

Q12 Difficulty Level: Easy

Knowledge Level: K1

A ray of light coming from the point $(1, 2)$ is reflected at a point A on the x-axis and then passed through point $(5, 3)$. The coordinates of the point A are

- $(13/5, 0)$
- $(5/13, 0)$
- $(-7, 0)$
- None of these

Q13 Difficulty Level: Easy

Knowledge Level: K1

If $r \sin \theta = 3, r = 4(1 + \sin \theta), 0 \leq \theta \leq 2\pi$ then $\theta =$

- $\frac{\pi}{6}, \frac{\pi}{3}$
- $\frac{\pi}{6}, \frac{5\pi}{6}$
- $\frac{\pi}{3}, \frac{\pi}{4}$
- $\frac{\pi}{2}, \pi$

Q14 Difficulty Level: Easy

Knowledge Level: K1

Axis of a parabola is $y = x$ and vertex and focus are at a distance $\sqrt{2}$ and $2\sqrt{2}$ respectively from the origin. Then, equation of the parabola is

- $(x - y)^2 = 8(x + y - 2)$
- $(x + y)^2 = 2(x + y - 2)$
- $(x - y)^2 = 4(x + y - 2)$
- $(x + y)^2 = 2(x - y + 2)$

Q15 Difficulty Level: Easy

Knowledge Level: K1

$$\text{If } \operatorname{cosec} \theta = \frac{p+q}{p-q}, \text{ then } \cot \left(\frac{\pi}{4} + \frac{\theta}{2} \right) =$$

- $\sqrt{\frac{p}{q}}$
- $\sqrt{\frac{q}{p}}$
- \sqrt{pq}
- pq

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Q17 Difficulty Level: Easy

Knowledge Level: K1

If $\cos x = \tan y$, $\cot y = \tan z$ and $\cot z = \tan x$ then $\sin x =$

- $\frac{\sqrt{5} + 1}{4}$
- $\frac{\sqrt{5} - 1}{4}$
- $\frac{\sqrt{5} + 1}{2}$
- $\frac{\sqrt{5} - 1}{2}$

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Q18 Difficulty Level: Easy

Knowledge Level: K1

A rod of fixed length k slides along the coordinate axes. If it meets the axes at $A(a,0)$ and $B(0,b)$ then

the minimum value of $\left(a + \frac{1}{a}\right)^2 + \left(b + \frac{1}{b}\right)^2$ is

- 0
- 8
- $k^2 - 4 + \frac{4}{k^2}$
- $k^2 + 4 + \frac{4}{k^2}$

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Q19 Difficulty Level: Easy

Knowledge Level: K1

Locus of middle point of all chords of $\frac{x^2}{4} - \frac{y^2}{9} = 1$. Which are at distance of '2' units from vertex of parabola $y^2 = -8ax$ is

- $\left(\frac{x^2}{4} + \frac{y^2}{9}\right) = \frac{xy}{6}$
- $\left(\frac{x^2}{4} - \frac{y^2}{9}\right)^2 = 4\left(\frac{x^2}{16} + \frac{y^2}{81}\right)$
- $\left(\frac{x^2}{4} + \frac{y^2}{9}\right)^2 = \left(\frac{x^2}{9} + \frac{y^2}{4}\right)$
- None of these

Q20 Difficulty Level: Easy**Knowledge Level: K1**

Statement 1 : An equation of a common tangent to the parabola $y^2 = 16\sqrt{3}x$ and the ellipse $2x^2 + y^2 = 4$ and $y = 2x + 2\sqrt{3}$

Statement 2 : If the line $y = mx + \frac{4\sqrt{3}}{m}$, ($m \neq 0$) is a common tangent to the parabola $y^2 = 16\sqrt{3}x$ and the ellipse $2x^2 + y^2 = 4$, then m satisfies $m^4 + 2m^2 = 24$

- Statement 1 is true, Statement 2 is true; Statement 2 is not a correct explanation for Statement 1.
- Statement 1 is true, Statement 2 is false.**
- Statement 1 is false, Statement 2 is true.**
- Statement 1 is true, Statement 2 is true; Statement 2 is a correct explanation for Statement 1.

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Section: Mathematics Section - B

Marks per question: 4

10 of 10 question(s) in this section will be shown to examinee

Examinee should answer any 5 question(s) out of the 10 question(s) shown

This section has negative marking for incorrect answer(s). 25% marks will be deducted for every incorrect answer.

Q1 Difficulty Level: Easy

Knowledge Level: K1

The mean square deviations of a set of observations x_1, x_2, \dots, x_n about a point c is defined to

$$\frac{1}{n} \sum_{i=1}^n (x_i - c)^2.$$

The mean square deviations about -1 and $+1$ of a set of observations are 7 and 3 , respectively. Find the variance of this set of observations.

SNo	Blank	Answers
1	Integers	i. 3

Q2 Difficulty Level: Easy

Knowledge Level: K1

The value of $6 + \log_{3/2} \left(\frac{1}{3\sqrt{2}} \sqrt{4 - \frac{1}{3\sqrt{2}} \sqrt{4 - \frac{1}{3\sqrt{2}} \sqrt{4 - \frac{1}{3\sqrt{2}} \dots}}} \right)$ is

SNo	Blank	Answers
1	Integers	i. 4

Q3 Difficulty Level: Easy

Knowledge Level: K1

The vertices of a triangle are $\left(pq, \frac{1}{pq}\right)$, $\left(qr, \frac{1}{qr}\right)$ and $\left(rp, \frac{1}{rp}\right)$ where p, q and r are the roots of equation $y^3 - 3y^2 + 6y + 1 = 0$. Find the sum of the coordinates of its centroid.

SNo	Blank	Answers
1	Integers	i. 1

Q4 Difficulty Level: Easy

Knowledge Level: K1

The coefficients of the $(r - 1)^{\text{th}}$, r^{th} and $(r + 1)^{\text{th}}$ terms in the expansion of $(x + 1)^n$ are in the ratio 1 : 3. Find $n + r$ _____.

SNo	Blank	Answers
1	Integers	i. 10

Q6 Difficulty Level: Easy

Knowledge Level: K1

$p^4 + q^3 = 2$ ($p > 0, q > 0$), if the maximum value of term independent of x in the expansion

$\left(px^{\frac{1}{12}} + qx^{-\frac{1}{9}} \right)^{14}$ is K then find the value of $\frac{2K}{14C_5}$

SNo	Blank	Answers
1	Integers	i. 3

Q7 Difficulty Level: Easy

Knowledge Level: K1

If $a = \log_{245} 175$ and $b = \log_{1715} 875$ then the value of $\frac{1-ab}{a-b}$ is _____

SNo	Blank	Answers
1	Integers	i. 5

Q9 Difficulty Level: Easy

Knowledge Level: K1

Let α and β be the roots of equation $x^2 - 6x - 2 = 0$. If $a_n = \alpha^n - \beta^n$, for $n \geq 1$ then the value

$$\frac{a_{12} - 2a_{10}}{2a_{11}} + \frac{a_{10} - 2a_8}{2a_9} = \underline{\hspace{2cm}}$$

SNo	Blank	Answers
1	Integers	i. 6

Q10 Difficulty Level: Easy

Knowledge Level: K1

The foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide. Then the value of

SNo	Blank	Answers
1	Integers	i. 7

