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A right Choice for the Real Aspirant



Central Office , Madhapur – Hyderabad

Jee-Main Online Paper-1

PHYSICS

Q.1

A transverse wave is represented by :

$$y = \frac{10}{\pi} \sin \left(\frac{2\pi}{T} t - \frac{2\pi}{\lambda} x \right)$$

For what value of the wavelength the wave velocity is twice the maximum particle velocity ?

- 1) 40 cm 2) 60 cm 3) 10 cm 4) 20 cm

Q.2

The magnetic field of earth at the equator is approximately 4×10^{-5} T. The radius of earth is 6.4×10^6 m. Then the dipole moment of the earth will be nearly of the order of :

- 1) 10^{20} A m² 2) 10^{23} A m² 3) 10^{10} A m² 4) 10^{16} A m²



Q.3

The magnitude of the average electric field normally present in the atmosphere just above the surface of the Earth is about 150 N/C , directed inward towards the center of the Earth. This gives the total net surface charge carried by the Earth to be :

[Given $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N-m}^2$,
 $R_E = 6.37 \times 10^6 \text{ m}$]

- 1) $+670 \text{ kC}$ 2) -670 kC 3) $+680 \text{ kC}$ 4) -680 kC

Q.4

Match **List I** (Wavelength range of electromagnetic spectrum) with **List II**. (Method of production of these waves) and select the **correct** option from the options given below the lists.

List I		List II	
(a)	700 nm to 1 mm	(i)	Vibration of atoms and molecules.
(b)	1 nm to 400 nm	(ii)	Inner shell electrons in atoms moving from one energy level to a lower level.
(c)	$< 10^{-3} \text{ nm}$	(iii)	Radioactive decay of the nucleus.
(d)	1 mm to 0.1 m	(iv)	Magnetron valve.

- 1) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv) 2) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
 3) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii) 4) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)



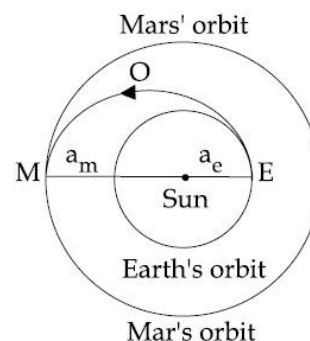
Q.5

When the rms voltages V_L , V_C and V_R are measured respectively across the inductor L , the capacitor C and the resistor R in a series LCR circuit connected to an AC source, it is found that the ratio $V_L : V_C : V_R = 1 : 2 : 3$. If the rms voltage of the AC source is 100 V, then V_R is close to :

- 1) 70 V 2) 100 V 3) 50 V 4) 90 V

Q.6

India's Mangalyan was sent to the Mars by launching it into a transfer orbit EOM around the sun. It leaves the earth at E and meets Mars at M. If the semi-major axis of Earth's orbit is $a_e = 1.5 \times 10^{11}$ m, that of Mar's orbit $a_m = 2.28 \times 10^{11}$ m, taken Kepler's laws give the estimate of time for Mangalyan to reach Mars from Earth to be close to :



- 1) 320 days 2) 260 days 3) 500 days 4) 220 days

Q.7

In materials like aluminium and copper, the correct order of magnitude of various elastic moduli is :

- | | |
|---|---|
| 1) Bulk moduli < Young's moduli < shear moduli. | 2) Young's moduli < shear moduli < bulk moduli. |
| 3) Bulk moduli < shear moduli < Young's moduli. | 4) Shear moduli < Young's moduli < bulk moduli. |

**Q.8**

Water of volume 2 L in a closed container is heated with a coil of 1 kW. While water is heated, the container loses energy at a rate of 160 J/s. In how much time will the temperature of water rise from 27°C to 77°C ? (Specific heat of water is 4.2 kJ/kg and that of the container is negligible).

- 1) 6 min 2 s 2) 14 min 3) 7 min 4) 8 min 20 s

Q.9

An experiment is performed to obtain the value of acceleration due to gravity g by using a simple pendulum of length L . In this experiment time for 100 oscillations is measured by using a watch of 1 second least count and the value is 90.0 seconds. The length L is measured by using a meter scale of least count 1 mm and the value is 20.0 cm. The error in the determination of g would be :

- 1) 1.7% 2) 4.4% 3) 2.7% 4) 2.27%

Q.10

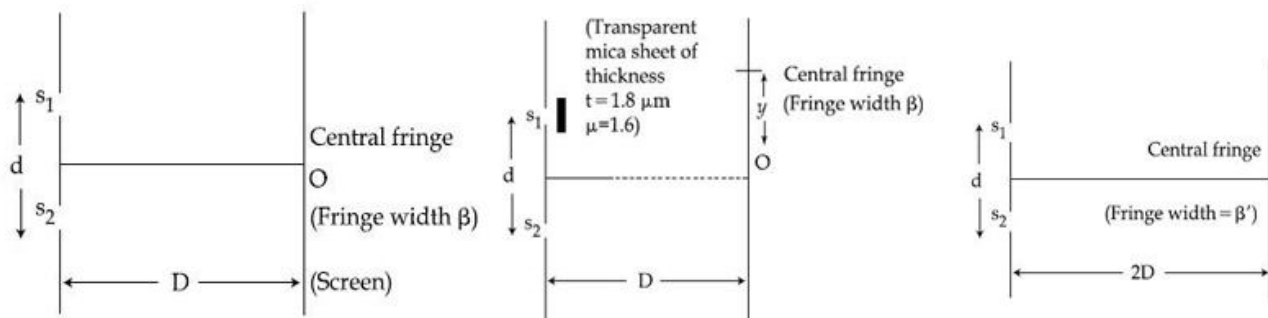
If the binding energy of the electron in a hydrogen atom is 13.6 eV, the energy required to remove the electron from the first excited state of Li^{++} is :

- 1) 30.6 eV 2) 3.4 eV 3) 13.6 eV 4) 122.4 eV

**Q.11**

Using monochromatic light of wavelength λ , an experimentalist sets up the Young's double slit experiment in three ways as shown.

If she observes that $y = \beta'$, the wavelength of light used is :



- 1) 560 nm 2) 540 nm 3) 520 nm 4) 580 nm

Q.12

A transmitting antenna at the top of a tower has a height 32 m and the height of the receiving antenna is 50 m. What is the maximum distance between them for satisfactory communication in line of sight (LOS) mode ?

- 1) 45.5 km 2) 54.5 km 3) 455 km 4) 55.4 km

Q.13



Water is flowing at a speed of 1.5 ms^{-1} through a horizontal tube of cross-sectional area 10^{-2} m^2 and you are trying to stop the flow by your palm. Assuming that the water stops immediately after hitting the palm, the minimum force that you must exert should be (density of water = 10^3 kgm^{-3}).

- 1) 15 N 2) 22.5 N 3) 33.7 N 4) 45 N

Q.14

Modern vacuum pumps can evacuate a vessel down to a pressure of $4.0 \times 10^{-15} \text{ atm}$. at room temperature (300 K). Taking $R = 8.3 \text{ JK}^{-1} \text{ mole}^{-1}$, $1 \text{ atm} = 10^5 \text{ Pa}$ and $N_{\text{Avogadro}} = 6 \times 10^{23} \text{ mole}^{-1}$, the mean distance between molecules of gas in an evacuated vessel will be of the order of :

- 1) 0.2 nm 2) 0.2 cm 3) 0.2 mm 4) 0.2 μm

Q.15



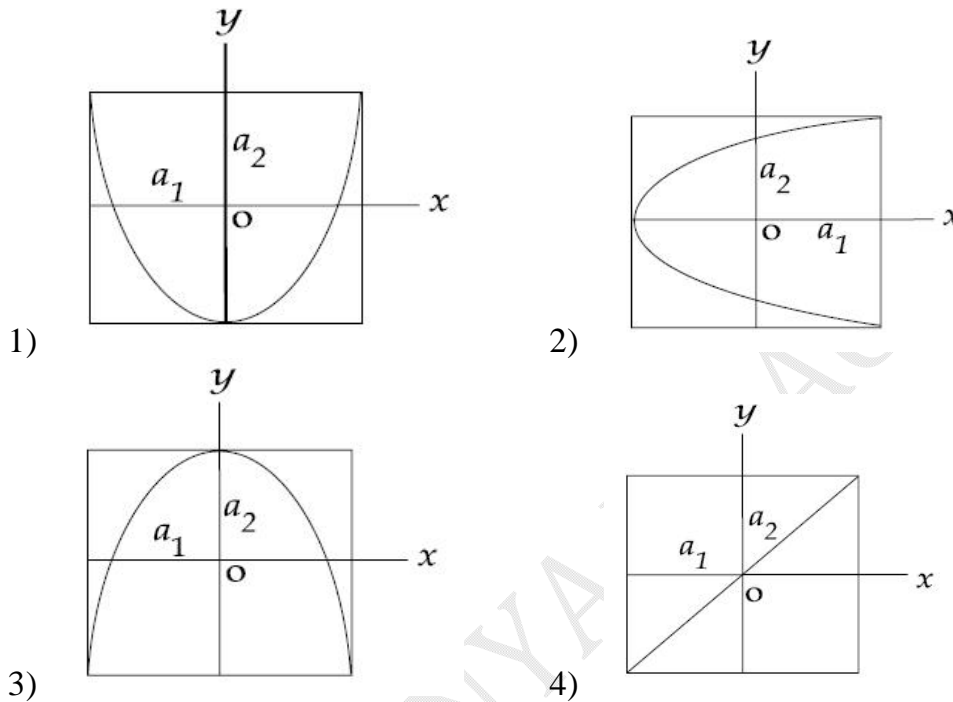
The equation of state for a gas is given by $PV = nRT + \alpha V$, where n is the number of moles and α is a positive constant. The initial temperature and pressure of one mole of the gas contained in a cylinder are T_0 and P_0 respectively. The work done by the gas when its temperature doubles isobarically will be :

- 1) $\frac{P_0 T_0 R}{P_0 - \alpha}$ 2) $P_0 T_0 R \ln 2$ 3) $P_0 T_0 R$ 4) $\frac{P_0 T_0 R}{P_0 + \alpha}$

Q.16



A particle which is simultaneously subjected to two perpendicular simple harmonic motions represented by ; $x = a_1 \cos \omega t$ and $y = a_2 \cos 2\omega t$ traces a curve given by :



Q.17

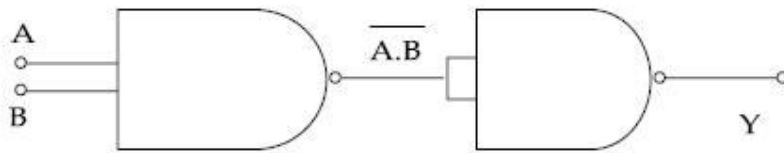
A block A of mass 4 kg is placed on another block B of mass 5 kg, and the block B rests on a smooth horizontal table. If the minimum force that can be applied on A so that both the blocks move together is 12 N, the maximum force that can be applied on B for the blocks to move together will be :

- 1) 25 N 2) 30 N 3) 48 N 4) 27 N

Q.18



Identify the gate and match A, B, Y in bracket to check.



- | | |
|----------------------------|----------------------------|
| 1) AND ($A=1, B=1, Y=1$) | 2) NOT ($A=1, B=1, Y=1$) |
| 3) OR ($A=1, B=1, Y=0$) | 4) XOR ($A=0, B=0, Y=0$) |

Q.19

The position of a projectile launched from the origin at $t=0$ is given by $\vec{r} = (40\hat{i} + 50\hat{j})$ m at $t=2$ s. If the projectile was launched at an angle θ from the horizontal, then θ is (take $g = 10 \text{ ms}^{-2}$).

- | | | | |
|----------------------------|----------------------------|----------------------------|----------------------------|
| 1) $\tan^{-1} \frac{2}{3}$ | 2) $\tan^{-1} \frac{4}{5}$ | 3) $\tan^{-1} \frac{7}{4}$ | 4) $\tan^{-1} \frac{3}{2}$ |
|----------------------------|----------------------------|----------------------------|----------------------------|

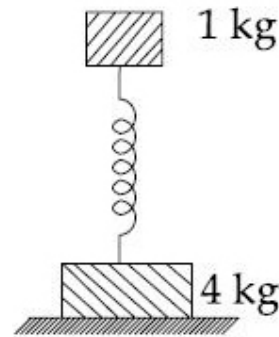
Q.20

A d.c. main supply of e.m.f. 220 V is connected across a storage battery of e.m.f. 200 V through a resistance of 1Ω . The battery terminals are connected to an external resistance 'R'. The minimum value of 'R', so that a current passes through the battery to charge it is :

- | | | | |
|---------|---------------|---------------|----------------|
| 1) Zero | 2) 7Ω | 3) 9Ω | 4) 11Ω |
|---------|---------------|---------------|----------------|

**Q.21**

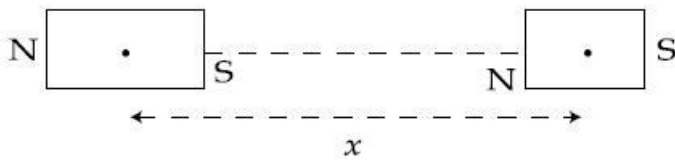
Two bodies of masses 1 kg and 4 kg are connected to a vertical spring, as shown in the figure. The smaller mass executes simple harmonic motion of angular frequency 25 rad/s, and amplitude 1.6 cm while the bigger mass remains stationary on the ground. The maximum force exerted by the system on the floor is (take $g = 10 \text{ ms}^{-2}$).



- 1) 10 N 2) 60 N 3) 20 N 4) 40 N

Q.22

The mid points of two small magnetic dipoles of length d in end-on positions, are separated by a distance x , ($x \gg d$). The force between them is proportional to x^{-n} where n is :



- 1) 1 2) 4 3) 3 4) 2

Q.23

An n-p-n transistor has three leads A, B and C. Connecting B and C by moist fingers, A to the positive lead of an ammeter, and C to the negative lead of the ammeter, one finds large deflection. Then, A, B and C refer respectively to :

- 1) Base, emitter and collector 2) Emitter, base and collector
3) Collector, emitter and base. 4) Base, collector and emitter

**Q.24**

The amplitude of a simple pendulum, oscillating in air with a small spherical bob, decreases from 10 cm to 8 cm in 40 seconds. Assuming that Stokes law is valid, and ratio of the coefficient of viscosity of air to that of carbon dioxide is 1.3, the time in which amplitude of this pendulum will reduce from 10 cm to 5 cm in carbondioxide will be close to ($\ln 5 = 1.601$, $\ln 2 = 0.693$).

- 1) 142 s 2) 208 s 3) 231 s 4) 161 s

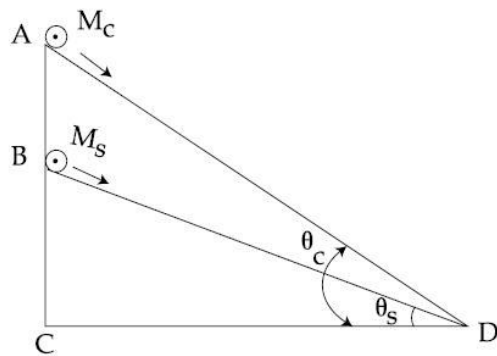
Q.25

A diver looking up through the water sees the outside world contained in a circular horizon. The refractive index of water is $\frac{4}{3}$, and the diver's eyes are 15 cm below the surface of water. Then the radius of the circle is :

- 1) $15 \times 3 \sqrt{7}$ cm 2) $\frac{15 \times 3}{\sqrt{7}}$ cm 3) $\frac{15 \times \sqrt{7}}{3}$ cm 4) $15 \times 3 \times \sqrt{5}$ cm

Q.26

A cylinder of mass M_c and sphere of mass M_s are placed at points A and B of two inclines, respectively. (See Figure). If they roll on the incline without slipping such that their accelerations are the same, then the ratio $\frac{\sin \theta_c}{\sin \theta_s}$ is :



- 1) $\frac{8}{7}$ 2) $\sqrt{\frac{15}{14}}$ 3) $\frac{15}{14}$ 4) $\sqrt{\frac{8}{7}}$

**Q.27**

For which of the following particles will it be most difficult to experimentally verify the de-Broglie relationship ?

- 1) an α -particle 2) a dust particle 3) an electron 4) a proton

Q.28

The focal lengths of objective lens and eye lens of a Galileian Telescope are respectively 30 cm and 3.0 cm. Telescope produces virtual, erect image of an object situated far away from it at least distance of distinct vision from the eye lens. In this condition, the Magnifying Power of the Galileian Telescope should be :

- 1) +11.2 2) +8.8 3) -8.8 4) -11.2

Q.29

A capillary tube is immersed vertically in water and the height of the water column is x . When this arrangement is taken into a mine of depth d , the height of the water column is y . If R is the radius of earth, the ratio $\frac{x}{y}$ is :

- 1) $\left(1 - \frac{d}{R}\right)$ 2) $\left(\frac{R-d}{R+d}\right)$ 3) $\left(1 - \frac{2d}{R}\right)$ 4) $\left(\frac{R+d}{R-d}\right)$

Q.30

Three capacitances, each of $3 \mu\text{F}$, are provided. These cannot be combined to provide the resultant capacitance of :

- 1) $1 \mu\text{F}$ 2) $2 \mu\text{F}$ 3) $6 \mu\text{F}$ 4) $4.5 \mu\text{F}$



CHEMISTRY

Q.31

The standard enthalpy of formation of NH_3 is -46.0 kJ/mol . If the enthalpy of formation of H_2 from its atoms is -436 kJ/mol and that of N_2 is -712 kJ/mol , the average bond enthalpy of $\text{N}-\text{H}$ bond in NH_3 is :

- | | |
|---------------------------|---------------------------|
| 1) $+1056 \text{ kJ/mol}$ | 2) -1102 kJ/mol |
| 3) -964 kJ/mol | 4) $+352 \text{ kJ/mol}$ |

Q.32

Which one of the following reactions will not result in the formation of carbon-carbon bond ?

- | | |
|------------------------|------------------------------|
| 1) Wurtz reaction | 2) Friedel Craft's acylation |
| 3) Cannizzaro reaction | 4) Reimer-Tieman reaction |

Q.33

The standard electrode potentials

$\left(E_{M^+/M}^{\circ}\right)$ of four metals A, B, C and D are

-1.2 V , 0.6 V , 0.85 V and -0.76 V ,

respectively. The sequence of deposition of metals on applying potential is :

- | | | | |
|---------------|---------------|---------------|---------------|
| 1) B, D, C, A | 2) D, A, B, C | 3) C, B, D, A | 4) A, C, B, D |
|---------------|---------------|---------------|---------------|

Q.34

Which of the following is **not** formed when H_2S reacts with acidic $\text{K}_2\text{Cr}_2\text{O}_7$ solution ?

- | | | | |
|---------------------------------|----------------------------|--------------------|------|
| 1) $\text{Cr}_2(\text{SO}_4)_3$ | 2) K_2SO_4 | 3) CrSO_4 | 4) S |
|---------------------------------|----------------------------|--------------------|------|

**Q.35**

Which one of the following class of compounds is obtained by polymerization of acetylene ?

- 1) Poly-amide 2) Poly-ester 3) Poly-ene 4) Poly-yne

Q.36

A current of 10.0 A flows for 2.00 h through an electrolytic cell containing a molten salt of metal X. This results in the decomposition of 0.250 mol of metal X at the cathode. The oxidation state of X in the molten salt is : ($F = 96,500 \text{ C}$)

- 1) $1+$ 2) $4+$ 3) $3+$ 4) $2+$

Q.37

In a face centered cubic lattice atoms A are at the corner points and atoms B at the face centered points. If atom B is missing from one of the face centered points, the formula of the ionic compound is :

- 1) AB_2 2) A_2B_5 3) A_5B_2 4) A_2B_3

Q.38

The form of iron obtained from blast furnace is :

- 1) Pig Iron 2) Wrought Iron 3) Cast Iron 4) Steel

**Q.39**

Van der Waal's equation for a gas is stated as,

$$p = \frac{nRT}{V - nb} - a \left(\frac{n}{V} \right)^2$$

This equation reduces to the perfect gas

equation, $p = \frac{nRT}{V}$ when ,

temperature is sufficiently high and

- 1) pressure is low.
- 2) both temperature and pressure are very high.
- 3) temperature is sufficiently low and pressure is high.
- 4) both temperature and pressure are very low.

Q.40

Which is the major product formed when acetone is heated with iodine and potassium hydroxide ?

- | | |
|----------------|-----------------|
| 1) Iodoacetone | 2) Acetophenone |
| 3) Iodoform | 4) Acetic acid |

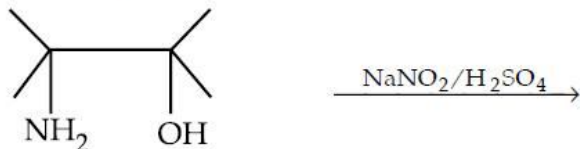
Q.41

Structure of some important polymers are given. Which one represents Buna-S ?

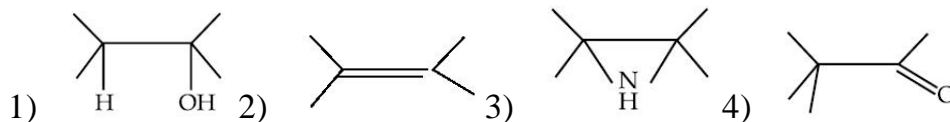
- | | |
|---|--|
| 1) $(-\text{CH}_2-\text{CH}=\text{CH}-\text{CH}_2-\underset{\text{C}_6\text{H}_5}{\text{CH}}-\text{CH}_2-)_n$ | 2) $(-\text{CH}_2-\overset{\text{CH}_3}{\underset{ }{\text{C}}}=\text{CH}-\text{CH}_2-)_n$ |
| 3) $(-\text{CH}_2-\text{CH}=\text{CH}-\text{CH}_2-\underset{\text{CN}}{\text{CH}}-\text{CH}_2-)_n$ | 4) $(-\text{CH}_2-\overset{\text{Cl}}{\underset{ }{\text{C}}}=\text{CH}-\text{CH}_2-)_n$ |

**Q.42**

The major product of the reaction



is :

**Q.43**

The energy of an electron in first Bohr orbit of H - atom is -13.6 eV. The energy value of electron in the excited state of Li^{2+} is :

- 1) 27.2 eV 2) -27.2 eV 3) 30.6 eV 4) -30.6 eV

Q.44

The temperature at which oxygen molecules have the same root mean square speed as helium atoms have at 300 K is :

(Atomic masses : He = 4 u, O = 16 u)

- 1) 600 K 2) 300 K 3) 1200 K 4) 2400 K

Q.45

Allyl phenyl ether can be prepared by heating :

- 1) $\text{C}_6\text{H}_5 - \text{CH} = \text{CH} - \text{Br} + \text{CH}_3 - \text{ONa}$
2) $\text{CH}_2 = \text{CH} - \text{Br} + \text{C}_6\text{H}_5 - \text{CH}_2 - \text{ONa}$
3) $\text{C}_6\text{H}_5\text{Br} + \text{CH}_2 = \text{CH} - \text{CH}_2 - \text{ONa}$
4) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{Br} + \text{C}_6\text{H}_5\text{ONa}$

**Q.46**

The correct statement about the magnetic properties of $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{FeF}_6]^{3-}$ is : ($Z = 26$).

- $[\text{Fe}(\text{CN})_6]^{3-}$ is diamagnetic,
- 1) $[\text{FeF}_6]^{3-}$ is paramagnetic.
 - 2) both are paramagnetic.
 - 3) both are diamagnetic.
 - 4) $[\text{Fe}(\text{CN})_6]^{3-}$ is paramagnetic, $[\text{FeF}_6]^{3-}$ is diamagnetic.

Q.47

The number and type of bonds in C_2^{2-} ion in CaC_2 are :

- 1) Two σ bonds and one π - bond
- 2) One σ bond and two π - bonds
- 3) Two σ bonds and two π - bonds
- 4) One σ bond and one π - bond

Q.48

An octahedral complex of Co^{3+} is diamagnetic. The hybridisation involved in the formation of the complex is :

- 1) d^2sp^3 2) dsp^3d 3) sp^3d^2 4) dsp^2

Q.49

Which of the following has unpaired electron(s) ?

- 1) N_2^{2+} 2) O_2^- 3) O_2^{2-} 4) N_2

**Q.50**

In the hydroboration - oxidation reaction of propene with diborane, H_2O_2 and NaOH , the organic compound formed is :

- | | |
|---|--------------------------------------|
| 1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ | 2) $\text{CH}_3\text{CHOHCH}_3$ |
| 3) $(\text{CH}_3)_3\text{COH}$ | 4) $\text{CH}_3\text{CH}_2\text{OH}$ |

Q.51

In the following sets of reactants which two sets best exhibit the amphoteric character of $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$?

Set 1 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ (s) and OH^- (aq)

Set 2 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ (s) and H_2O (l)

Set 3 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ (s) and H^+ (aq)

Set 4 : $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ (s) and NH_3 (aq)

- | | | | |
|------------|------------|------------|------------|
| 1) 1 and 2 | 2) 1 and 3 | 3) 3 and 4 | 4) 2 and 4 |
|------------|------------|------------|------------|

Q.52

At a certain temperature, only 50% HI is dissociated into H_2 and I_2 at equilibrium.

The equilibrium constant is :

- | | | | |
|---------|--------|--------|--------|
| 1) 0.25 | 2) 1.0 | 3) 0.5 | 4) 3.0 |
|---------|--------|--------|--------|

Q.53

Dissolving 120 g of a compound of (mol. wt. 60) in 1000 g of water gave a solution of density 1.12 g/mL. The molarity of the solution is :

- | | | | |
|-----------|-----------|-----------|-----------|
| 1) 1.00 M | 2) 2.00 M | 3) 2.50 M | 4) 4.00 M |
|-----------|-----------|-----------|-----------|



Q.54

In which of the following pairs A is more stable than B ?

- | | A | B |
|----|-------------------------------|-----------------------------------|
| 1) | | |
| 2) | $\text{Ph}_3\text{C}^\bullet$ | $(\text{CH}_3)_3\text{C}^\bullet$ |
| 3) | | |
| 4) | | |

Q.55

In a nucleophilic substitution reaction :



which one of the following undergoes complete inversion of configuration ?

- | | |
|--|--|
| 1) $\text{C}_6\text{H}_5\text{CCH}_3\text{C}_6\text{H}_5\text{Br}$ | 2) $\text{C}_6\text{H}_5\text{CHC}_6\text{H}_5\text{Br}$ |
| 3) $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$ | 4) $\text{C}_6\text{H}_5\text{CHCH}_3\text{Br}$ |

Q.56

The half-life period of a first order reaction is 15 minutes. The amount of substance left after one hour will be :

- | | |
|--|--|
| 1) $\frac{1}{32}$ of the original amount | 2) $\frac{1}{16}$ of the original amount |
| 3) $\frac{1}{4}$ of the original amount | 4) $\frac{1}{8}$ of the original amount |

**Q.57**

The gas evolved on heating CaF_2 and SiO_2 with concentrated H_2SO_4 on hydrolysis gives a white gelatinous precipitate. The precipitate is :

- | | |
|--------------------------|--------------------------|
| 1) hydrofluosilicic acid | 2) silica gel |
| 3) silicic acid | 4) calciumfluorosilicate |

Q.58

Chloro compound of Vanadium has only spin magnetic moment of 1.73 BM. This Vanadium chloride has the formula :
(at. no. of V = 23)

- | | | | |
|-------------------|-------------------|-------------------|-------------------|
| 1) VCl_5 | 2) VCl_2 | 3) VCl_3 | 4) VCl_4 |
|-------------------|-------------------|-------------------|-------------------|

Q.59

For the compounds CH_3Cl , CH_3Br , CH_3I and CH_3F , the correct order of increasing C-halogen bond length is :

- | | |
|--|--|
| 1) $\text{CH}_3\text{Cl} < \text{CH}_3\text{Br} < \text{CH}_3\text{F} < \text{CH}_3\text{I}$ | 2) $\text{CH}_3\text{F} < \text{CH}_3\text{Br} < \text{CH}_3\text{Cl} < \text{CH}_3\text{I}$ |
| 3) $\text{CH}_3\text{F} < \text{CH}_3\text{Cl} < \text{CH}_3\text{Br} < \text{CH}_3\text{I}$ | 4) $\text{CH}_3\text{F} < \text{CH}_3\text{I} < \text{CH}_3\text{Br} < \text{CH}_3\text{Cl}$ |

Q.60

The amount of oxygen in 3.6 moles of water is :

- | | | | |
|-----------|-----------|-----------|------------|
| 1) 57.6 g | 2) 18.4 g | 3) 28.8 g | 4) 115.2 g |
|-----------|-----------|-----------|------------|



MATHEMATICS

Q.61

If OB is the semi-minor axis of an ellipse, F_1 and F_2 are its foci and the angle between F_1B and F_2B is a right angle, then the square of the eccentricity of the ellipse is :

- 1) $\frac{1}{2}$ 2) $\frac{1}{4}$ 3) $\frac{1}{2\sqrt{2}}$ 4) $\frac{1}{\sqrt{2}}$

Q.62

Let P be the relation defined on the set of all real numbers such that

$P = \{(a, b) : \sec^2 a - \tan^2 b = 1\}$. Then P is :

- 1) reflexive and symmetric but not transitive. 2) reflexive and transitive but not symmetric.
- 3) symmetric and transitive but not reflexive. 4) an equivalence relation.

Q.63

Given three points P, Q, R with P(5, 3) and R lies on the x-axis. If equation of RQ is $x - 2y = 2$ and PQ is parallel to the x-axis, then the centroid of ΔPQR lies on the line :

- 1) $2x - 5y = 0$ 2) $2x + y - 9 = 0$
- 3) $x - 2y + 1 = 0$ 4) $5x - 2y = 0$

**Q.64**

The sum of the digits in the unit's place of all the 4-digit numbers formed by using the numbers 3, 4, 5 and 6, without repetition, is :

- 1) 108 2) 432 3) 36 4) 18

Q.65

A line in the 3-dimensional space makes an angle θ $\left(0 < \theta \leq \frac{\pi}{2}\right)$ with both the x and y axes. Then the set of all values of θ is the interval :

- 1) $\left[\frac{\pi}{6}, \frac{\pi}{3}\right]$ 2) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$ 3) $\left(0, \frac{\pi}{4}\right]$ 4) $\left(\frac{\pi}{3}, \frac{\pi}{2}\right]$

Q.66

If $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $|2\vec{a} - \vec{b}| = 5$, then

$|2\vec{a} + \vec{b}|$ equals :

- 1) 7 2) 17 3) 1 4) 5

Q.67

If a, b, c are non-zero real numbers and if the system of equations

$$(a-1)x = y+z,$$

$$(b-1)y = z+x,$$

$$(c-1)z = x+y,$$

has a non-trivial solution, then

$ab+bc+ca$ equals :

- 1) abc 2) -1 3) $a+b+c$ 4) 1

**Q.68**

If $\frac{1}{\sqrt{\alpha}}$ and $\frac{1}{\sqrt{\beta}}$ are the roots of the equation, $ax^2 + bx + 1 = 0$ ($a \neq 0, a, b \in \mathbf{R}$), then the equation, $x(x + b^3) + (a^3 - 3abx) = 0$ has roots :

- 1) $\alpha \beta^{1/2}$ and $\alpha^{1/2} \beta$ 2) $\sqrt{\alpha \beta}$ and $\alpha \beta$
3) $\alpha^{-3/2}$ and $\beta^{-3/2}$ 4) $\alpha^{3/2}$ and $\beta^{3/2}$

Q.69

Equation of the plane which passes through the point of intersection of lines

$$\frac{x-1}{3} = \frac{y-2}{1} = \frac{z-3}{2} \text{ and}$$

$$\frac{x-3}{1} = \frac{y-1}{2} = \frac{z-2}{3}$$

and has the largest distance from the origin is :

- 1) $4x + 3y + 5z = 50$ 2) $5x + 4y + 3z = 57$
3) $3x + 4y + 5z = 49$ 4) $7x + 2y + 4z = 54$

Q.70

If $\operatorname{cosec} \theta = \frac{p+q}{p-q}$ ($p \neq q \neq 0$), then

$\left| \cot \left(\frac{\pi}{4} + \frac{\theta}{2} \right) \right|$ is equal to :

- 1) pq 2) $\sqrt{\frac{q}{p}}$ 3) $\sqrt{\frac{p}{q}}$ 4) \sqrt{pq}

**Q.71**

If $f(x)$ is continuous and $f\left(\frac{9}{2}\right) = \frac{2}{9}$, then

$\lim_{x \rightarrow 0} f\left(\frac{1 - \cos 3x}{x^2}\right)$ is equal to :

- 1) $\frac{2}{9}$ 2) 0 3) $\frac{8}{9}$ 4) $\frac{9}{2}$

Q.72

If equations $ax^2 + bx + c = 0$,
($a, b, c \in \mathbb{R}, a \neq 0$) and $2x^2 + 3x + 4 = 0$ have
a common root, then $a : b : c$ equals :

- 1) $1 : 2 : 3$ 2) $4 : 3 : 2$ 3) $2 : 3 : 4$ 4) $3 : 2 : 1$

Q.73

Let a and b be any two numbers satisfying

$$\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{4}.$$

Then, the foot of perpendicular from the origin on the

variable line, $\frac{x}{a} + \frac{y}{b} = 1$, lies on :

- 1) a circle of radius = 2 2) a hyperbola with each semi-axis = 2.
3) a circle of radius = $\sqrt{2}$ 4) a hyperbola with each semi-axis = $\sqrt{2}$.

Q.74

Let w ($\text{Im } w \neq 0$) be a complex number.

Then the set of all complex numbers z
satisfying the equation $w - \bar{w}z = k(1 - z)$,
for some real number k , is :

- 1) $\{z : z = \bar{z}\}$ 2) $\{z : |z| = 1, z \neq 1\}$
3) $\{z : z \neq 1\}$ 4) $\{z : |z| = 1\}$

**Q.75**

Let $A = \{(x, y) : y^2 \leq 4x, y - 2x \geq -4\}$. The area (in square units) of the region A is :

- 1) 8 2) 10 3) 11 4) 9

Q.76

If the differential equation representing the family of all circles touching x -axis at the

origin is $(x^2 - y^2) \frac{dy}{dx} = g(x) y$, then $g(x)$ equals :

- 1) $\frac{1}{2}x^2$ 2) $\frac{1}{2}x$ 3) $2x^2$ 4) $2x$

Q.77

In a set of $2n$ distinct observations, each of the observation below the median of all the observations is increased by 5 and each of the remaining observations is decreased by 3. Then the mean of the new set of observations :

- 1) decreases by 1. 2) increases by 1.
3) increases by 2. 4) decreases by 2.

Q.78

The number of terms in the expansion of $(1+x)^{101} (1+x^2-x)^{100}$ in powers of x is :

- 1) 302 2) 301 3) 101 4) 202

**Q.79**

If the point $(1, 4)$ lies inside the circle $x^2 + y^2 - 6x - 10y + p = 0$ and the circle does not touch or intersect the coordinate axes, then the set of all possible values of p is the interval :

- 1) $(25, 29)$ 2) $(0, 25)$ 3) $(25, 39)$ 4) $(9, 25)$

Q.80

The integral $\int_0^{\frac{1}{2}} \frac{\ln(1+2x)}{1+4x^2} dx$, equals :

- 1) $\frac{\pi}{16} \ln 2$ 2) $\frac{\pi}{8} \ln 2$ 3) $\frac{\pi}{4} \ln 2$ 4) $\frac{\pi}{32} \ln 2$

Q.81

If A and B are two events such that $P(A \cup B) = P(A \cap B)$, then the **incorrect** statement amongst the following statements is :

- 1) $P(A \cap B') = 0$ 2) $P(A) + P(B) = 1$
3) A and B are equally likely 4) $P(A' \cap B) = 0$

Q.82

Given an A.P. whose terms are all positive integers. The sum of its first nine terms is greater than 200 and less than 220. If the second term in it is 12, then its 4th term is :

- 1) 8 2) 20 3) 24 4) 16

**Q.83**

The number of values of α in $[0, 2\pi]$ for which $2 \sin^3 \alpha - 7 \sin^2 \alpha + 7 \sin \alpha = 2$, is :

- 1) 4 2) 6 3) 3 4) 1

Q.84

The contrapositive of the statement "I go to school if it does not rain" is :

- 1) If I do not go to school, it rains.
2) If it rains, I do not go to school.
3) If it rains, I go to school.
4) If I go to school, it rains.

Q.85

If $f(x) = \left(\frac{3}{5}\right)^x + \left(\frac{4}{5}\right)^x - 1$, $x \in \mathbf{R}$, then the equation $f(x) = 0$ has :

- 1) two solutions 2) more than two solutions
3) no solution 4) one solution

$\int \frac{\sin^8 x - \cos^8 x}{(1 - 2 \sin^2 x \cos^2 x)} dx$ is equal to :

Q.86

- 1) $-\sin^2 x + c$ 2) $\frac{1}{2} \sin 2x + c$ 3) $-\frac{1}{2} \sin x + c$ 4) $-\frac{1}{2} \sin 2x + c$

Q.87



If the sum

$$\frac{3}{1^2} + \frac{5}{1^2 + 2^2} + \frac{7}{1^2 + 2^2 + 3^2} + \dots + \text{upto}$$

20 terms is equal to $\frac{k}{21}$, then k is equal to :

- 1) 240 2) 120 3) 180 4) 60

Q.88

If $y = e^{nx}$, then $\left(\frac{d^2 y}{dx^2}\right)\left(\frac{d^2 x}{dy^2}\right)$ is equal to :

- 1) 1 2) $n e^{-nx}$ 3) $n e^{nx}$ 4) $-n e^{-nx}$

Q.89

If the Rolle's theorem holds for the function $f(x) = 2x^3 + ax^2 + bx$ in the interval

$[-1, 1]$ for the point $c = \frac{1}{2}$, then the value of $2a + b$ is :

- 1) 2 2) -2 3) -1 4) 1

Q.90

If B is a 3×3 matrix such that $B^2 = 0$, then $\det. [(I + B)^{50} - 50B]$ is equal to :

- 1) 50 2) 3 3) 1 4) 2



KEY SHEET

Physics:

1) 1	2) 2	3) 4	4) 1	5) 4	6) 2	7) 4	8) 4	9) 3	10) 1
11) 2	12) 1	13) 2	14) 3	15) 1	16) 1	17) -	18) 1	19) 3	20) 4
21) 2	22) 2	23) 4	24) 4	25) 2	26) 3	27) 2	28) 4	29) 1	30) 1

Chemistry:

31) 4	32) 3	33) 3	34) 3	35) 3	36) 3	37) 2	38) 1	39) 1	40) 3
41) 1	42) 4	43) 4	44) 4	45) 4	46) 2	47) 2	48) 1	49) 2	50) 1
51) 2	52) 1	53) 2	54) 2	55) 3	56) 2	57) 3	58) 4	59) 3	60) 1

Mathematics:

61) 1	62) 3	63) 1	64) 1	65) 2	66) 4	67) 1	68) 4	69) 1	70) 2
71) 1	72) 3	73) 1	74) 2	75) 4	76) 4	77) 2	78) 4	79) 1	80) 1
81) 2	82) 2	83) 3	84) 2	85) 4	86) 4	87) 2	88) 4	89) 3	90) 3