

Class: XI[Science]
Subject: Physics (1011)

Full Mark: 75
Time: 3 Hours

Candidates are required to give their answers in their own words as far as practicable. The figures in the margins indicate full marks.

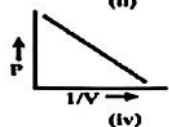
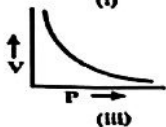
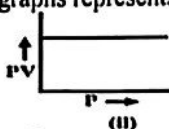
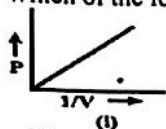
Group 'A'

[11×1=11]

Rewrite the correct options of each questions in your answer sheet.

- Which of the following is dimensionless quantity?
a) frequency
b) power of lens
c) strain
d) all of above
- Dot or Scalar product of the vectors $A=2i-3j+3k$ and $B=2j+2k$ is
a) Zero
b) 6
c) 12
d) 13
- The maximum value of static friction when the body is at the verge of starting motion is known as
a) Static friction *or relative motion*
b) Limiting friction
c) Dynamic friction *relative motion*
d) Angle of repose
- A man pushes a wall but fails to displace it is...
a) positive work
b) negative work
c) no work at all
d) non
- An ant moves towards the plane mirror with speed of 2 m/s. What is the relative velocity between the ant and its image?
a) 6 m/s
b) 2 m/s
c) 8 m/s
d) 4 m/s
- The temperature of a body increases by 50°C , then the increase in temperature in absolute scale will be
a) 60K
b) 55K
c) 50K
d) 45K
- When heat is transferred from hot body to cold body, in a straight line, without affecting the intervening medium, it is referred as heat transfer by
a) conduction
b) convection
c) radiation
d) conduction and radiation

8. Which of the following graphs represents the correct Boyle's law?



- a) i
b) ii
c) iii
c) iv

9. 1 C charge contains the following number of electrons.

- a) 1.6×10^{-17}
b) 1.6×10^{-18}
c) 1.6×10^{-19}
d) 1.6×10^{-20}

10. Holes are majority charge carriers in

- a) N-type semiconductor
b) Mixed type semiconductor
c) P-type semiconductor
d) All of the above

11. Which is the particle-antiparticle pair?

- a) electron and proton
b) electron and positron
c) proton and neutron
d) electron and neutron

Group "B"

[8×5=40]

12. a) Define centripetal force.

b) What is the role of frictional force between the road and tyre of a vehicle while taking turn? What happens if there is no frictional force? 1+1

c) A mass of 1 kg is attached to the lower end of a string 1 m long whose upper end is fixed. The mass is made to rotate in a horizontal circle of radius 60 cm. If the circular speed of the mass is constant, calculate the tension in the string. 2

13. The velocity-time graph of a truck is plotted as shown.

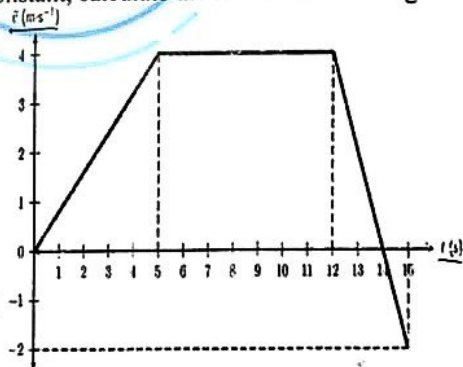
Calculate i) Total distance covered

by the truck after 15 s. 2

ii) The total displacement of the truck after 15 s. 1

iii) Acceleration of the truck at 10th second. 1

iv) Explain the motion of the truck at exactly 14th second. 1



$$\frac{v-u}{t}$$

14. a) What do you mean by thermal expansion? Write down one application of it. 2

b) Define the coefficient of the linear expansion with its expression. 1

c) A steel rod of original length 55 cm at temperature 20°C is heated to 80°C . Calculate the total length of the rod at temperature 80°C . (The coef. of linear expansion of the steel = $12 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$) 2

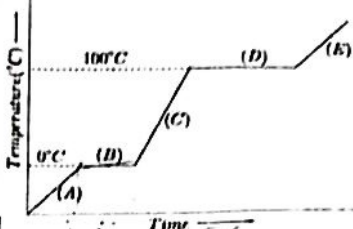
or

a) The diagram below shows the change of phases of water on a temperature-time graph. Now, answer the followings,

i) What do the parts B and C represent?

ii) What is the meaning of the horizontal part D?

iii) If $D = 2B$, what do you infer? 1+1+1



b) How much amount of heat is required to convert 5 Kg of water at 50°C into steam at 100°C ? [Specific heat of water = $4200 \text{ J Kg}^{-1} \text{ }^{\circ}\text{C}^{-1}$ and Latent heat of evaporation of water = $2.26 \times 10^6 \text{ J Kg}^{-1}$] 2

15. a) Write down the relation between angle of prism, angle of minimum deviation and the refractive index for a prism. 1

b) Under what condition, a glass prism becomes the small angled prism? 1

c) A narrow beam of light incident normally on one face of an equilateral prism (refractive index 1.5) being surrounded by water (refractive index 1.44). At what angle the ray of light emerges out? 3

18. a) What do you mean by chromatic aberration of light? 1

b) Derive the required condition for the achromatism. 3

c) Does the dispersion take place when monochromatic light is passed through the glass prism? 1

16. a) What do you mean by the quantization of charge? 1

b) Is there difference between the electric charge and the electric current? 1

c) How do you charge a metallic body positively by electrostatic induction method? Explain. 3

17. a) Define one electron volt (1 eV). 1

b) No work is done in moving a test charge over an equipotential surface, why? 2

c) A charged oil drop remains stationary when situated between two parallel horizontal metal plates 25 mm apart and a p.d. of 1000 V is applied to the plates. Find the charge on the drop if it has a mass of $5 \times 10^{-15} \text{ Kg}$. (Assume $g = 10 \text{ m/s}^2$) 2

or

a) Derive an expression for the equivalent capacitance of the capacitors connected in parallel. 3

b) Write down one use of capacitor. 1

- c) What do you mean by the polar dielectric molecule? 1
19. a) Define nuclear fission with one suitable nuclear reaction. 1
- b) Mention one use of nuclear fission. 1
- c) Calculate the binding energy per nucleon for a Helium nucleus. Given that mass of helium nucleus = 4.001509 amu, mass of proton = 1.007277 amu and mass of neutron = 1.008666 amu. 3

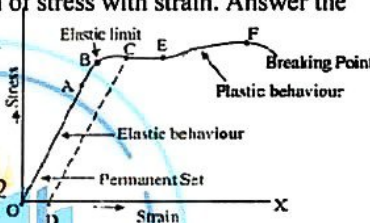
Group "C"

[8×3=24]

20. a) What do you mean by satellite? 1
- b) Derive an expression for orbital velocity of satellite. 3
- c) Write one use of artificial satellite. 1
- d) An artificial satellite revolves around the earth at a distance of 34,000 km. Calculate the period of revolution. (Given, radius of earth = 6400 km and $g=9.8 \text{ m/s}^2$) 3

Or

- a) The following figure shows the variation of stress with strain. Answer the followings, 1+1+1

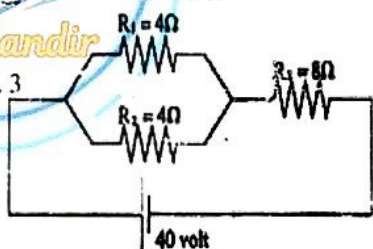
- 
- i) Which section of the graph shows the Hook's law?
- ii) What is plastic behaviour there?
- iii) Explain the term Breaking Point?
- b) Which is more elastic a rubber or steel? 2
- c) A wire 2 m long and cross-sectional area 10^{-6} m^2 is stretched 1 mm by a force of 50 N in the elastic region. Calculate the Young's modulus and the energy stored in the wire. 3

23. a) What do you mean by D.C. current? 1+1

Write down one application of it. 1+1

- b) Derive an expression for the drift velocity. 3

- c) In the given circuit, calculate the current flowing and the voltage dropped across 8Ω . 3



21. a) Write down the two postulates of kinetic theory of gases. 1

- b) Derive the ideal gas equation by using Charles law and Boyles law for n mole of gas. 3

- c) Write down the relation between the rms speed of gas molecule and temperature. 1

- d) Find the number of molecules and the number of moles in one cubic meter of air at 1 atmospheric pressure and 0°C . [$R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$] 3

"GOOD LUCK"

Time: 3 Hours

Class: XI Science

PHYSICS

2081/06/11

Full Marks: 75

Pass Marks: 30

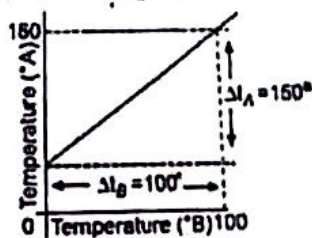
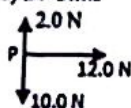
Candidates are required to give their answers of theory and numerical separately in their own words as far as practicable. The figures in the margin indicate full marks.
(All answers of numerical problems should be expressed in S.I. System)

Group - A

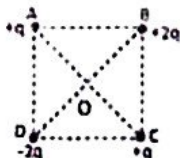
Rewrite the correct options of each question in your answer sheet

(11×1=11)

- The dimensions of kinetic energy have
a) -1 in mass b) +1 in length c) -2 in time d) -2 in length
- If P, Q and R are physical quantities having different dimensions. Which of the following combinations can never be a meaningful quantity?
a) (P-Q)/R b) PQ-R c) PQ/R d) (PR-Q²)/R
- Which of the following lists comprises three vector quantities?
a) Displacement, velocity, energy b) Displacement, velocity, momentum
c) Velocity, acceleration, power d) Force, work, energy
- What is the area of the parallelogram whose vectors $P = 2\vec{i} + 3\vec{j}$ and $Q = \vec{i} + 4\vec{j}$ represent?
a) 5 Units b) 10 Units c) 15 Units d) 20 Units
- Three forces act at point P at the same time as shown on the vector diagram. What is the magnitude of the resultant force?
a) 14.4 N b) 17.0 N
c) 20.0 N d) 24.0 N
- On which of the following temperature scale, the temperature is never negative.
a) Celsius b) Fahrenheit c) Reaumer d) Kelvin
- The relation between real and apparent expansion of a liquid is
a) Real expansion = apparent expansion
b) Real expansion < apparent expansion
c) Real expansion > apparent expansion
d) Depending on the nature of the liquid, sometimes apparent expansion and sometimes real expansion is greater
- The graph between two temperature scales A and B is shown in figure. Between upper fixed point and lower fixed point there are 150 equal division on scale A and 100 on scale B. The relationship for conversion between the two scales is given by
a) $\frac{t_A - 180}{100} = \frac{t_B}{150}$ b) $\frac{t_A - 30}{150} = \frac{t_B}{100}$
c) $\frac{t_B - 180}{150} = \frac{t_A}{100}$ d) $\frac{t_B - 40}{100} = \frac{t_A}{180}$
- Coefficient of linear expansion of brass is $19 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$. If the area of a circular brass disc at 0°C is 25 cm^2 , then at 80°C , its area will be
a) 25.038 cm^2 b) 25.076 cm^2 c) 25.114 cm^2 d) 25.38 cm^2



10. A body is positively charged, it implies that
- There is only positive charge in the body
 - There is positive as well as negative charge in the body but the positive charge is more than negative charge
 - There is equal positive and negative charge in the body but the positive charge lies in the outer regions
 - Negative charge is displaced from its position
11. Four charges are arranged at the corners of a square ABCD as shown in the diagram. The force on the positive charge Q kept at the center O is
- Zero
 - along the diagonal AC
 - Along the diagonal BD
 - perpendicular to side AB



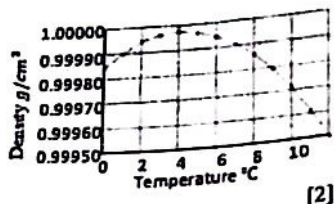
Group - B

Answer the following questions.

(8×5=40)

12. a) Can a set of measurements be precise but not accurate? Explain with an example. [2]
 b) The diameter of steel rod is given as (56.47 ± 0.02) mm. What does it mean? [1]
 c) Perform these calculations, following the rules for significant figures. [2]
 i. $5.67 \times 2.6 = ?$ ii. $63.258 + 734.2 = ?$
13. a) What do you mean by dimensions of a physical quantity? [1]
 b) Use dimensional analysis to check the correctness of the formula $t = 2\pi\sqrt{\frac{m}{k}}$ where t be the time period, m is the mass and k is the force per unit displacement. [2]
 c) A new system of units is proposed in which unit of mass is α kg, unit of length β m and unit of time γ s. How much will 5J measure in this new system? [2]
14. a) What is resolution of vector? [1]
 b) Resolve a vector in a plane in two mutually perpendicular directions. [2]
 c) A lamp is suspended from two wires as shown in the diagram. The tension/force in each wire is 4.5 N. Use concept of resolution of vectors to calculate weight of the lamp? [2]
-
15. a) What is absolute temperature? Absolute zero temperature is not the temperature of zero energy. Explain. [1]
 b) A body at higher temperature contains more heat. Do you agree with this statement? Explain. [1]
 c) Two beakers of water P and Q are initially at same temperature. The temperature of water in beaker P is increased by 10°F and temperature of water in beaker Q is increased by 10K . After these temperature changes, which beaker of water has higher temperature. Explain with calculations. [2]
16. a) The difference between the length of the brass rod and the length of aluminum rod is claimed to be constant at all temperature. How is it possible? [1]
 b) Show that coefficient of cubical expansion is three times the coefficient of linear expansion. [2]

- c) Figure shows variation of density of water with temperature. From the graph, calculate cubical expansivity of water in the temperature range 4°C to 12°C .



OR

- a) Show that coefficient of superficial expansion is two times the coefficient of linear expansion.
 b) Figure shows brass ring that is to be fitted in the wooden wheel. The diameter of the wheel and the ring is 25cm and 24cm respectively at 25°C . [Linear expansivity of brass is $20 \times 10^{-6}\text{K}^{-1}$]
 i. Why is the ring always slightly smaller than the wheel? [1]
 ii. To what temperature, should the ring be heated to fix on the wheel? [2]



17. a) The diagram shows a metal bridge constructed over a river.



- i. Briefly explain why you think one end of the bridge is constructed on rollers. [1]
 ii. What do you think would happen if the bridge had been constructed with no gap? [1]
 b) Two ends of steel wire of length 8m and 2mm radius are fixed to two rigid supports. Calculate the increase in tension in the wire when temperature falls by 10°C Given: Young's modulus of elasticity for steel $= 2 \times 10^{11}\text{Nm}^{-2}$, and linear expansivity for steel is $12 \times 10^{-6}\text{K}^{-1}$ [3]

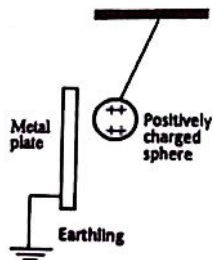
18. a) State and Explain Coulomb's law of force. [2]

- b) What do you mean by permittivity of a medium. [1]

- c) How many excess electrons must be placed on each of two small spheres spaced 3cm apart if the force of repulsion between the spheres is to be 10^{-19}N ? [2]

9. a) What is electrostatic induction? [1]

- b) Figure shows a positively charged sphere hanging by an insulating thread close to an earthed metal plate.

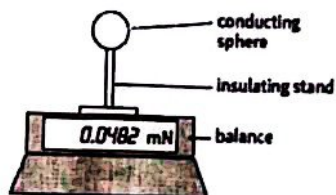


- i. Explain why the sphere is attracted towards the metal plate. [2]

- ii. More charge can be placed on the sphere if it is highly polished than when its surface is rough. Why? [2]

OR

- a) Figure shows a conducting sphere carrying a charge of $+6 \times 10^{-8}\text{C}$ resting on a balance. Does the mass of the sphere change when the sphere is made neutral? Give reason. [2]



- b) An identical sphere carrying a charge of $-4.5 \times 10^{-8} \text{ C}$ is held so that its centre is 5.0 cm vertically above the centre of the first sphere.
- Calculate the electric force between the two spheres. [1]
 - Calculate the new reading on the balance. [2]

Group - C

(3 × 8 = 24)

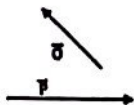
Give long answers to the following question.

20. a) Is a physical quantity having magnitude and direction necessarily a vector quantity? Explain with an example. [2]
- b) State parallelogram law of vector addition. [1]
- c) Using this law, derive an expression for the magnitude and direction of the resultant of two vectors inclined at an angle θ from each other. [3]
- d) A force (in newton) expressed in vector notation as $\vec{F} = 4\vec{i} + 7\vec{j} - 3\vec{k}$ is applied on a body and produces a displacement (in meter), $\vec{D} = 3\vec{i} - 2\vec{j} - 5\vec{k}$ in 4 seconds. Estimate the power. [2]

OR

- a) If the scalar product of the two vectors is equal to magnitude of their vector product find the angle between them. [2]
- b) A rocket fires two engines simultaneously. One produces a thrust of 725N directly forward, while the other gives a 513N thrust at 32.4° above the forward direction. Find the magnitude of resultant force that these engines exert on the rocket. [2]

- c) Magnitude and direction of two vectors $\vec{P}$ and $\vec{Q}$ are as shown in figure. Geometrically represent the sum $\vec{P} + \vec{Q}$ and difference $\vec{P} - \vec{Q}$ of the given vectors. [1+1]



- d) $\vec{C}$ is the vector sum of $\vec{A}$ and $\vec{B}$. i.e. $\vec{C} = \vec{A} + \vec{B}$. For $C = A + B$ to be true, what is the angle between $\vec{A}$ and $\vec{B}$? [2]

21. a) What is real expansion of liquid? [1]
- b) Derive relation between coefficients of real and apparent expansion of liquid. [2]
- c) A copper vessel with a volume of exactly 100 m^3 at a temperature of 15°C is filled with glycerin. If the temperature rises to 25°C , how much glycerin will spill out? (α for copper = $16.7 \times 10^{-6} \text{ }^\circ \text{C}^{-1}$, γ for glycerin = $5.32 \times 10^{-5} \text{ }^\circ \text{C}^{-1}$.) [3]
- d) Why a column of mercury in a thermometer first descends slightly and then rises when placed in hot water? Explain. [2]
2. a) State Gauss's theorem in electrostatics. [1]
- b) Apply it to obtain an expression for electric field of linearly charged body. [3]
- c) Two point charges $3\mu\text{C}$ and $-3\mu\text{C}$ are located 20 cm apart in vacuum.
- Sketch an electric field pattern due to these two unlike charges. [1]
 - What is electric field at the midpoint of the line joining the two charges? [2]
 - If a positive test charge of magnitude $1.5 \times 10^{-9} \text{ C}$ is placed at this mid-point, what is the force experienced by the test charge? [1]

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 3 hrs.

Full Marks: 75

You may use the following constants wherever is necessary: Charge of an electron (e) = $1.6 \times 10^{-19} \text{ C}$, Mass of an electron (m) = $9.1 \times 10^{-31} \text{ Kg}$, Speed of light (C) = $3 \times 10^8 \text{ ms}^{-1}$, Acceleration due to gravity (g) = 10 ms^{-2} , $\epsilon_0 = 8.85 \times 10^{-12} \text{ N}^{-1} \text{ m}^{-2} \text{ C}^2$

Attempt all questions.

Group 'A'

Rewrite the correct option of each question in your answer sheet. (11 × 1 = 11)

- Which of the following sets have different dimensions?
 - Pressure, Young's modulus, stress.
 - Emf, potential difference, electric potential
 - Heat, work, energy.
 - ✓ Dipole moment, electric flux, electric field .
- Resultant of two forces F_1 and F_2 is F_1 and the resultant is at right angle to the force F_1 . Then the force F_2 is equal to
 - $2F_1$
 - 0
 - F_1
 - ✓ $\sqrt{2}F_1$.
- If the net force acting on a body is zero, then the body _____
 - can be in uniform motion.
 - must be in uniform motion.
 - can be accelerating.
 - ✓ must be at rest.
- Which of the following is correct statement?
 - ✓ Momentum is conserved in all collisions, but kinetic energy is conserved only in inelastic collisions.
 - Neither momentum nor kinetic energy is conserved in inelastic collision.
 - Momentum is conserved in all collisions but not kinetic energy. •
 - Both momentum and kinetic energy are conserved in all collisions.
- What is the minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of $2R$?
 - $\frac{5GmM}{6R}$
 - $\frac{2GmM}{3R}$
 - ✓ $\frac{GmM}{2R}$.
 - $\frac{GmM}{3R}$
- A ray of light is incident on a plane mirror at an angle of incidence 30° . The ray after reflection is deviated through
 - 130°
 - 30°
 - 120°
 - ✓ 60° .

Contd ...

7. A convex lens of a focal length f is cut into two parts along the dotted lines as shown in the figure. The focal length of each part will be
- a. f b. $2f$ c. $\frac{f}{2}$ d. $\frac{3}{2}f$
8. A convex lens produces a real image m times the size of the object. What is the distance of the object from lens?
- a. $(m+1)f$ c. $\left(\frac{m-1}{m}\right)f$
 b. $(m-1)f$ d. $\left(\frac{m+1}{m}\right)f$
9. A prism of refracting angle 60° produces a minimum deviation of 30° . Then the angle of incidence is
- a. 30° b. 60° c. 45° d. 90°
10. Two electric bulbs marked 25W - 220V and 100W - 220V are connected in series to 440 V supply. Which of the bulbs will fuse?
- a. both b. 100 W c. 25 W d. neither
11. Quark combination of the proton is
- a. uss b. uud c. udd d. dds

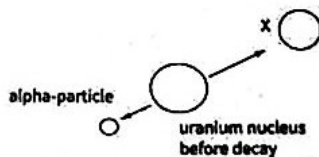


Group B

(8 × 5 = 40)

Answer the following questions.

12. a. A stationary uranium nucleus disintegrates, emitting an alpha-particle of mass $6.65 \times 10^{-27} \text{ kg}$ and another nucleus X of mass $3.89 \times 10^{-25} \text{ kg}$. Explain why the alpha-particle and nucleus X must be emitted in exactly opposite directions.[2]



- b. A neutron having a mass $1.67 \times 10^{-27} \text{ kg}$ and moving at 10^8 m/s collides with a deuteron at rest and sticks to it. If the mass of deuteron $3.34 \times 10^{-27} \text{ kg}$, find the speed of the combination.[2]
- c. Why has a horse to pull a cart harder during the first few steps of its motion?[1]

OR

- a. State the work-energy theorem. Prove it for a constant force. [1+2]
- b. A 650 KW power engine of a vehicle of mass $1.5 \times 10^5 \text{ kg}$ is rising on an inclined plane of inclination 1 in 100 with a constant speed of $\frac{50}{3} \text{ m/s}$.

Contd

(3)

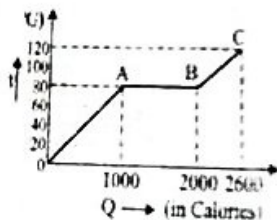
c. Find the frictional force between the wheels of the vehicle and the plane. [2]

13. a. Deduce an expression for the thermal conductivity of a good conductor in steady state and hence define thermal conductivity? [2+1]

b. A slab of stone of area 0.36m^2 and thickness 10cm is exposed on the lower surface to steam 100°C . A block of ice at 0°C rests on the upper surface of the slab. In one hour, 4.8kg of ice is melted. Calculate the thermal conductivity of stone. [Given: latent heat of ice is 336000J/kg] [2]

14. a. Define the coefficient of superficial expansion of a solid. Liquid ^{has} only cubical expansion, why? [1+1]

b. A substance is in solid form at 0°C . The amount of heat added to this substance and its temperature are plotted in the given graph. If the specific heat capacity of the solid substance is $500\text{cal/kg}\cdot\text{K}$, find from the graph.



- the mass of substance [1]
- the specific latent of the melting process. [1]
- the specific heat of the substance in the liquid state. [1]

15. a. What do you mean by perfect gas? [1]

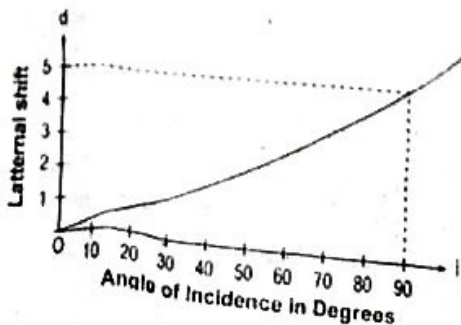
b. Obtain an expression for average translational KE of a gas molecule with Boltzmann constant. [2]

c. Why does the cycle tube burst sometimes in summer? [1]

d. Why a temperature less than absolute zero is not possible? [1]

16. a. A physics student in the lab measured different values of lateral shift corresponding to various value

of angle of incidence using glass slab in refraction of light experiment. Then graphical plot showing variation of lateral shift with angle of incidence is obtained as shown in figure.



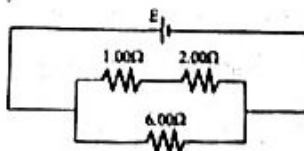
- (4)
- What do you mean by lateral displacement? [1]
 - At what angle of incidence, real thickness of glass slab is obtained in refraction of light experiment? What is the thickness of glass slab used? [2]
- b. An object 10 cm high is placed in front of a convex mirror of focal length 20 cm and the object is 30 cm from the mirror. Find the height of the image. [2]

Giv
20.

OR

- What is dispersion of light? Also explain the cause of dispersion of light. [1+1]
 - Explain the terms angular dispersion and dispersive power. How are the two related? Write expression for these quantities in terms of refractive index. [3]
17. a. Define electric flux and hence state gauss law in electrostatic. [1+1]
- b. A uniformly conducting charged sphere of 24 m diameter has a surface charge density of $80 \mu\text{C}/\text{m}^2$. (i) Find the charge on the sphere. (ii) What is the total electric flux leaving the surface of sphere. [1+1]
- c. Define electric potential at a point in an electric field. [1]
18. a. Draw V-I graph for ohmic and non ohmic conductors. [1]
- b. The current flowing through a conductor is 2mA at 50V and 3mA at 60V. Is it an ohmic or non-ohmic conductor? [1]

- c. In the circuit shown in fig, the voltage across the 2.00Ω resistor is 12V. What are the emf of the battery and the current through the 6.00Ω resistor? [3]



2

9. a. In what form is the energy stored in a charged capacitor? [1]
- b. Show that the capacitance of an isolated spherical conductor is proportional to its radius. [2]
- c. In a parallel plate capacitor, the capacitance increases from $4\mu\text{F}$ to $80\mu\text{F}$, on introducing a dielectric medium between the plates. What is the dielectric constant of the medium? [2]

Contd ...

(5)

(Group C)

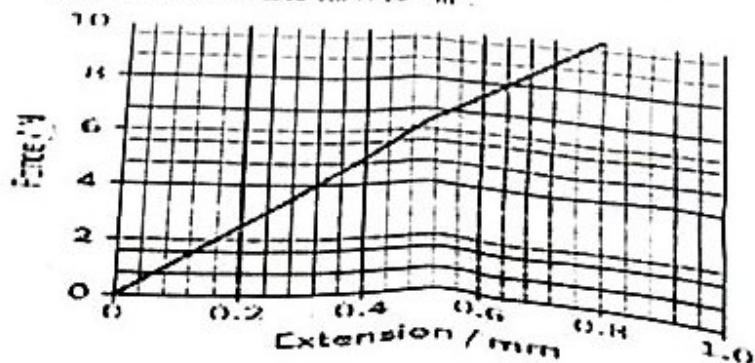
(3 × 8 = 24)

Give long answers to the following questions.

20. a. A projectile is projected with initial velocity u making an angle θ with the horizontal. Derive an expression for its horizontal range. Determine the condition for maximum horizontal range. [2+1]
- b. Assume that a ball is kicked at an angle of 60° with the horizontal. So if the horizontal component of its velocity is 19.6m/s , determine its maximum height. [2]
- c. Define angle of repose. Deduce its relationship with coefficient of static friction. [1+2]

OR

- a. What is centripetal force? Give any two examples of it. [1+1]
- b. A disc revolves with a speed of $33\frac{1}{3}\text{ rev min}^{-1}$, and has radius of 15 cm . Two coins are placed 4 cm and 14 cm away from the centre of the disc. If the coefficient of friction between the coins and the disc is 0.15 , which of the two coins will revolve with the disc? and why? [2]
- c. How does ' g ' at a point vary with the distance from the centre of the earth? Where is the largest value of ' g '. Also sketch graphs to show the variation. [2]
- d. The period of moon revolving under the gravitational force of the earth is 27.3 days. Find the distance of the moon from the centre of the earth if the mass of earth is $5.97 \times 10^{24}\text{ kg}$. [2]
21. a. Why steel is said to be more elastic than rubber? Derive an expression for the energy stored in a stretched string. [1+3]
- b. This is the force-extension graph for a metal wire of length 2.0 m and cross-sectional area $1.5 \times 10^{-7}\text{ m}^2$.



(6)

- i. Calculate the Young modulus. [2]
- ii. Determine the energy stored in the wire when the extension is 0.8 mm. [1]
- iii. Calculate the work done in stretching the wire between 0.4 mm and 0.8 mm. [1]

22. a. What are extrinsic semiconductors? Mention their two types. [1+1]
- b. Define Binding energy and Mass Defect. [1+1]
- c. Binding energies of deuteron (2_1H) and α -particle (4_2He) are 1.25 and 7.2 MeV/nucleon respectively. Which one is more stable and why? [1]
- d. Find the power production corresponding to 1g of ${}_{92}U^{235}$ consumed per day in a nuclear reactor. Energy released per fission of ${}_{92}U^{235}$ is about 200 MeV. [3]



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First Term Examination – 2081

Subject: Physics

Class: XI

Time: 2hrs

FM: 50

PM: 18

Group 'A' (9x1=9)

(Multiple Choice Question)

- The least count is 0.01mm. Two wires of length L_1 and L_2 are measured in meter (m) and they are connected forming a single wire. Then the measurement is
 - $[L_1+L_2]m \pm 0.02mm$
 - $[L_1+L_2]m \pm 0.01mm$
 - $[L_1-L_2]m \pm 0.02mm$
 - $[L_1-L_2]m \pm 0.01mm$
- If energy E , velocity v and time T are taken as fundamental units, the dimensional formula of surface tension becomes
 - $[E^0V^{-2}T^{-2}]$
 - $[E^0V^{-2}T^{-2}]$
 - $[E^2V^2T^{-2}]$
 - None of the above
- The temperature of Sun is measured by
 - Platinum thermometer
 - Gas thermometer
 - Pyrometer
 - Vapor pressure thermometer
- The error in measurement of radius of the sphere is 2% then what will be the possible error in measurement of volume.
 - 5%
 - 6%
 - 8%
 - 9%
- If $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ angle between $\vec{A}$ & $\vec{B}$ is
 - 0°
 - 30°
 - 60°
 - 90°
- If two vectors each having magnitude p is acting at a point and angle between them is θ resultant is given by
 - $\sqrt{2}p \cos \theta / 2$
 - $2p \cos \theta / 2$
 - $\sqrt{2}p \sin \theta / 2$
 - None
- Which of the following has same dimension?
 - Work and power
 - Power and energy
 - Planck's constant and angular momentum
 - Angular momentum and torque

- b. Two beakers of water A & B, initially are at the same temperature. The temperature of water in beaker A is increased by 10°F and temperature of the water in beaker B is increased by 10 K . After the temperature changes, which beaker of water has the higher temperature? Explain [2]
- c) A student claimed that thermometers are useless because a thermometer always registers its own temperature. How would you respond? [1]

Group 'C' (8x2=16)

- 15.a) State Parallelogram law of vector addition of two vectors & represent graphically. [2]
- b) Obtain expressions of magnitude & direction of resultant vector of vector addition of two vectors. [3]
- c) Two dogs pull flesh by applying forces of 5 N & 10 N at a point by making angle of 60° then find the resultant force exerted by dogs on the flesh at that point of contact. [3]
- 16.a. Define coefficient of linear and cubical expansion of solid. Obtain the relation between them [1+3]
- b. Steel rail road 18 m long are laid on a winter day when the temperature is -6°C
- i. If the rails were originally laid in Contact, what would be the stress in them on a summer day when the temperature is 44°C . {Young's modulus of steel = $2 \times 10^{11}\text{ N/m}^2$, Linear expansivity of steel = $12 \times 10^{-6}\text{ K}^{-1}$ } [3]
- ii. Why small gaps are left in between two successive railway tracks? [1]