GRADE XI (SCIENCE)

Subject: Physics **SET A** **F.M. :75**

Time : 3:00 hrs. **P.M : 30**

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

GROUP 'A'

Multiple choice questions **[11×1=11]**

1. The ~~acceleration~~ Velocity v of a particle is given in terms of time t by the following relation, $v = \frac{b}{t+c}$, the dimensions of b and c are [a] b = T, c = LT [b] b=LT, c=L [c] b = L, c=T. [d] b=LT, $c=T^2$
2. If the error in the measurement of the radius of a sphere is 2 %, then the maximum possible error in the measurement of its volume is [a] 6% [b] 3% [c] $\frac{1}{2}$ % [d] $\frac{4}{3}\pi$ %
3. If $\vec{A}$, $\vec{B}$, $\vec{C}$ vectors have magnitude 6, 8 & 10 respectively, $\vec{A}+\vec{B}=\vec{C}$, angle between A & B is :[a] 0° [b] 90° [c] 45° [d] 180°
4. If the magnitude of the difference between two unit vectors is $\sqrt{3}$, then the magnitude of the sum of the two vectors is : [a] $\frac{1}{2}$ [b] 1 [c] 2 [d] 3
5. The resultant of two forces 8N and 6N is -[a] 1N [b] 10N [c] 15N [d] 20N
6. A difference of temperature of 25 °C is equivalents to difference of Kelvin scale: (a) 45 K (b) 248 K (c) 298 K (d) 25 K
7. A hole is there in a metal plate. Upon heating the plate diameter of hole would: (a) increases (b) decrease (c) remains the same (d) may increase or decrease
8. If a bimetallic strip is heated it will: (a) towards the metal with lower thermal expansion coefficient (b) bend towards the metal with higher thermal expansion coefficient (c) twist itself into a helix (d) have no bending
9. What is the dimensional formula of permittivity of free space? (a) $[M^{-1}L^{-3}T^{4}A^{2}]$ (b) $[M^{-1}L^{-3}T^{3}A^{-2}]$ (c) $[M^{-1}L^{-2}T^{3}A2]$ (d) $[M^{-1}L^{-2}T^{-3}A^{2}]$

10. Two charged particles are at a distance R exert F force on each other. If the medium of dielectric constant 64 is placed between them, then the distance at which the same force is: (a) R (b) 8R (c) $\frac{R}{8}$ (d) $\frac{R}{64}$

11. The number of electrons in one coulomb of charge will be: (a) 1.667×10^{19} (b) 6.25×10^{18} (c) 6.023×10^{23} (d) 6.25×10^{19}

GROUP 'B'

Short answers questions. **[8×5 = 40]**

12. (a) Convert 50 joule into erg by using the dimensional method. [2]

(b) In Vander Waals equation, $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ where P be the pressure, V be the volume, T be the temperature and R be the universal gas constant. What are the dimensions of the constants 'a' and 'b'? [3]

13. (a) Determine the area of the parallelogram whose adjacent sides are $2\hat{i} + \hat{j} + 3\hat{k}$ and $\hat{i} - \hat{j}$. [2]

(b) A spelunker is surveying a cave. She follows a passage 180 m straight west, then 210 m in a direction 45° east of south, and then 280 m at 30° east of north. After a fourth unmeasured displacement, she finds herself back where she started. Use a scale drawing to determine the magnitude and direction of the fourth displacement. [3]

14. (a) What do you mean by linear expansivity? Does it depend on the original length? Explain. [2]

(b) A glass flask of volume 600 cm^3 is just filled with mercury at 10 °C. How much mercury overflows when the temperature of the system is raised to 90° C? (Linear expansivity for glass = 4×10^{-6} /K and cubical expansivity for mercury = 18×10^{-5} /K) [3]

15. (a) Force of attraction between two-point charges at a distance x is F. What distance should they be kept in the same medium so that the net force between them is $\frac{F}{4}$? [2]

(b) Define point of action. State and explain coulomb's law in electrostatics. [3]

16. (a) Two identical particles are charged and held at a distance of 1m from each other. They are found to be attracting each other with a force of 0.027 N. Now, they are connected by a conducting wire so that charge flows between them. When the charge flow stops, they are found to be repelling each other with a force of 0.009 N. Find the initial charge on each particle. [3]

(b) Why is repulsion sure test for testing a charged body? [2]

17. (a) What are differences between real and virtual image? [2]

(b) Derive the mirror formula for a convex mirror. [3]

18. (a) Derive the relation $f = \frac{R}{2}$ for concave mirror with appropriate sign convention. [2]

(b) A spherical concave shaving mirror has a radius of curvature of 32 cm. What is the magnification of a person's face when it is 12 cm to the left of the vertex of the mirror? [3]

19. (a) What do you mean by tangential acceleration? Derive an expression for maximum velocity with which vehicle can take safe turn on a leveled road. [1+ 2]

(b) At what angle should a circular road be banked so that a car running at 72 km/hr be safe to go around in the circular turn of 200 m radius? [2]

OR

(a) What do you mean by young modulus of elasticity? Does it depend on area of the wire? [2]

(b) A 5 m long aluminum wire ($Y = 7\times10^{10} Nm^{-2}$) of diameter 3 mm supports a 40 kg mass. In order to have the same elongation in the copper wire ($Y = 12\times10^{10} Nm^{-2}$) of the same length under the same weight. What should be the diameter of copper wire? [3]

GROUP 'C'

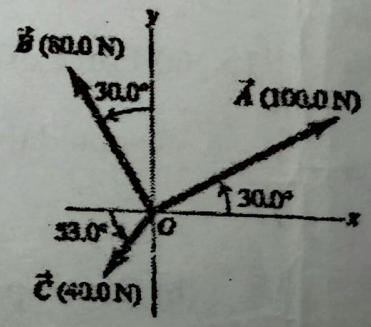
Long answers questions

[3×8 = 24]

20. (a) State parallelogram law of vector addition. Obtain an expression for the resultant of two vectors $\vec{A}$ and $\vec{B}$ inclined at an angle θ. [1+3]

(b) What is a condition to get the minimum value of the resultant? [1]

(c) Three horizontal ropes pull on a large stone in the ground, producing the vector forces $\vec{A}$ (100 N), $\vec{B}$ (80 N) and $\vec{C}$ (40 N) as shown in fig. Find the magnitude and direction of the fourth force on the stone that will make the vector sum of the four forces zero. [3]



21. (a) Derive an expression for the elastic energy stored in a uniform stretc...

(b) Two wires have equal lengths and are made up of the same material. If t... of one wire is twice another wire, which one has a greater extension for a ... load?

(c) The rubber catapult has a cross-sectional area 1 mm^2 and a total unstretched lengt... of 10 cm. It is stretched to 12 cm and then released to project a missile of mass 5 gm. Calculate the velocity of the projection. (Young's modulus of elasticity of rubber $Y = 5 \times 10^8 N/m^2$) [3]

OR

(a) What do you mean by tangential acceleration and radial acceleration? [2]

(b) Show that the period of oscillation of conical pendulum is given by

$T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$, where symbols have their usual meanings. [3]

(c) An object of mass 8 kg is whirled around a vertical circle of radius 2 m with a constant speed of 6 m/s. Calculate the maximum tension in the string. [3]

22. (b) A circular piece is cut from a flat metal sheet. The sheet is then placed in a furnace. Will the size of the hole become larger or smaller? Explain. [2]

(b) How can you determine the linear expansivity of a solid in the laboratory? Can cubical expansivity be derived from this value? [3]

(c) A clock which has a brass pendulum beats seconds correctly when the temperature of the room is 45°C. How many seconds will it lose or gain per day when the temperature of the room falls to 15°C? [α for brass $= 1.9 \times 10^{-5}/K$] [3]

Best Of Luck