

Sub.Code : 110'D'

HSEB-GRADE XI
2072 (2015)
Physics
(New Course)

It is for those students whose first two digit of registration number starts from 66 or greater than.

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

Time : 3 hrs.

Full Marks:- 75

Pass Marks:- 27

You may use the following values of physical constants wherever necessary:

Acceleration due to gravity = 10 m/s^2

Coefficient linear expansion of aluminium = $2.4 \times 10^{-5} \text{ K}^{-1}$

Coefficient linear expansion of brass = $2.0 \times 10^{-5} \text{ K}^{-1}$

Universal gas constant = $8.314 \text{ Jmol}^{-1} \text{ K}^{-1}$

Group 'A'

1. Answer, in brief, any six questions: 6x2=12
 - a) The length of rod is exactly 1 cm. An observer records the readings as 1.0 cm, 1.00 cm, and 1.000 cm, which is the most accurate measurement?
 - b) Given two vectors $\vec{A} = 4.00 \hat{i} + 3.00 \hat{j}$ and $\vec{B} = 5.00 \hat{i} - 2.00 \hat{j}$.
Find the magnitude of each vector.
 - c) At what condition does a body become weightless at the equator?
 - d) A handle or a knob is fixed at the free end of the door. Explain why?
 - e) What is elastic limit and breaking stress?
 - f) Why is a suction effect experienced by a person standing close to the platform at a station when a fast train passes?
 - g) Why does a cricketer lower his hand while catching cricket ball?

2. Answer, in brief, any two questions: 2x2=4
 - a) What is the difference between saturated and unsaturated vapour?
 - b) when a gas expands adiabatically, it does work on its surroundings. But, if there is no heat input to the gas where does the energy come from?

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- c) On reducing the volume of a gas at constant temperature, the pressure of a gas increase. Why?
3. Answer, in brief, any **one** question: 2
- a) Define Luminous intensity of a source. What is its unit?
- b) When white light dispersed by a prism, red light appears at the top of the spectrum whereas violet at the bottom. why?
4. Answer, in brief, any **one** question: 2
- a) What is electrostatic shielding?
- b) Two charged conductors are touched mutually and then separated. What will be the charge on them?

Group 'B'

5. Answer any **three** questions: 3x4=12
- a) State Newton's laws of motion. How does it lead to the principle of conservation of linear momentum?
- b) What is a geostationary satellite? Derive an expression for the time period of the satellite revolving around the earth.
- c) Define moment of inertia and radius of gyration. Derive an expression for the kinetic energy of rotation of a rigid body.
- d) Define surface tension and angle of contact. Deduce an expression for rise of a liquid in a capillary tube.
6. Answer any **two** questions: 2x4=8
- a) State and explain Newton's law of cooling. Describe with mathematical detail a method for the measurement of specific heat capacity of a liquid.
- b) Explain the term, Thermodynamic process. Obtain an expression for the work done by a gas during adiabatic expansion.
- c) State and explain Stefan's law of black body radiation. Can a perfect black body be realized in practice?
7. Answer any **one** question: 4
- a) Discuss the phenomenon of refraction through a prism. Derive an expression for the refractive index of the material of the prism in terms of the angle of minimum deviation.
- b) With a ray diagram, explain the working of a compound microscope. Obtain an expression for its magnifying power, when the image is at near point.

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8. Answer any **one** question: 4

a) What is electric flux? State and explain Gauss law in electrostatics. Use it to find electric field intensity due to infinite plane sheet of charge.

b) Obtain relations for equivalent capacitance for capacitors connected in series and parallel.

Group 'C'

9. Answer any **three** numerical questions: 3x4=12

a) An airplane is flying with a velocity of 90.0m/s at an angle of 23.0° above the horizontal. When the plane is 114 m directly above a dog that is standing on level ground, a suitcase drops out of luggage compartment. How far from the dog will the suitcase land? You can ignore air resistance.

b) You throw a 20N rock vertically into the air from ground level. You observe that when it is 15 m above the ground, it is travelling at 25m/s upward. Use the work-energy theorem to find (i) its speed as it left the ground and (ii) its maximum height.

c) A stone with mass 0.8 kg is attached to one end of a string 0.9 m long. The string will break if its tension exceeds 600N . The stone is whirled in a horizontal circle, the other end of the string remains fixed. Find the maximum speed, the stone can attain without breaking the string.

d) Castor oil at 20°C has a coefficient of viscosity 2.42 Ns/m^2 and density 940 kg/m^3 . Calculate the terminal velocity of steel ball of radius 2.00 mm falling under gravity in the oil, taking density of steel as 7800 kg/m^3 .

10. Answer any **two** numerical questions: 2x4=8

a) The marking on an aluminium ruler and a brass ruler are perfectly aligned at 0°C . How far apart will the 20.0 cm marks be on the two rulers at 100°C , if precise alignment of the left hand ends of the rulers is maintained? Coefficient of linear expansion of aluminium and brass are $2.4 \times 10^{-5}\text{ K}^{-1}$ and $2.0 \times 10^{-5}\text{ K}^{-1}$, respectively.

b) A cylindrical tank has a tight fitting piston that allows the volume of the tank to be changed. The tank originally contains 0.110m^3 of air at a pressure of 3.4 atm . The piston is slowly pulled out until the volume of the gas is increased to 0.390 m^3 . If the temperature remains constant what is the final value of the pressure?

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- c) A diesel engine performs 2200J of mechanical work and discards 4300J of heat each cycle. (i) How much heat must be supplied to the engine in each cycle? (ii) What is the thermal efficiency of the engine?
11. An optical fiber with refractive index 1.72 is surrounded by a glass coating having refractive index 1.50. Find the critical angle for total internal reflection at the fiber glass interface. 4
12. An electron of mass 9.1×10^{-31} Kg and charge 1.6×10^{-19} C is situated in a uniform electric field of intensity 1.2×10^4 Vm⁻¹. Find the time it takes to travel 1 cm from rest. 3
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