

SUBJECT: PHYSICS

TIME: 3 hours

Full Marks: 200

Note: Question No. 1 is compulsory and any four from the remaining seven questions .All questions carry equal marks.

Q.No. 1 Attempt any 10(ten)

10x4=40

- A. A force of $(10\hat{i}+3\hat{j}+6\hat{k})$ Newton acts on a body of mass 100 gm and displaces it from $(6\hat{i}+5\hat{j}-6\hat{k})$ metre to $(10\hat{i}-2\hat{j}+7\hat{k})$ metre. Calculate the work done. (the symbol \hat{i} , \hat{j} and \hat{k} are unit vectors along X,Y and Z axis)
- B. Distinguish between conservative and non conservative force. Give examples.
- C. A brick of mass 2kg is placed on a uniform slope which makes an angle of 30° with the horizontal. If the coefficient of kinetic friction is 0.25, calculate the acceleration of the brick.
- D. A drop of liquid of radius R splits up in to 1000 droplets each of radius r . Find out change in surface energy. (surface tension of liquid is T).
- E. The height of a waterfall is 84 m. Assuming that the entire kinetic energy of falling water is converted in to heat , calculate the rise in temperature of water.
- F. At what temperature the velocity of sound will be double its value at 273K.
- G. A closed organ pipe and an open organ pipe have their first overtone identical in frequency. Calculate the ratio of their lengths.
- H. State the postulate of special theory of relativity and write Lorentz transformation equations.
- I. How can you detect a polarized light .State Malus law.
- J. A heat flux of 4000 Joule/sec is to be passed through a copper rod of length 10 cm and area of cross section 100 cm^2 . Thermal conductivity of copper is $400 \text{ watt/m}^2 \text{ C}$ Find out temperature difference between the two ends of the rod.
- K. What is a thermocouple? How it can be used as a thermometer.
- L. A wheel of moment of inertia $5 \times 10^3 \text{ kg-m}^2$ is rotating with 20 rad/sec. How much torque is required to stop it in 10 sec.

Q No. 2 Attempt any 8(eight)

8x5=40

- A. State radio active disintegration law and derive disintegration equation.
- B. Explain with circuit diagram how to determine internal resistance of a cell by a potentiometer.
- C. Define mean free path of gas molecule. Find an expression for it.
- D. Prove energy conservation in case of simple harmonic oscillator.
- E. What is spherical aberration. Mention some methods of eliminating it.
- F. Discuss transistor action of n-p-n transistor. Which are the major carrier in it.

- G. Establish Einstein's photo electric equation. Why wave theory failed to explain photo electric effect.
- H. What is a couple ? Prove that it produces translational equilibrium but not rotational equilibrium.
- I. Two cells of emf 5volts and 8volts of internal resistance 1 ohm and 2 ohm are connected across a load of 10 ohm. Calculate current through the load.
- J. Discuss different modes of vibration of open organ pipe and find out the ratio of the frequency of different modes.

Q NO. 3 Attempt any 5(five)

5x8=40

- A. What is Doppler's effect? Find relation between actual frequency and apparent frequency of sound when source moves towards the stationary receiver.
- B. Show how a biprism produces interference pattern. Find expression for fringe width.
- C. What is a Carnot's engine? Describe a carnot cycle.
- D. Define orbital velocity of a satellite. Find out height of geostationary satellite.
- E. Discuss the characteristics of a vacuum tube triode with the help of graphs. What is amplification factor.
- F. What do you mean by matter wave? Describe an experiment to establish wave nature of electron.
- G. Explain how capacitance of a capacitor changes by introducing a dielectric in to it. How the energy in the capacitor changes when the source of voltage is removed?

Q No. 4. Attempt any 4(four)

4x10=40

- A. What is Compton effect? Deduce an expression for the change in wavelength of x-ray during this phenomena.
- B. Describe principle , construction and working of cyclotron . Why electrons can not be accelerated by this device.
- C. State 1st law of thermodynamics. Prove the relation

$$C_p - C_v = R$$

- D. What is damping. Find out equation of damped harmonic oscillator.
- E. Establish Stoke's law by dimensional analysis. Find out expression for terminal velocity using this law.

Q No. 5. Attempt any 2 (two)

2x20=40

- A) Draw the circuit diagram of transistor amplifier (common emitter) and explain it's working. Calculate the voltage gain.
- B) Derive expression for pressure due to a gas by applying the postulates of kinetic theory. Prove Avogadro's law from this.
- C) Find out equivalent focal length of combination of two lenses separated by some distance.