

Set 4

Model Question -4

Grade: XII Subject: Physics (102)

Full marks: 75 (11 marks Obj+ 64 marks Sub)

Time: 3 Hours

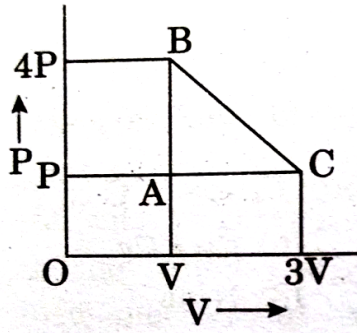
Attempt all the questions:

Group "A"

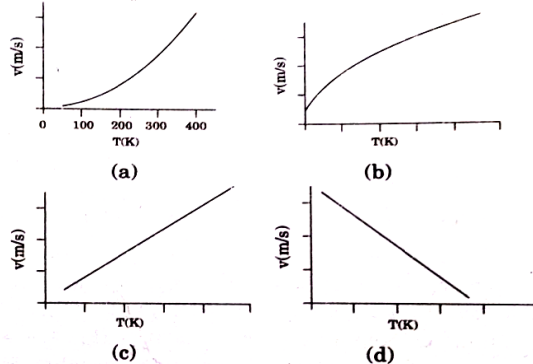
Rewrite the correct option in your answer sheet:

11X1=11

- 1) When water is heated from 0°C to 4°C then
 a. $C_p > C_v$ b. $C_p < C_v$ c. $C_p = C_v$ d. None
- 2) An ideal gas is taken through series of changes represented in the diagram below. The net work done by the gas at the end of the cycle is equal to



- a. $12P_1V_1$ b. $6P_1V_1$ c. $3P_1V_1$ d. P_1V_1
- 3) Elastic waves in a solid are
 a. only transverse b. only longitudinal
 c. Either transverse or longitudinal d. Neither transverse nor longitudinal
- 4) The variation of speed of sound in a gas with its pressure is best represented by curve:



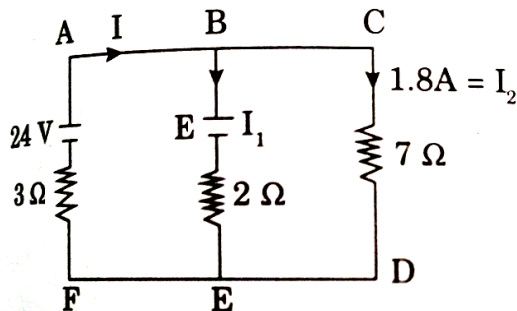
- 5) A string has mass 0.01 kg and has length 1 m. if the tension is 1000N, the velocity of transverse wave in the string is
 a. 316m/sec b. 340m/sec c. 336m/sec d. 366m/sec
- 6) When both source and listener move in same direction with a speed equal to half the speed of sound, the change in frequency of the sound is
 a. zero b. 25% c. 50% d. 100%
- 7) What happens to fringe pattern when the Young's double slit experiment is performed in water instead of air?
 a. shrinks b. disappears c. unchanged d. enlarged
- 8) To send 10% of the main current through a moving coil galvanometer of resistance 99Ω . The shunt required is
 a. 9.9Ω b. 10Ω c. 11Ω d. 9Ω
- 9) The time period of a freely suspended thin magnet is 4 seconds. If it is broken in length in two equal parts and one part is suspended in the same way, then its time period (in seconds) will be
 a. 2 b. 4 c. 0.5 d. 0.25
- 10) In a semiconductor crystal if the current flows due to breakage of crystal bonds, then the semiconductor is called
 a. acceptor b. donor
 c. extrinsic semiconductor d. intrinsic semiconductor
- 11) Analysis of what particles began the search for the Higgs boson?
 a. up and down quark b. neutrino and photon
 c. mesons and baryons d. w and z bosons

Group "B"

Short answer questions:

8X5=40

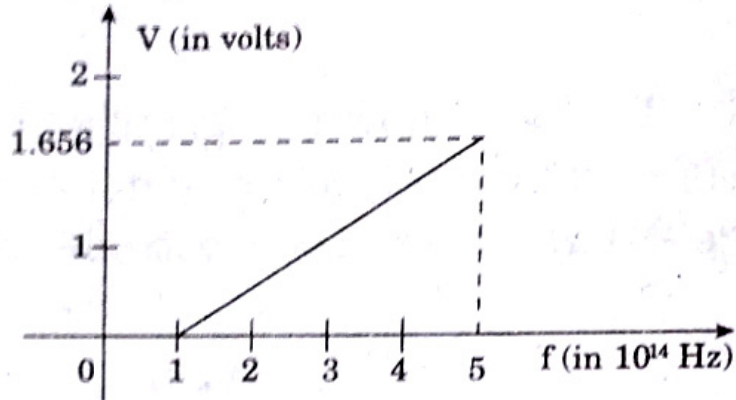
- 1)
- You are provided with a light spring, meter scale and a known mass. How will you find the time period of oscillation of the mass attached to the spring without the use of clock? 1
 - Why the mass of spring is usually neglected in such type of problem? 1
 - A mass m attached to a spring oscillates with a period of 2 seconds. If the mass is increased by 2 kg, the period increases by 1 second. Find the initial mass m , assuming that Hooke's law is obeyed. 3
- OR**
- Define angle of contact. 1
 - Where is the angle of contact obtuse, acute or zero degree? 1
 - Water rises in a capillary tube to a height of 8 cm. calculate the height to which a liquid rises in the tube when the tube is immersed in the liquid. [Surface tension of water is $7.0 \times 10^{-2} \text{ Nm}^{-1}$ and that of the liquid is $5.0 \times 10^{-2} \text{ Nm}^{-1}$. The angle of contact of the liquid is 30° and its density = 800 kgm^{-3} .] 3
- 2)
- What do you mean by adiabatic process? 1
 - Write adiabatic gas equation in terms of
 - Pressure and volume
 - Volume and temperature 1
 - A sample of gas ($\gamma = 1.5$) is taken through an adiabatic process in which the volume is compressed from 1600 cm^3 to 400 cm^3 . If the initial pressure is 150 KPa.
 - What is the final pressure and
 - How much work is done by the gas in the process? 3
- 3)
- Write Newton's formula for velocity of sound in air. 1
 - What discrepancy was there in Newton's formula for velocity of sound in air? Discuss in brief. 2
 - Speed of sound in air at STP is 332 m/sec. what will be its value in hydrogen at STP, density of hydrogen at STP is $1/16$ that of air? 2
- 4)
- What do you mean by diffraction of light? 1
 - We do not observe diffraction from a wide slit illuminated by monochromatic light. Why? 2
 - A single slit is used to obtain diffraction pattern on a screen. Calculate the wavelength of light for which fourth maxima in diffraction pattern coincide with third minima for wavelength 6000 \AA . 2
- 5)
- Kirchhoff's law is preferred over Ohm's law, describe it. 1
 - On what principles Kirchhoff's laws depend? 1
 - What must be the emf E in its circuit so that the current flowing through the 7Ω resistor is 1.80 A ? each emf source has negligible internal resistance. 3



OR

- a) Define thermoelectric effect. 1
b) Define inversion temperature and write the factors on which it depends. 2
c) The temperature of cold junction of a thermocouple is 10°C and the neutral temperature is 270°C . calculate temperature of inversion. 2
- 6) a) The mean or average value of a.c. over a complete cycle is zero. Explain, why? 1
b) Define r.m.s. value of alternating current and write the importance of r.m.s. value. 2
c) The natural frequency of a circuit of negligible resistance, capacitance C and inductance L is 1600 Hz. Calculate the frequency if the values of C and L each are doubled. 2
- 7) a) Write properties of photon. 1
b) What is photoelectric effect? 1
c) The plot of stopping potential versus the frequency of light used in an experiment on photoelectric effect is shown in figure. Calculate
i) Work function
ii) The ratio h/e

PHOTOELECTRIC EFFECT



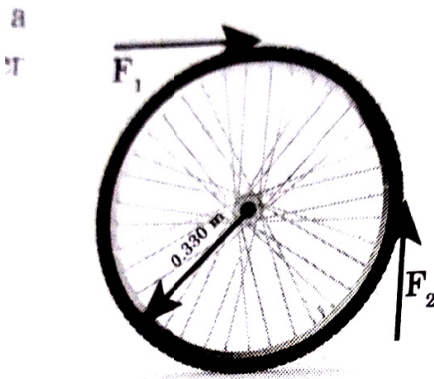
- 8) a) Define excitation energy and excitation potential. 1
b) The life time of an excited state of an atom is about 10^{-8} secs. Calculate the minimum uncertainty in the determination of the energy of the excited state. 2
c) In 9^{th} Bohr orbit, how many times does the electron go around the orbit in 1 second? 2

Group "C"

Long answer questions:

3X8=24

- 9) a) Define torque. 1
b) A wrench of longer arm is preferred than a wrench of shorter arm. Why? 2
c) Establish the relation between torque and angular acceleration of a rigid body. 2
d) Forces $F_1 = 7.5 \text{ N}$ and $F_2 = 5.3 \text{ N}$ are applied tangentially to a wheel with radius 0.33 m as shown in figure. What is the net torque on the wheel due to these two forces for an axis perpendicular to the wheel and passing through its centre? 3



10)

- a) Write an expression for energy stored in an inductor? 1
- b) Soft iron is used in making the core of a transformer, why? 2
- c) Discuss the sources of energy loss in practical transformer. 2
- d) A transformer connected to a 120 V (r.m.s.) to a portable electronic device. The total equivalent resistance of the system is 5.0Ω .
 - i) What should the ratio of primary to secondary turns of the transformer be? 3
 - ii) What r.m.s. current must the secondary supply? 3

OR

- a) Explain Hall effect. 2
- b) In Hall effect, derive an expression for Hall Voltage $V_H = \frac{BI}{net}$ where t is thickness. 3
- c) A Hall probe consists of a copper strip, $n = 8.5 \times 10^{28}$ electrons per cubic meter which is 2.0 cm. wide and 0.10 cm. thick. Calculate the magnetic field when $I = 50$ A and the Hall potential is
 - i) $4.0 \mu V$ and
 - ii) $6.0 \mu V$

11)

- a) What is the evidence that electrons emitted in a β - decay comes from the nucleus rather than the atomic electrons? 2
- b) The half life of the body polonium 210 is about 140 days. During this period the average number of α - emission per day from a mass of polonium initially equal to 1 microgram is about 12×10^{12} . Assuming that one emission takes place per atom and that the approximate density of polonium is 10 gmcm^{-3} . Estimate the number of atoms in 1 cm^3 of polonium. 4
- c) Analyze some medical uses of radioactivity. 2