4. During the propagation of sound waves through a medium, particles in the medium move simple harmonically.
   a. Write the equation of plane progressive wave traveling along $-X\ axis$.   1
   b. Explain which property of a medium is responsible to form wave patterns from SHM of particles.   2
   c. A piece of cork oscillates up and down in a ripple water tank. The ripples travel at $0.20ms^{-1}$, have a wavelength of $15\ mm$, and amplitude of $5.0\ mm$. What is the maximum velocity of the cork?   2

OR

Two open organ pipes of different lengths are resonated with two tuning forks of different frequencies. The waves patterns in the pipes are shown below:

a.

Pipe A   Pipe B
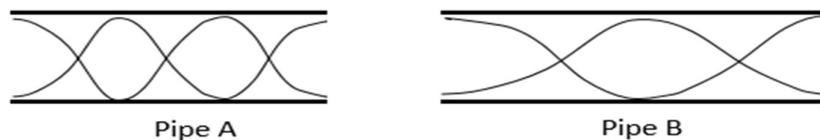
Find the harmonics and overtones in each of the given pipes A and B.   2
b. If pipe B resonates at a frequency of $288\ Hz$, what can be the resonating frequency in pipe A?   2
c. The sound produced by an open organ pipe is of higher quality than that by a closed organ pipe. Explain.   1

5. Meter bridge is usually used to determine the resistance of a wire segment and the comparison of resistance of two resistors.
   a. Link up the working of meter bridge with Wheatstone bridge.   1
   b. How can you measure an unknown resistance using meter bridge?   2
   c. What happens to the ratio of balanced length segment if the polarity of the cell is reversed?   2

6. When two current carrying straight conductors are brought nearer to each other, they experience force either attractive or repulsive.
   a. Define 1 Ampere of current on the basis of the force between two parallel wires. 1
   b. Derive an experience for force per unit length between two parallel straight conductors carrying current in opposite direction.   2
   c. A horizontal wire of length $5\ cm$ and carrying a current of $2A$, is placed in the middle of a long solenoid at right angles to the axis. The solenoid has 1000 turns per meter and carries a steady current I. Calculate I if the force on the wire is equal to $10^{-4}N$.   2

7. The energy level diagram with ground state energy of $-54.4\ eV$ is shown in given figure.

a. Identify the atom.   1
b. Calculate:
    i. The ionization potential   1
    ii. The second excitation energy   2
    iii. The shortest possible wavelength of photon that can be emitted.   1

$n = 3$
$n = 2$
$-54.4\ eV$
$n = 1$
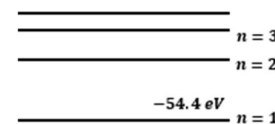
8. Radioactivity is the spontaneously occurring phenomenon in nature.
   a. What is the cause of radioactivity?   1
   b. Obtain decay equation and write its significance.   3
   c. Find the half-life and average life of a radioactive sample whose disintegration constant is $2.31 \times 10^{-3}\ day^{-1}$ 1

[GROUP C]   [3 × 8 = 24]

9. The given diagram shows the experimental arrangement to produce the interference fringes in Young's double slit experiment.
   a. What are coherent sources of light?   1
   b. What is the required condition for sustainable interference?   1

   c. What happens to the interference fringe width if,
    i. Slit width is reduced to half?   1
    ii. One of the slits is closed?   1
    iii. The whole arrangement is immersed in water ($\mu = 1.33$)?   1
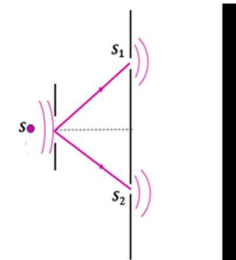
10. a. Electric field can be produced by changing magnetic field. The magnitude of induced emf is determined by faraday's laws and its direction is determined either by Lenz's law or Fleming right hand rule.
    i. State faraday's laws of electromagnetic induction.   2
    ii. Lentz law is consistent with principle of conservation of energy. Explain.   2
   b. What is a generator? An ac generator consists of o coil of 100 turns and cross sectional area $3m^2$, rotating at constant angular speed $60\ radSec^{-1}$ in a uniform magnetic field $0.004\ T$. The resistance of the coil is $500\ \Omega$. Calculate the maximum current drawn from the generator and maximum power dissipated in the coil.   3
   c. Why is the core of transformer made of soft iron?   1

OR