AMBITION ACADEMY SECONDARY School

Model Set-3 (XII Physics)

Circle the best alternative to the following questions $(11 \times 1 = 11)$

Group 'A'

1. **If 'L' is the angular momentum and 'I' is the moment of inertia of a rigid body about an axis of rotation then its rotational kinetic energy is:**

   a. LI b. LI^2 c. $\frac{L}{2I^2}$ d. $\frac{LI^2}{2}$

2. **Water is flowing uniformly on a horizontal pipe of the circular cross-section. Which of the following is true for the velocity of water?**
   a. It is equal at every part of its flow
   b. It is more in the region near to wall of the pipe
   c. It is maximum along the axis of the pipe
   d. It is least along the axis of the pipe

3. **A Carnot engine takes 10^3 calories of heat from a reservoir at 227 ^{0}C and rejects heat to a reservoir at 127 ^{0}C. The work done by it is:**
   a. 100 cals b. 200 cals c. 300 cals d. 400 cals

4. **A gas is compressed adiabatically. Which of the following is correct?**
   a. Its temperature decreases
   b. Its temperature increases
   c. It absorbs heat from the surrounding
   d. It rejects heat to the surrounding

5. **A car is moving away from a stationary listener with a velocity of 20 m/s and blows a horn at a frequency of 512 Hz. The speed of sound in air is 330 m/s. The change in pitch observed by the listener is:**
   a. 482.7 Hz b. 545Hz c. 29.3 Hz d. 33 Hz

6. Which of the following is not true for the light wave?

a. It is a transverse wave
b. It is an electromagnetic wave
c. It is a longitudinal wave
d. It is a non-mechanical wave

7. The emf of s thermocouple changes its sign at 800 K. If the neutral temperature is 580 K, what is the temperature of the cold junction?

a. 360 K b. 480 K c. 580 K d. 800 K

8. What is the shape of a magnet in a moving coil galvanometer to make the radial magnetic field?

a. Convex cylindrical magnet
b. Horse-shoe magnet
c. Concave cylindrical magnet
d. None

9. The direction of induced emf is given by:

a. Ampere's law
b. Lenz's law
c. Faraday's law
d. Biot-Savart's law

10. Area of hysteresis curve indicates:

a. Retentivity b. Coercivity
c. Loss in energy per cycle d. Loss in energy per cycle

11. The point of origin of seismic wave is called the focus. The point on the earth's surface vertically above the 'focus' is:

a. Hypocenter b. Metacenter c. Epicenter d. Barycenter

Group 'B'

Short answer Questions **(8 × 5 = 40)**

1. Answer the following questions.

a. Define 'angle of contact'. How does the angle of contact determine whether the given liquid rises or depresses in the capillary tube? Explain.**[1+1]**

b. The water strider can walk on the surface of water without penetrating it. Explain how this become possible **[1]**

c. Obtain the relation between surface tension and surface energy. **[2]**

2. **Answer the following questions.**

a. Define the term 'moment of inertia' of a body.**[1]**

b. If the earth is struck by meteorite, what happens to the length of the day? Explain.**[1.5]**

c. A uniform rod of mass 135 g and length 12.4 cm is hung at its center with the help of a thin string and set into an angular simple harmonic motion.

i. Calculate the moment of inertia of the rod.**[1]**

ii. Find the period of angular SHM if the torsional constant of the string is $10^{-3}\ Nm^{-1}deg^{-1}$.**[1.5]**

OR

a. State Bernoulli's principle.**[1]**

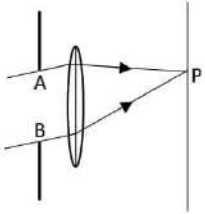
b. Prove the relation: $a_1v_1 = a_2v_2$ (equation of continuity) **[2]**

c. At a certain point in a horizontal pipe the gauge pressure is $6 \times 10^4\ Nm^{-2}$ and at the other point the pressure is $2.5 \times 10^4\ Nm^{-2}$. If the areas of the pipe at these two points are 25 cm^2 and 15 cm^2 respectively, calculate the rate of flow of water through the pipe.**[2]**

3. **Answer the following questions.**

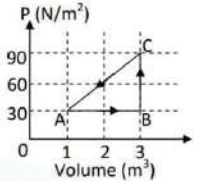
a. Distinguish between interference and diffraction of light. **[2]**

b. The figure shows a Fraunhoffer diffraction through a single slit AB using the monochromatic light of wavelength λ. What is the nature of fringe (bright or dark) formed at P if the path difference between waves emitted from points A and B is 3λ? Explain with figure.**[2]**



c. Show graphically how does the intensity of bright fringes formed on the either side of the central bright fringe varies with angle of diffraction. **[1]**

4. The adjacent figure shows a change in a thermodynamic system in going from an initial state A to the state B and C returning to the state A. If U_A = 0 , U_B = 30 J and heat given to the system in the process B→C is 50 J, then determine: (U refers the internal energy)



a. Internal energy of the system in state C.**[1]**
b. Heat given to the system in the process A→B. **[1]**
c. Heat extracted from the system in the process C→A. **[1]**
d. Net work done in the complete cycle. **[2]**

5. Answer the following questions.
a. What do you mean by Hall Effect? **[1]**
b. Explain with figure, the mechanism of development of Hall voltage. **[2.5]**
c. How the Hall-effect measurements be used to determine the magnetic field in the region of space? Explain. **[1.5]**

6. Answer the following questions.
a. State and explain the 'Lenz law'. **[2]**
b. A 0.25m long bar moves along the two parallel rails (of negligible resistances) which are connected to a 6 Ω resistor as shown in the figure. The system is placed in a uniform magnetic field of flux density 1.20 T acting perpendicularly inwards the plane of paper.

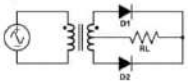
i. Why does the current appear in the resistor when the bar is kept in motion along the rails? **[1]**
ii. At certain instant, the current in the resistor is 1.75A and flowing counterclockwise in the circuit. What is the magnitude and direction of the velocity of the bar at that instant**? [2]**

7. Answer the following questions.
a. What do you mean by the photoelectric effect? **[1]**
b. There is a large number of free electrons in a metal. Why don't they emit spontaneously? **[1]**
c. How does the photoelectric effect manifest the particle nature of light? Explain. **[1.5]**
d. Calculate the energy of a photon of light of wavelength 900 nm. **[1.5]**

8. Answer the following questions.
a. State the Bohr's 'quantization condition'. **[1]**
b. What happens if the ground-state electron in a hydrogen atom suddenly absorbss a photon of energy 10.2 eV? **[2]**
c. Can you apply Bohr's atomic model to calculate the energy of valance electrons in helium an atom as similar to H-atom? Do you think any necessary modifications he Bohr's theory for such a case? Explain. **[2]**

OR

a. Give the logic symbol and truth table of NAND gate. **[1+1]**
b. The adjacent figure shows full-wave rectifier.



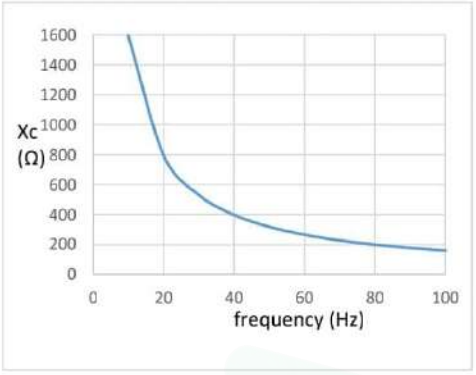
i. Define rectification. **[1]**
ii. The output of this rectifier is not a pure dc. You want to filter the ac components using a capacitor as a filter. Draw a circuit diagram to show how you would connect a capacitor in the above circuit. Also explain how does the use of capacitor help refining the rectifier output. **[2]**

Group 'C'

Long answer Questions **(3 × 8 = 24)**

9. The equation of plane progressive wave travelling in a medium its standard form is given by $y = Asin(\omega t - kx)$ where symbols have their usual meanings.
a. Show that particles of the medium vibrate simple harmonically. **[2]**
b. When the sound wave in the form of the given equation travel in the medium, the variation of pressure in a medium takes place. Show that, the change in pressure occurs according to: $P = P_0 Cos(\omega t - kx)$, where $P_0 = BAk$ is the pressure amplitude and B is the bulk modulus of the medium. **[3]**
c. For a person with normal hearing, the faintest sound that can be heard at a frequency of 400 Hz has a pressure amplitude of about 6×10^{-5} Pa. Calculate the corresponding intensity and intensity level. (take speed of sound 344 m/s and density of air 1.2 kg/m^3). **[1.5+1.5 =3]**

10. The graph below shows the variation of capacitive reactance (X_C) of some capacitor with the frequency of an ac.



a. What do you mean by the term 'capacitive reactance' of a capacitor? **[1]**
b. Calculate the value of capacitance of the capacitor. **[2]**
c. An inductor of inductance L has same reactance as the capacitor at 40Hz. Calculate the value of L.**[2]**
d. Plot the graph showing how inductive reactance varies with the frequency of ac. Use the same axis labeling as the above graph. **[2]**
e. The capacitor and inductor discussed above are connected in series with a resistor of 25Ω to make a LCR series circuit. Calculate the resonating frequency of the circuit.**[1]**

OR

a. When two parallel wires carrying current placed close to each other experience a force. Why? Explain. **[2]**
b. Show that the force per unit length experienced by two parallel wires carrying a current of I_1 and I_2 placed 'r' distance apart is equal to: $\frac{\mu_0 I_1 I_2}{2\pi r}$. **[2]**
c. When does this force become attractive and repulsive? Explain with the necessary figure. **[2]**
d. Two parallel wires carry 12A and 8A currents in the same direction. If the wires are 10 cm apart, find where a third parallel wire also carrying current must be placed so that the force experienced by it shall be zero. **[2]**

11. Answer the following questions.

a. What do you mean by cross-field? **[1]**
b. What is the purpose of using cross-field in J.J. Thomson's experiment? Explain with necessary relation. **[2]**
c. A moving electron suddenly enters midway between two oppositely charged horizontal parallel plates in the direction parallel to the plates. What is the nature othe f path followed by the electron? Show with necessary mathematical calculations. **[3]**
d. An electron accelerated by a p.d of 2000V enters a uniform magnetic field of 0.02T in the direction perpendicular to it. Find the angular momentum of an electron moving in a circular path. [$m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$C] **[2]**

OR

Complete the following decay equations: **[1]**

a. ${}_{92}U^{238} \rightarrow {}_{90}U^{234} + \ldots\ldots\ldots$
b. ${}_{90}U^{234} \rightarrow \ldots Pa \ldots + \beta$
c. How does a β particle differ from an electron? **[1]**
d. Write radioactive decay equation. Using this equation find the relation between half-life period and decay constant. **[3]**
e. Mention any two uses of radioisotopes. **[1]**
f. The measured activity of C^{14} in a piece an ancient wood is 14 counts per minute per gram. It is assumed that the activity of the C^{14} isotopes in the wood should be 19 counts per minute per gram. Considering the thalf-life of C^{14} is about 5600 years, find the age of the wood. **[2]**