Question Paper

Physics

ℵℯ? **format for 2017-18**

Subject : PHYSICS   **Std. XII Science**

Time : 2 ½ hours   **Maximum marks : 55**

<u>GENERAL</u> INSTRUCTIONS

1. Attempt all questions.
2. Q. No. 1 to Q.No. 4 are multiple choice questions. Candidates are to choose and write the most suitable answer. Each carries one mark.
3. Q. No. 5 to Q.No. 7 are very short answer type questions and each carries one mark.
4. Q. No. 8 to Q. No. 15 are short answer type questions carrying two marks Each, with internal choice in one question only.
5. Q. No. 16 to Q. No. 23 are short answer type questions carrying three marks each, with Internal choice in one question only.
6. Q. No. 24 and 25 are long answer type questions carrying four marks each with internal choice in each question.
7. Use of calculators is not permitted. However, Log tables will be provided on request.
8. You may use the following values of physical constants wherever necessary:

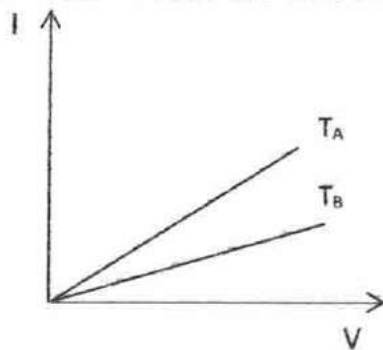$$c = 3 \times 10^8 \, ms^{-1}$$

$$e = 1.6 \times 10^{-19} \, C$$

$$h = 6.6 \times 10^{-34} \, Js$$

$$m_e = 9.1 \times 10^{-31} \, kg$$

$$\mu_0 = 4\pi \times 10^{-7} \, TmA^{-2}$$

1. The electric field of point source charge in free space shows
   - Cylindrical symmetry
   - Spherical symmetry
   - Linear symmetry
   - Planar symmetry

2. The fig. shows the variation of current (I) with the potential difference (V) for a given conductor at two different temperatures T_A and T_B . Then

- $T_A > T_B$
- $T_A < T_B$
- $T_A = T_B$
- $T_A \geq T_B$

3. In a double slit experiment, the intensity at a certain point on the screen is 75% of the maximum intensity. The phase difference between the waves from the two slits interfering at that point is

- $\pi / 6$
- $\pi / 3$
- $2\pi / 3$
- $3\pi / 4$

4. In a common emitter amplifier, the current gain is 62. The collector resistance and input resistance are 5 kΩ and 500 Ω respectively. If the input voltage is 0.01 V the output voltage is :

- 620 V
- 0.62 V
- 6.2 V
- 62 V

5. Two coils can be arranged in any of the three situations shown in the figure.

(a)   (b)   (c)
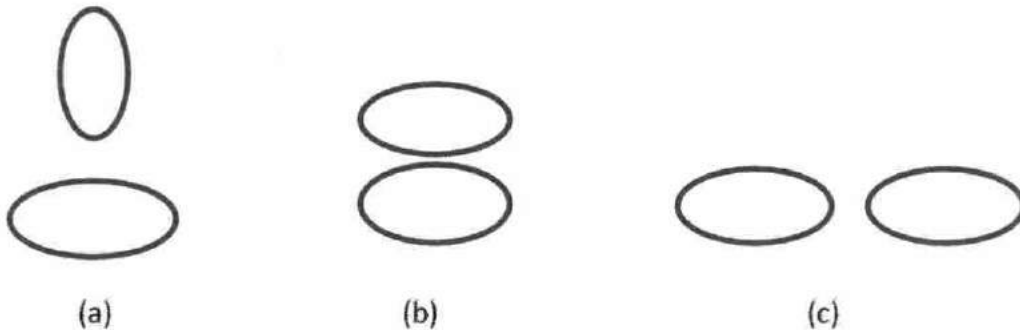
In which situation will their mutual inductance be maximum? Why?

6. When the number of turns of the coil in the galvanometer is doubled without changing any other factors, what happens to its (i) voltage sensitivity? (ii) current sensitivity?

7. The electrostatic force acting between two charges separated by a distance 'd' is F. At what separation should the charges be kept so that the force between them is 3F?

8. Electromagnetic radiation
   (i) A is used in treating certain forms of cancer.
   (ii) B is used for satellite communication.
   (iii) C is used to detect fracture in bones.
   Identify A, B and C. Arrange them in increasing order of their wavelengths.

45

9. How does the current density in a conductor vary with the
    (i)   Increase in potential gradient?
    (ii)   Increase in temperature?
           Give reason for the answers.

10. A circular coil of radius 8 cm and 20 turns is rotated about its vertical diameter at 120 rpm in a uniform horizontal magnetic field 0.03 Tesla. Calculate the maximum and the rms values of the induced emf.

11. The graph shows stopping potential (V_0) verses frequency (v) of the incident radiation for two different metals **A** and **B**.
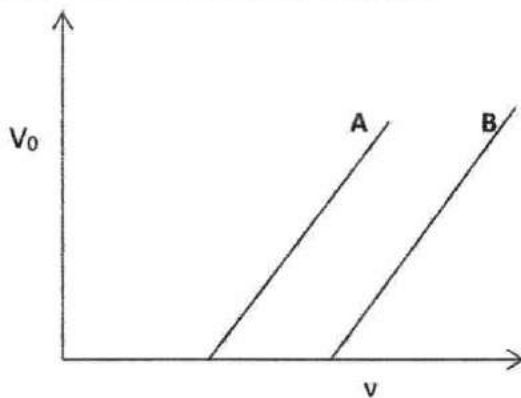
(i) From which metal out of the two it is easier to remove photoelectrons? Why?
(ii) Write any one implication from the observation of this graph which support Einstein's theory of photoelectric effect.

12. With respect to their mode of propagation distinguish between sky waves and space waves.

13. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.
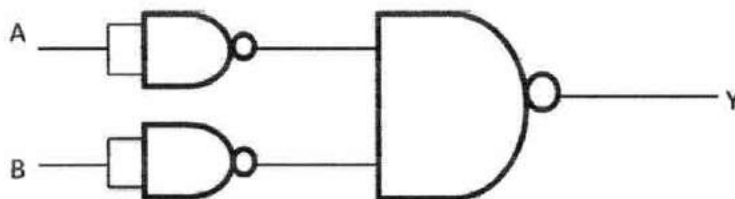

14. The wavelength of the longest wavelength line of Lyman series of the hydrogen spectrum is 1218 A^0. Determine the wavelength of the longest wavelength line of Balmer series.

15. Double-convex lens is to be manufactured from a glass of refractive index 1.55, with both faces having the same radius of curvature. What is the radius of curvature required if the focal length is to be 20 cm?

An object of size 3.0 cm is placed 14cm in front of a concave lens of focal length 21cm. Find the position and size of the image produced by the lens.

16. A certain potential difference is applied using a battery across a parallel plate air-filled capacitor. The battery is removed and the air is replaced by a dielectric medium having a dielectric constant greater than that of air. Explain with valid reasons
   (i) How will this affect the capacitance of the capacitor?
   (ii) How will this affect the charge stored in the capacitor?
   (iii) How will this affect the energy stored in the capacitor?

17.
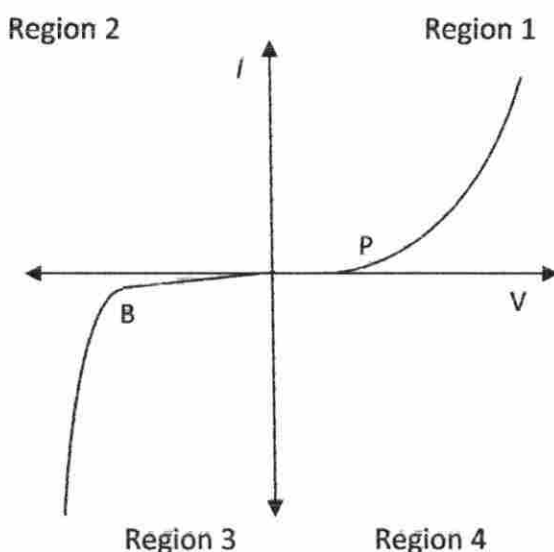
The figure shows the V- I characteristics of a p-n junction diode.
(i)Identify the regions in which the diode is (a)reverse biased and (b) forward biased
(ii)Why is the current almost zero till the point 'P' in region 1?
(iii)Why does the current increases rapidly after the point 'B' in region 3 ?

18. An ac source of voltage $V_0 = V_0 \sin \omega t$ is connected across a series combination of an inductor, a capacitor and a resistor. Use the phasor diagram to obtain the expression for the (i) impedance of the circuit and (ii) phase angle between the voltage and the current.

OR

Obtain the relationship between the ratio of voltages and the ratio of number of terns of a transformer. How is the energy loss due to eddy currents minimised in a transformer?

19. A storage battery of emf 8.0 V and internal resistance 0.5 Ω is being charged by a 120 V dc supply using a series resistor of 15.5 Ω. What is the terminal voltage of the battery during charging?

20. Explain how polarisation occurs when light incidents at Brewster's angle on the surface of a transparent medium. Obtain the relationship between Brewster's angle and refractive index of the medium.

21. A radioactive nucleus D decays according to the following sequence:

$$D \xrightarrow{\alpha} D_1 \xrightarrow{\beta^-} D_2 \xrightarrow{\alpha} D_3 \xrightarrow{\gamma} D_4$$
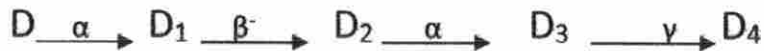
If the mass number and atomic number for D_4 are respectively 172 and 69, then find the corresponding values for D.
How can a nucleus emit β^- particles though it does not contain any negatively charged Particles in it?

22. What is meant by a point dipole?
An electric dipole with dipole moment 3×10^{-8} C m and dipole length 1 cm is placed at the centre of a sphere of radius 10.5 cm in such a way that the centre of the dipole coincides with the centre of the sphere. What is the total electric flux over the sphere?
Calculate the electric potential due to the dipole at a point on the surface of the sphere which lies on the axis of the dipole.

23. Figure shows a small magnetised needle P placed at a point O. The arrow shows the direction of its magnetic moment. The other arrows show different positions and orientations of the magnetic moments of another identical magnetised needle Q.
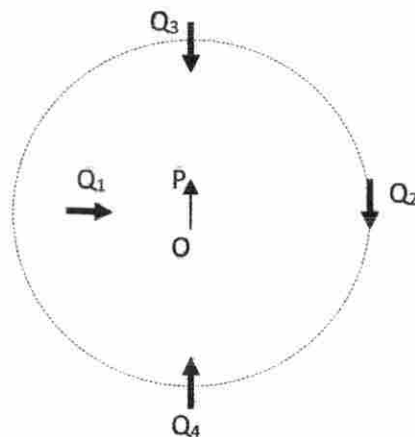
(a) In which configuration the system is not in equilibrium?
(b) In which configuration is the system in unstable equilibrium?
(c) Which configuration corresponds to the lowest potential energy?

24. Obtain an expression for the force acting per unit length on two parallel infinitely long straight conductors carrying currents in the opposite directions.
In the diagram shown below X , Y and Z are three infinitely long straight parallel conductors separated by the same distance 'd' and carrying currents as shown in the figure. What will be the net force per unit length experienced by Y?
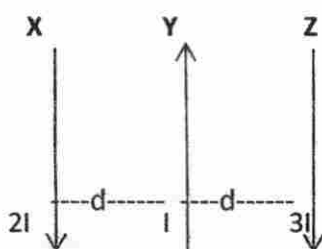
OR

Explain clearly the role of crossed electric and magnetic fields in accelerating the charge in a cyclotron. Hence derive the expression for the kinetic energy acquired by the charged particle.

An α particle and a proton are released from the centre of the cyclotron and made to accelerate. Can both be accelerated at the same cyclotron frequency? Give reasons to justify your answer.

25. Obtain an expression for the refractive index of the material of a prism in terms of its refracting angle and the angle of minimum deviation produced by it.

Why does light undergo dispersion when it passes through a prism ?

OR

Obtain the relationship between refractive indices n_1 and n_2, object distance u, image distance v and the radius of curvature R in the case of refraction at a convex spherical surface with the object in the rarer medium of refractive index n_1 and image in the denser medium of refractive index n_2.

What will be the relationship if the positions of object and image are interchanged?

END