

**CBSE Board
Class XII Physics
Sample Paper - 7****Time: Three Hours****Maximum Marks: 70****General Instructions**

- (a) All questions are compulsory.
- (b) There are 29 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 16 carry two marks each, questions 17 to 25 carry three marks each and questions 27 to 29 carry five marks each.
- (c) Question 26 is a value based question carrying four marks.
- (d) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.
- (e) Use of calculator is not permitted.
- (f) You may use the following physical constants wherever necessary.

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

$$c = 3 \times 10^8 \text{ m s}^{-1}$$

$$h = 6.6 \times 10^{-34} \text{ J s}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ T ma}^{-1}$$

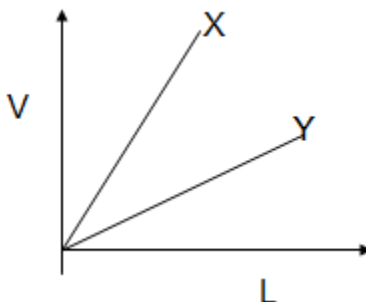
$$K_B = 1.38 \times 10^{23} \text{ J K}^{-1}$$

$$N_A = 6.023 \times 10^{23} \text{ /mole}$$

$$m_n = 1.6 \times 10^{-27} \text{ kg}$$

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1. If electric field intensity at a place is zero, will the electric potential be necessarily zero at that point? Justify your answer. (1)
 2. How will you identify whether the magnetic field at a given point is due to Earth or due to some current carrying wire? (1)
 3. What is inductive reactance X_L in the ac circuit? What is its value in dc circuit? (1)
 4. What phase relationship exists between electric & magnetic field in an electromagnetic wave? (1)

5. Is the light coming out from headlight of a car: i) plane polarized ii) highly coherent? (1)
6. When photons of energy 5eV fall on the surface of a metal, the emitted photoelectrons are stopped by a cut off potential of 3.5 volt. What is the work function of the metal? (1)
7. A neutron is absorbed by a ${}_3\text{Li}^6$ nucleus with subsequent emission of an α -particle. Write the corresponding nuclear reaction. (1)
8. The output of an OR gate is connected to both the inputs of NOR gate. Draw the logic circuit of the combination. (1)
9. Write an expression for electric field intensity due to a charged spherical shell at a point
 (i) inside the shell
 (ii) outside the shell.
 Represent graphically the variation of electric field vector E as a function of position vector r in the case of charged spherical shell. (2)
10. Two charged conductors A (hollow) & B (solid) carry charges q & q' respectively. Conductor B is inserted inside A such that the surface B is kept insulated from A. What will be the total charge outside the surface of A? (2)
11. The variation of potential difference with length is given in case of two potentiometers X and Y is shown. Which one of these will you prefer to compare emf's of two cells & why? Justify. (2)



12. A current I flows through a wire of length L . Prove that if this wire is bent into a circular coil & suspended in a magnetic field B , then the torque acting on it will be maximum when the coil of single turn is formed. What will this maximum torque be? (2)
13. Two parallel current carrying wires in the same direction attract each other. Give reason. Depict pictorially as well. (2)

14.

- (a) The susceptibility of iron is greater than that of aluminium. What do you infer from this?
- (b) A certain region of space needs to be shielded from a magnetic field. How can this be done? (2)

15. Derive an expression for the emf induced when the area of rectangular loop placed perpendicular to the uniform magnetic field is changed by moving one of its arms. (2)

16. Represent an analog & a digital signal graphically. (2)

17.

- (a) It is often heard “The domestic supply is at a voltage of 220V”. What voltage value is this referring to? Express both peak & rms values.
- (b) What is the instantaneous and average power per cycle supplied to the Capacitor? (3)

18. For refraction through a glass prism, derive the prism formula:

$$n_{21} = \frac{\sin[(A + D_m)/2]}{\sin[A/2]} \quad (3)$$

19. A convex lens has 20 cm focal length in air. What is the focal length in water? (Refractive index of air-water = 1.33, refractive index for air-glass is 1.5.) (3)

20. The frequency of incident light is doubled keeping the intensity constant. What is the effect on:

- (i) KE of the photoelectrons
- (ii) Photoelectron current
- (iii) Stopping potential? (3)

21. How many alpha & beta particles are given out when ${}_{92}\text{X}^{235}$ changes into ${}_{88}\text{Y}^{219}$? State & define a unit of decay rate. (3)

22. The base region in a transistor is usually thin. Why?

In the common emitter mode of a transistor, the dc current gain is 20 & emitter current is 7mA. Find (i) the base & (ii) the collector current. (3)

OR

A pure inductive circuit does not consume any power in a complete cycle. Prove it. (3)

23. Draw input & output characteristics for a transistor in common emitter mode. Draw the corresponding circuit diagram.

Conclude at least one important feature from each of the characteristic curves. (3)

24. Name the device used for data transmission from one computer to another. What does it do?

Draw a simple block diagram depicting the general form of communication systems. (3)

25. Define the term 'resolving power' of an astronomical telescope. How does it get affected by

(i) Increasing the aperture of the objective lens?

(ii) Increasing the wavelength of the light used?

Justify your answer in each case. (3)

26. In a winter night, Sonu was sitting with his grandmother, she told him "when I was of your age, paisa coins were used like one paisa, two paisa etc., and those paisa coins were having great value at that time." Sonu asked his grandmother, "from which metal was the coin made up of?"

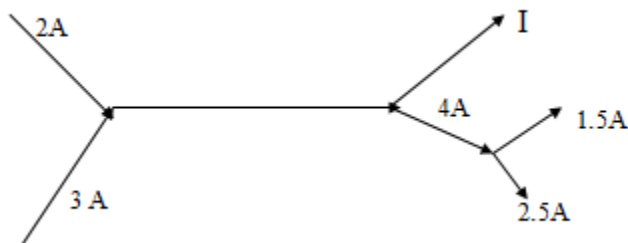
Grandmother replied, "I don't know about it, as I am not educated and I even never tried to know about that". But Sonu's elder brother Monu was standing behind and listening to the conversation between them, he told Sonu that those were made up of Aluminium Magnesium alloy. Grandmother felt happy with her grandsons.

(a) Write about Monu's intelligence.

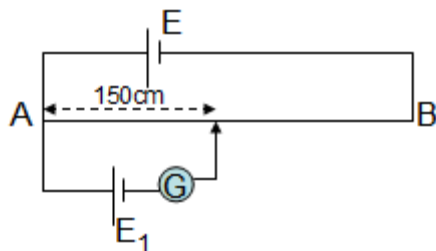
(b) A paisa coin weighs 0.75 g and is square shaped with diagonal 17 mm. Suppose it is electrically neutral. If the coin is only made up of aluminium, find the magnitude of equal number of +ve and -ve charges. (4)

27.

(a) What is current I in the figure below?

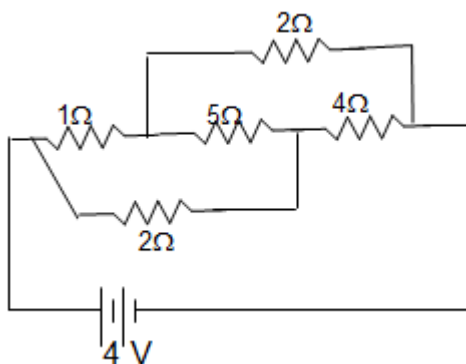


(b) AB is a wire of uniform cross section on which exists a potential gradient of 0.01V/cm .



- (i) If the galvanometer shows zero deflection in the position shown, find the emf E_1 of the cell used.
- (ii) If the internal resistance of the driver cell E_1 increases somehow, how will it effect the balance point?

(c) Find the current drawn from a battery of 4V in the given network.



(5)

OR

A transistor is used in common emitter mode in an amplifier circuit. When a signal of 20 mV is added to the base-emitter voltage, the base current changes by 20 μA and the collector current changes by 2 mA. The load resistance is 5 k Ω . Calculate (a) the factor β , (b) the input resistance R_{BE} , (c) the transconductance and (d) the voltage gain. (5)

28.

- (a) An electron & a proton moving with the same speed enter a uniform magnetic field B perpendicularly. Which particle will have larger radius of its circular path? Find the ratio of their radii. The masses of electron & proton are $9.1 \times 10^{-31} \text{ kg}$ & $1.67 \times 10^{-27} \text{ kg}$.
- (b) Show that for a moving charged particle in a uniform magnetic field, the kinetic energy of the particle remains constant.
- (c) A coil placed in the plane of the page has a current in the clockwise direction when looking from above. What will be the change in the magnetic field at the center of the coil if
 - (i) the current through the coil is reduced to half?
 - (ii) radius of the coil is doubled ?
 - (iii) what will be the direction of the magnetic field?

(5)

OR

- (a) Derive an expression for the magnifying power of an astronomical telescope. Draw a ray diagram showing image formation in it.
- (b) An astronomical telescope consists of two thin lens set 36cm apart and has a magnifying power 8. Calculate the focal length of the lens.
- (c) A giant refracting telescope at an observatory has an objective lens of focal length 15 cm. If an eye-piece of focal length 1.0 cm is used, what is the angular magnification of the telescope? If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens? The diameter of the moon is 3.48×10^6 m, and the radius of lunar orbit is 3.8×10^8 m. (5)

29.

- (a) Double convex lenses need to be manufactured from a glass of refractive index 1.55 with both faces of same radii of curvature. What is the radius of curvature required if the focal length of the lens is to be 20 cm?
- (b) In case of a microscope:
 - (i) Magnifying power of simple microscope is inversely proportional to the focal length of the lens. What then stops us from using a convex lens of smaller focal length & achieving greater magnifying power?
 - (ii) Why must both the objective & the eye piece of a compound microscope have short focal length?
- (c) An object is first seen in blue light & then in red light through a simple microscope. Compare its magnifying power. (5)

OR

Write the relation for the force $\vec{F}$ acting on a charge carrier q moving with a velocity $\vec{v}$ through a magnetic field $\vec{B}$ in vector notation. Using this relation, deduce the conditions under which this force will be (i) maximum (ii) minimum

An electron travelling west to east enters a chamber having a uniform electrostatic field in a north to south direction. Specify the direction in which a uniform magnetic field should be set up to prevent the electron from deflecting from its straight line path. (5)