B2E Learning

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# Sample Paper 1

## Class- XII Exam - 2022-23

# PHYSICS

**Time : 3 Hours** **Maximum Marks : 70**

**General Instructions :**

(1) There are 35 questions in all. All questions are compulsory

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.

(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.

(4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.

(5) Use of calculators is not allowed.

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## SECTION-A

Q1. When a body is connected to the earth, then electrons from the earth, f ow into the body. It means that the body is [1]

(a) unchanged (b) an insulator

(c) positively charged (d) negatively charged

Q2. The energy stored in a capacitor is actually stored [1]

(a) between the plates (b) on the positive plate

(c) on the negative plate (d) on the outer surfaces of the plates

Q3. A charge moving with uniform velocity produces [1]

(a) only an electric field (b) only a magnetic field

(c) electromagnetic field (d) none of these

Q4. The image formed by objective lens of a compound Microscope is [1]

(a) Virtual and diminished (b) Real and diminished

(c) Real and large (d) Virtual and Large

Q5. The magnifying power of a magnifying glass of power 12 dioptre is [1]

(a) 4 (b) 1200

(c) 3 (d) 25

Q6. In a closed circuit of resistance $10\Omega$, the linked flux varies with time according to relation $\varphi = 6t^2 - 5t + 1$. At $t = 0.25$ second, the current (in Ampere) flowing through the circuit is [1]

(a) 0.4 (b) 0.2

(c) 2.0 (d) 4.0

Q7. In an oscillating LC circuit, maximum charge on the capacitor is Q. The charge on this capacitor, when the energy is stored equally between the electric and magnetic fields is [1]

(a) $Q$ (b) $\frac{Q}{2}$

(c) $\frac{Q}{\sqrt{3}}$ (d) $\frac{Q}{\sqrt{2}}$

Q8. A parallel plate capacitor consists of two circular plates each of radius 2 cm separated by distance of 0.1 mm. If rate of change of potential difference is $5 \# 10^{13}$ V-s$^{-1}$, then displacement current will be [1]

(a) 5.6 A (b) $5.6 \times 10^2$ A

(c) $5.6 \times 10^3$ A (d) $5.6 \times 10^4$ A

Q9. Light of two different frequencies, whose photons have energies of 1 eV and 2.5 eV successively illuminate a metal whose work function is 0.5 eV. The ratio of maximum velocities of the emitted electrons will be [1]

(a) 1 : 5 (b) 1 : 4

(c) 1 : 2 (d) 1 : 1

Q10. In the nuclear fusion reaction ${}_1H^2 + {}_1H^3$ " ${}_2He^4 + n$, the repulsive potential energy between the two nuclei is $7.7 \times 10^{-14}$ J. The temperature at which the gases must be heated to initiate the reaction is nearly (Boltzmann's constant $k = 1.38 \times 10^{-23}$ J-K$^{-1}$) [1]

(a) $10^9$ K (b) $10^7$ K

(c) $10^5$ K (d) $10^3$ K

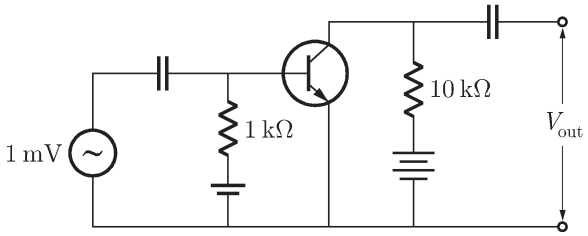
**DIRECTION :** (Q11-Q14) Fill in the blanks with appropriate answer.

Q11. The net charge on a current carrying conductor is ..... . [1]

Q12. The value of maximum amplitude produced due to interference of two waves is given by $y_1 = 4\sin \omega t$ and $y_2 = 3\cos \omega t$ is ..... [1]

Q13. Excitation energy of a hydrogen-like ion, in its first excitation state is 40.8 eV. The energy needed to remove the electron from the ion in ground state, is ..... . [1]

Q14. In the following common-emitter configuration an $n$-$p$-$n$ transistor with current gain $\beta = 100$ is used. The output voltage of the amplifier will be ..... $V$. [1]



**DIRECTION :** (Q15-Q18) Answer the following

Q15. A concave mirror is held in water. What should be the change in focal length of the mirror? [1]

Q16. Magnetic f eld lines can be entirely conf ned within the core of a toroid but not within a straight solenoid, why? [1]

Q17. A cell of emf $E$ and internal resistance $r$ is connected across a variable resistor $R$. Plot a graph showing the variation of terminal potential $V$ with resistance $R$. Predict from the graph, the condition under which $V$ becomes equal to $E$. [1]

Q18. Write any two properties of $X$-rays. [1]

**OR**

Write down two properties of electromagnetic wave. [1]

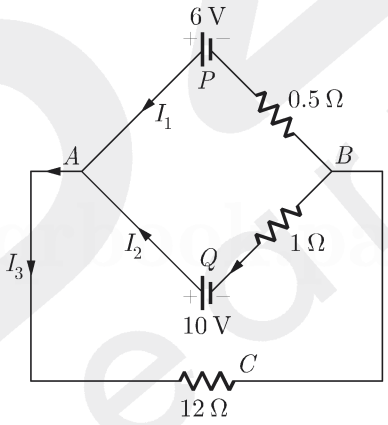
## SECTION-B

Q19. Usually it has been seen in off ces choke coil is needed in the f uorescent tubes with AC mains. Also, an ordinary resistor can not used instead of choke coil. Why? What is the value hidden in the question? [2]

Q20. Draw suitable graphs to show the variation of photoelectric current with collector plate potential for [2]

1. A f xed frequency but different intensities $I_1 > I_2 > I_3$ of radiation.
2. A f xed intensity but different frequencies $f_1 > f_2 > f_3$ of radiation.

Q21. Apply Kirchhoff's laws to the loops $ACBPA$ and $ACBQA$ to write the expressions for the current $I_1$ , $I_2$ and $I_3$ in the network. [2]




Circuit diagram of loops

Q22. What kinetic energy of a neutron will be associated by the de-Broglie wavelength $1.32 \times 10^{-10}$m ? Given that mass of a neutron $= 1.675 \times 10^{27}$kg. [2]

Q23. Answer the following questions: [2]

1. The angle of dip at a location in southern India is about 18c. Would you except a greater or smaller dip angle in Britain?
2. Geologists claim that besides the main magnetic N-S pole, there are several local poles in the earth's surface oriented in different directions. How is such a thing possible at all?

Q24. Define magnifying power of a telescope. Also, write its expression. [2]

**OR**

Show that linear magnif cation of an image formed by a curved mirror may be expressed as ,

$$m = \frac{f}{f - u} = \frac{f - v}{f}$$

Where, letters have their usual meanings.

Q25. Define mean value and root mean square value of alternating current. [2]

**OR**

What is transformer? What do you mean by its eff ciency?

## SECTION C

Q26. (i) An electrostatic f eld line is a continuous curve, i.e. a f eld line cannot have sudden break. Why not? [3]

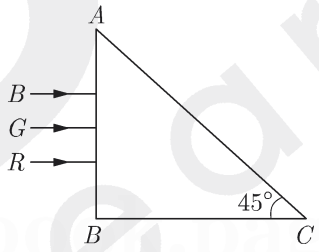
(ii) Explain, why two f eld lines never cross each other at any point?

(iii) A proton is placed in a uniform electric f eld directed along the positive X-axis. In which direction will it tend to move?

Q27. (i) Two slits are made 1 mm apart and the screen is placed 1 m away. What is the fringe separation, when blue-green light of wavelength 500 nm is used?

(ii) What should be the width of each slit to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern? [3]

Q28. Three light rays, red $R$, green $G$ and blue $B$ are incident on a right angled prism $ABC$ at face $AB$. The refractive indices of the material of the prism for red, green and blue wavelengths are 1.39, 1.44 and 1.47, respectively. Our of the three, which colour of ray will emerge out of face $AC$? Justify your answer. Trace the path of these rays after passing through face $AB$. [3]




Q29. A beam of light consisting of two wavelengths 560 nm and 450 nm, is used to obtain interference fringes in a Young's double slit experiment. Find the lest distance from the central maximum, where the bright fringes due to both the wavelengths coincide. The distance between the two slits is 4mm and the screen is at a distance of 1 m from the slits. [3]

Q30. Calculate the binding energy (BE) per nucleon of $_{20}Ca^{40}$ nucleus. Given: [3]

$$m(_{20}Ca^{40}) = 39.962589 \text{ u}$$
$$m_n = 1.008665 \text{ u}$$
$$m_p = 1.007825 \text{ u}$$

(Take, 1 amu = 931 MeV).

## SECTION D

Q31. Find an expression for the torque acting on an electric dipole placed in uniform electric field. A system of two charges, $q_A = 2.5 \times 10^{-7}$ C and $q_B = 2.5 \times 10^{-7}$C located at points $A(0,0,-15\,\text{cm})$ and $B(0,0,+15\,\text{cm})$, respectively. Find the electric dipole moment of the system and the magnitude of the torque acting on it, when it is placed in a uniform electric field $5 \times 10^{4}\,\text{NC}^{-1}$ making an angle 30° with it. [5]

**OR**

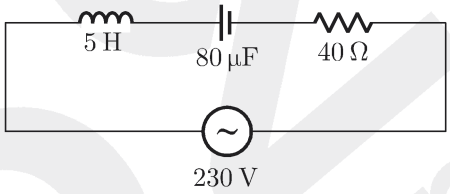
A capacitor of capacitance $C$ is charged fully by connecting it to a battery of emf $E$. It is then disconnected from the battery. If the separation between the plates of the capacitor is not doubled, what will happen to

1. Charge stored by the capacitor?
2. Potential difference across it?
3. Field strength between the plates?
4. Energy stored by the capacitor?
5. Capacitance of the capacitor?

Q32. Explain with the help of a neat and labelled diagram, the principle, construction and working of a transformer. [5]

**OR**

The given circuit diagram shows a series $L$-$C$-$R$ circuit connected to a variable frequency 230 V source.




1. Determine the source frequency which derives the circuit in resonance.
2. Obtain the impedance of the circuit and the amplitude of current at the resonating frequency.
3. Determine the rms potential drop across the three elements of the circuit.
4. How do you explain the observation that the algebraic sum of the voltage across the three elements in capacitance ($C$) is greater than the supplied voltage?

Q33. Show that the refractive index of the material of a prism is given by [5]

$$\mu = \frac{\sin\frac{(A+\delta_m)}{2}}{\sin\frac{A}{2}}$$

Where, the symbols have their usual meanings.

**OR**

Define the term resolving power of an astronomical telescope. How does, it get affected on

1. increasing the aperture of the objective lens?
2. increasing the wavelength of light used?
3. increasing the focal length of the objective lens?

## SECTION E

Q34. A convex or converging lens is thicker at the centre than at the edges. It converges a parallel beam of light on refraction through it. It has a real focus. Convex lens is of three types:

(i) Double convex lens

(ii) Plano-convex lens

(iii) Concavo-convex lens. Concave lens is thinner at the centre than at the edges. It diverges a parallel beam of light on refraction through it. It has a virtual focus. (4)

(i) point object 0 is placed at a distance of 0.3 m from a convex lens (focal length 0.2 m) cut into two halves each of which is displaced by 0.0005 m as shown in figure. What will be the location of the image

(a) 30 cm right of lens (b) 60 ern right of lens

(c) 70 ern left of lens (d) 40 cm left oflens

(ii) Two thin lenses are in contact and the focal length of the combination is 80 cm. If the focal length of one lens is 20 cm, the focal length of the other would be

(a) -26.7 cm (b) 60 crn

(c) 80 cm (d) 20 cm

(iii) A spherical air bubble is embedded in a piece of glass. For a ray of light passing through the bubble, it behaves like a

(a) converging lens (b) diverging lens

(c) plano-converging lens (d) plano-diverging lens

(iv) Lens used in magnifying glass is

(a) Concave lens (b) Convex lens

(c) Both (a) and (b) (d) None of the above

Q.35. Photoelectric effect is the phenomenon of emission of electrons from a metal surface, when radiations of suitable frequency fallon them. The emitted electrons are called photoelectrons and the current so produced is called photoelectric current. (4)

(i) With the increase of intensity of incident radiations on photoelectrons emitted by a photo tube, the number of photoelectrons emitted per unit time is

(a) increases (b) decreases

(c) remains same (d) none of these

(ii) It is observed that photoelectron emission stops at a certain time t after the light source is switched on. The stopping potential (V) can be represented as

(a) $2(KE_{max}/e)$ (b) $(KE_{max}/e)$

(c) $(KE_{max}/3e)$ (d) $(KE_{max}/2e)$

(iii) A point source of light of power $3.2 \times 10^{-3}$ W emits monoenergetic photons of energy 5.0 eV and work function 3.0 eV. The efficiency of photoelectron emission is 1 for every $10^{6}$ incident photons. Assume that photoelectrons are instantaneously swept away after emission. The maximum kinetic energy of photon is

(a) 4 eV (b) 5 eV

(c) 2 eV (d) Zero

(iv) Which of the following device is the application of Photoelectric effect?

(a) Light emitting diode (b) Diode

(c) Photocell (d) Transistor