CLASS XII (2019-20)
PHYSICS (042)
SAMPLE PAPER-2

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

General Instructions :

(i) All questions are compulsory. There are 37 questions in all.
(ii) This question paper has four sections: Section A, Section B, Section C, Section D.
(iii) Section A contains twenty questions of one mark each, Section B contains seven questions of two marks each, Section C contains seven questions of three marks each and Section D contains three questions of five marks each.
(iv) There is no overall choice. However, internal choices has been provided in two question of one marks each, two question of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
(v) You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^8\,\text{m/s}$, $h = 6.63 \times 10^{-34}\text{Js}$, $e = 1.6 \times 10^{-19}\text{C}$, $\mu_0 = 4\pi \times 10^{-7}\text{TmA}^{-1}$,

$\varepsilon_0 = 8.854 \times 10^{-12}\text{C}^2\text{N}^{-1}\text{m}^{-2}$, $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\text{Nm}^2\text{C}^{-2}$, $m_e = 9.1 \times 10^{-31}\text{kg}$,

Mass of neutron $= 1.675 \times 10^{-27}\text{kg}$,

Mass of proton $= 1.673 \times 10^{-27}\text{kg}$, Avogardro's number $= 6.023 \times 10^{23}$ per gram mole,

Boltzmann constant $= 1.38 \times 10^{-23}\text{JK}^{-1}$.

SECTION A

DIRECTION : (Q 1-Q 10) Select the most appropriate option from those given below each question

Q1. Nickel is **(1)**

(a) diamagnetic (b) paramagnetic
(c) ferromagnetic (d) none of these

Q2. To convert mechanical energy into electrical energy one can use **(1)**

(a) D.C. dynamo (b) A.C. dynamo
(c) Motor (d) Transformer

Q3. According to the Maxwell's displacement current law, a changing electric field is source of **(1)**

(a) an e.m.f. (b) magnetic field
(c) pressure gradient (d) all of these

Q4. Which of the following phenomena taken place when a monochromatic light is incident on a prism? **(1)**

(a) Dispersion (b) Deviation
(c) Interference (d) All of these

Q5. When two converging lenses of same focal f are placed in contact, the focal length of the combination is. **(1)**

(a) f (b) $2f$
(c) $\frac{f}{2}$ (d) $3f$

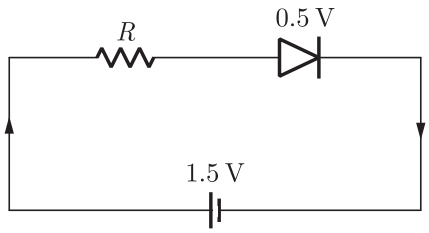
Q6. The wave front due to a point source a finite distance from the source is- **(1)**

(a) Spherical (b) Cylindrical
(c) Plane (d) Circular

Q7. On disintegration of one atom of U-235, the amount of energy obtained is 200 MeV. The power obtained in a reactor is 1000 kW. How many atoms are dps ? **(1)**

(a) 3.125×10^{8} (b) 3.125×10^{16}
(c) 3.125×10^{24} (d) 3.125×10^{32}

Q8. The p-n junction diode used in the circuit shown in the figure has a constant voltage drop at $0.5\,\mathrm{V}$ at all currents and a maximum power rating of 100 mW. What should be the value of the resistor R, connected in series and with p-n junction diode for obtaining maximum current? **(1)**



(a) $5\,\Omega$ (b) $10\,\Omega$
(c) $15\,\Omega$ (d) $20\,\Omega$

Q9. A spherical capacitor has inner sphere of radius $12\,\mathrm{cm}$ and an outer sphere of radius $13\,\mathrm{cm}$.The outer sphere is earthed and the inner sphere has a charge of $2.5\,\mu\mathrm{C}$. If space between the concentric spheres is filled with a liquid of dielectric constant 32, then the capacitance of the capacitor is **(1)**

(a) $4.5 \times 10^{-9}\,\mathrm{F}$ (b) $5.5 \times 10^{-9}\,\mathrm{F}$
(c) $6.5 \times 10^{-9}\,\mathrm{F}$ (d) $7.5 \times 10^{-9}\,\mathrm{F}$

Q10. Light passes successively through two polarimeter tubes each of length $0.29\,\mathrm{m}$. The first tube contains dextro rotatory solution of concentration $60\,\mathrm{kg-m^{-3}}$ and specific rotation $0.01\,\mathrm{rad-m^2-kg^{-1}}$. The second tube contains laevo rotatory solution of concentration $30\,\mathrm{kg-m^{-3}}$ and specific rotation $0.02\,\mathrm{rad-m^2-kg^{-1}}$. The net rotation produced is **(1)**

(a) 0° (b) 10°
(c) 15° (d) 20°

DIRECTION : (Q11-Q15) Fill in the blanks with appropriate answer.

Q11. The AC voltage across a resistance can be measured using a ..... . **(1)**

Q12. In the Bohr's atomic model of hydrogen atom, the ratio of the kinetic energy to the total energy of the electron in n^{th} quantum state is ..... **(1)**

Q13. For a transistor working as common-base amplifier, the emitter current is $7.2\,\mathrm{mA}$. If the current gain is 0.96, then the collector current is ..... . **(1)**

Q14. n identical small spherical drops, each of radius r are charged to same potential V. They are combined to form a bigger drop. The potential of the big drop will be ..... . **(1)**

Q15. Two wires of the same dimensions but resistivities ρ_1 and ρ_2 are connected in series. The equivalent resistivity of the combination is ..... . **(1)**

OR

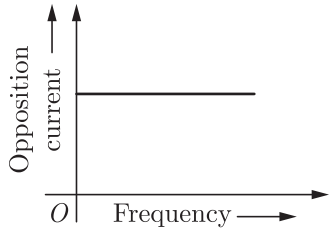
An electron of mass 9.1×10^{-31} kg under the action of a uniform magnetic field moves in a circle of radius 2 cm at a velocity of $3 \times 10^{6}\ \mathrm{m - s^{-1}}$. If a proton of mass 1.67×10^{-27} kg were to move in a circle of the same radius in the same magnetic field, then its speed would be ..... . **(1)**

DIRECTION : (Q16-Q20) Answer the following:

Q16. The lab instructor told a student that in a galvanometer a coil has been wrapped on a conducting frame. Why? Which value is shown by the lab instructor? **(1)**

Q17. The horizontal component of earth's magnetic field at a place is B and angle of dip is 60°. What is the value of vertical component of earth's magnetic field at this place? **(1)**

Q18. The graph given below represents the variation of the opposition offered by the circuit element to the flow of alternating current with the frequency of the applied emf. Identify the circuit element. **(1)**



Q19. A converging lens is kept coaxially in contact with a diverging lens both the lenses being of equal focal lengths. What is the focal length of the combination? **(1)**

Q20. A 10 m long horizontal straight wire extending from East to West is falling with a speed of 5m/s at right angles to the horizontal component of the Earth's magnetic field of $0.30 \times 10^{-4}\ \mathrm{Wbm^{-2}}$. What is the instantaneous value of the emf induced in the wire? **(1)**

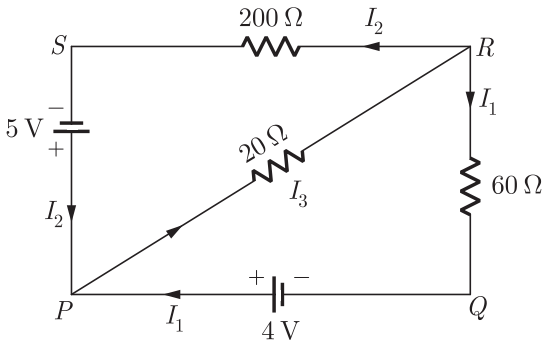
OR

An alternating current in a circuit is given by, $I = 20 \sin(100\pi t + 0.05\pi)\ \mathrm{A}$. What is the rms value of current?

SECTION B

Q21. Guess a possible reason, why water has a much greater dielectric constant than mica? **(2)**

Q22. Apply Kirchhoff's laws to the loops $PRSP$ and $PRQP$ to write the expressions for the currents I_1, I_2 and I_3 in the given circuit. **(2)**



Q23. Write Einstein's photoelectric equation. Plot a graph showing the variation of stopping potential versus the frequency of incident radiation. **(2)**

Q24. An electron and a proton have the same kinetic energy. Which of the two has a greater wavelength? Explain. **(2)**

Q25. (i) State Kirchhoff's loop rule for an electrical network.

(ii) State principle of working of a meter bridge. **(1+1=2)**

Q26. Calculate the distance of an object of height (h) from a concave mirror of focal length 10 cm, so as to obtain a real image of magnification 2. **(2)**

OR

A screen is placed 90 cm from an object. The image is obtained on the screen by a convex lens at two different locations separated by 20 cm. Determine the focal length of lens.

Q27. Calculate the binding energy per nucleon of nucleus ${}_{20}\mathrm{Ca}^{40}$. Given m_n and m_p are 1.008665 u and 1.007825 u respectively and $m({}_{20}\mathrm{Ca}^{40}) = 39.962589\,\mathrm{u}$. **(2)**

OR

Using the Bohr's model, calculate the speed of the electron in a H-atom in the $n = 1$ and 2 levels. **(2)**

SECTION C

Q28. In a single slit diffraction pattern, how does the angular width of central maximum changes when

1. Slit width is decreased?
2. Distance between the slit and screen is increased?
3. Light of smaller visible wavelength is used? Justify your answer in each case. **(3)**

Q29. A circular coil of N-turns and radius R is kept normal to a magnetic field given by $B = B_0 \cos \omega t$. Deduce an expression for the emf induced in this coil. State the rule which helps to detect the direction of induced current. **(3)**

Q30. A convex lens made of a material of refractive index n_1 is kept in a medium of refractive index n_2. A parallel beam of light is incident on the lens. Complete the path of rays of light emerging from the convex lens, if **(3)**

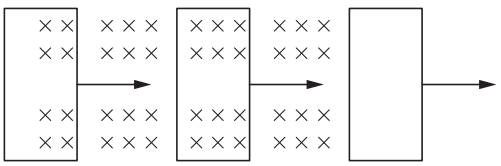
1. $n_1 > n_2$
2. $n_1 = n_2$
3. $n_1 < n_2$.

Q31. (i) What will be the effect on the fringe width, if the entire Young's double slit experiment's apparatus is immersed in water? **(3)**

(ii) Draw a diagram showing the formation of primary rainbow and explain at what angles the primary rainbow is visible.

Q32. (i) Steel is preferred for making permanent magnets, whereas soft iron is preferred for making electron magnets. Why?

(ii) A uniform magnetic field exists normal to the plane of the paper over a small region of space. A rectangular loop of wire is slowly moved with a uniform velocity across the field as shown in the figure.



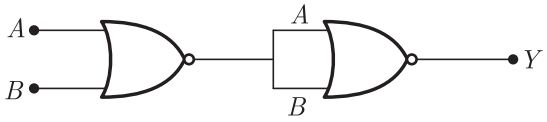
Draw the graph showing the variation of
(a) Magnetic flux linked with the loop and
(b) The induced emf in the loop with time. **(3)**

OR

A small compass needle of magnetic moment m and moment of inertia I is free to oscillate in a magnetic field B. It is slightly disturbed from its equilibrium position and then released. Show that it executes simple harmonic motion. Hence, write the expression for its time period. **(3)**

Q33. Find the half-life period of a radioactive material, if its activity drops to (1/16)th of its initial value in 30 yr. **(3)**

Q34. Write the truth table for circuit given in figure below consisting of NOR gates and identify the logic operation (OR, AND, NOT) which this circuit is performing. **(3)**



SECTION D

Q35. Explain with the help of diagram, the principle and working of an AC generator. Write the expression for the emf generated in the coil in terms of its speed of rotation. **(5)**

OR

The primary coil of an ideal step-up transformer has 100 turns and the transformation ratio is also 100. The input voltage and the power are 220 V and 1100 W. Find:
1. Number of turns in secondary
2. The current in the primary
3. Voltage across the secondary
4. The current in the secondary
5. Power in the secondary. **(5)**

Q36. (i) What do you mean by the polarisation of light? Define law of Malus and then show that the intensity of light becomes half, when ordinary light is incident on a polariser.

(ii) Two polarising sheets have their polarising direction parallel, so that the intensity of the transmitted light is maximum. Through what angle must the either sheet be turned, if the intensity is to drop by one half? **(5)**

OR

1. Define Brewster's law. Show that the sum of angle of polarisation and angle of refraction is 90°.
2. Discuss the intensity of transmitted light, when polaroid sheet is rotated between two crossed polaroid. **(5)**

Q37. Find an expression for the capacitance of a parallel plate capacitor. An air capacitor has a capacitance of $2\,\mu F$, which becomes $12\,\mu F$, when a dielectric medium is filled in the space between the plates. Find dielectric constant of that material. **(5)**

OR

Find an expression for the electric field intensity at a point on equatorial line due to an electric dipole. **(5)**