DOON GLOBAL SCHOOL Shaping Futures For 25 Years	**Set-1** **Q.P Code -55/3/1** **DOON GLOBAL SCHOOL** **PRE BOARD-1 (2024-25)** **CLASS - XII** **SUBJECT- PHYSICS** **SUBJECT-CODE-042**
TIME – 3Hrs	**M. MARKS- 70**

General Instructions:

(1) There are 33 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.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculator is not allowed.

Section -A

1. A +3 nC charge Q is initially at a distance of r_1= 10 cm from a 5 nC charge q fixed at the origin. The charge Q is moved away from q to a new position at r_2= 15 cm. In this process, the work done by the field is

(a) 1.29×10^{-5} J
(b) 3.6×10^{5} J
(c) $-4.5 \times 10^{7}\ J$
(d) 4.5×10^{-7}J

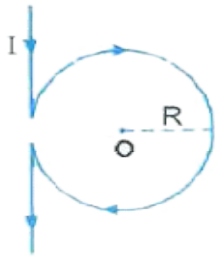
2. A current carrying circular loop of magnetic moment M is suspended in a vertical plane in external magnetic field B such that its plane is normal to B The work done in rotating this loop by 45 degree about an axis perpendicular to B is closest to:

(a)-0.3 MB
(b)0.3 MB
(c)-1.7 MB
(d)1.7 MB

3. A straight conducting rod of length l and mass m is suspended in a horizontal plane by a pair of flexible strings in a magnetic field of magnitude B. To remove the tension in the supporting strings, the magnitude of the current in the wire is:

(a) $\frac{mgB}{l}$
(b) $\frac{mgl}{B}$
(c) $\frac{mg}{lB}$
(d) $\frac{lB}{mg}$

4. A current I flows through a long straight conductor which is bent into a circular loop of radius R in the middle as shown in the figure.
The magnitude of the net magnetic field at point O will be



(a) zero
(b) $\frac{\mu_0 I}{2R}(1+\pi)$
(c) $\frac{\mu_0 I}{4\pi R}$
(d) $\frac{\mu_0 I}{2R}(1-\frac{1}{\pi})$

5. Two parallel conductors carrying current of 4.0 A and 10.0 A are placed 2.5 cm apart in vacuum. The force per unit length between them is -
(a) 6.4 x 10^{-5} N/m
(b) 6.4 x 10^{-2}N/m
(c) 4.6 x 10^{-4} N/m
(d) 3.2 x 10^{-4} N/m

6. If the magnetising field on a ferromagnetic material is increased, it's permeability.
(a) Is decreased
(b) Is increased
(c) is unaffected
(d) May be increased or decreased

7. The self inductance L of a solenoid of length l and area of cross section A, with a fixed number of turns N increases as
(a) l and A Increase
(b) l decreases and A increases
(c) l increases and A decreases
(d) Both l and A decrease

8.The phase difference between the current and voltage series LCR circuit at resonance is
(a) π.
(b) π/2.
(c)π/3.
(d)Zero

9.Which one of the following has the highest frequency
(a) Infrared rays
(b)Gamma rays
(c) Radio waves
(d) Microwaves

10. Which one of the following is the correct graph between the maximum kinetic energy of the emitted photo electrons and frequency of incident radiation for a given photo sensitive surface:

11. The kinetic energy of the electron in an orbit of radius r in hydrogen atomic proportional to
(a) $\frac{e^2}{r}$
(b) $\frac{e^2}{2r}$
(c) $\frac{2e^2}{r}$
(d) $\frac{e^2}{3r}$

12. The energy of hydrogen atom in the nth orbit is E_n, then the energy in the nth orbit of single ionised helium atom is

(a) $\frac{E_n}{2}$ (c) $4E_n$

(b) $2E_n$ (d) $\frac{E_n}{4}$

Q. Nos (13-16). Two statements are given-one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

a) Both A and R are true and R is the correct explanation of A

b) Both A and R are true and R is NOT the correct explanation of A

c) A is true but R is false

d) A is false and R is also false

13. Assertion: A convex mirror cannot form real images

Reason: Convex mirror converges the parallel rays that are incident on it.

14. Assertion: In a non uniform electric field a dipole will have translatory as well as rotatory motion.

Reason: In a non uniform electric field dipole experience a force as well as torque.

15. Assertion: The photo electrons produced by monochromatic light beam incident on a metal surface, have a spread in their kinetic energies.

Reason: The work function of the metal varies as a function of depth from the surface.

16. Assertion: Electric field is always normal to equipotential surface and along the direction of decreasing order of potential

Reason: Negative gradient of electric potential is electric field.

Section -B

17. State Kirchhoff's rules. Explain briefly how these rules are justified.

18 .For a glass prism (μ=✓3) the angle of minimum deviation is equal to the angle of the prism. Find the angle of the prism.

19. How is n-type. Semi-conductor formed? Name the majority charge carriers in it. Draw the energy band diagram of n-type semiconductor?

Or

The number of silicon atoms per m^{-3} is 5×10^{28}.This is doped simultaneously with 5×10^{22} atoms per $m^{-3}$of arsenic and 5×10^{20}per m^{-3}atoms of indium. Calculate the number of electrons and holes .Given n_i=1.5×10^{16} per m^{-3}.

20. In Young's double slit experiment the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wavelength of light used in this experiment.

21. State the main implications of observations obtained from various photoelectric experiments.

Section-C

22. How is the mutual inductance of a pair of coils affected when?

(a). Separation between the coils is increased?

(b). the number of turns of each coil is increased?

(c). A thin iron sheet is placed between the two coils, other factors remaining the same?

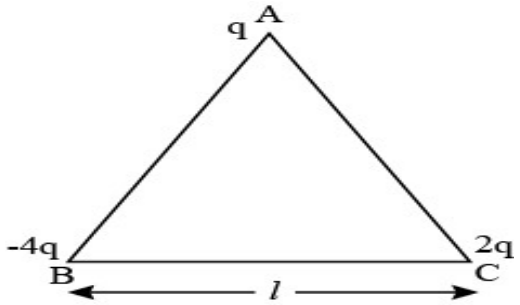
23. (a). Name the electromagnetic radiation used to take the photograph of the bones.
(b). How is this radiation produced?
(c). Mention the range of the wavelength of this electromagnetic radiation.

24. Two long straight parallel current carrying conductors are kept 'a' distant apart in air. The direction of current in both the conductors is same. Find the magnitude of force per unit length and direction of the force between them. Hence define one ampere.

Or

A coil in the shape of an equilateral triangle of side 0.02 m is suspended from a vertex such that it is hanging in a vertical plane between the pole pieces of permanent magnet producing a horizontal magnetic field 5×10^{-2} tesla. Find the couple acting on the coil when a current of 0.1 A is passed through it and the magnetic field is parallel to its plane.

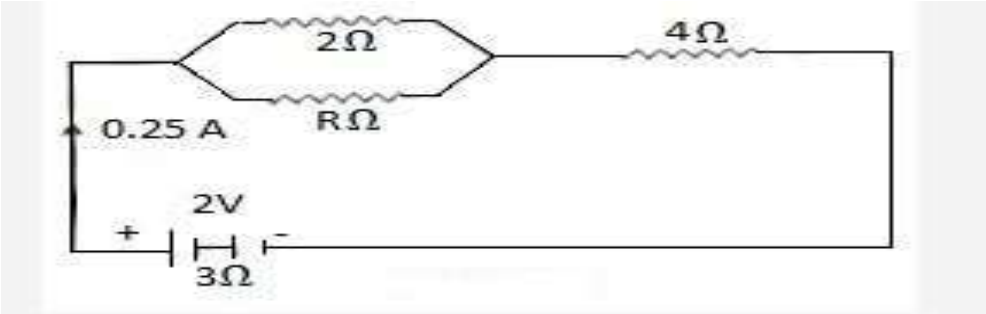
25. Three point charges q, - 4q and 2q are placed at the vertices of an equilateral triangle ABC of side 'l' as shown in the figure.(a) Obtain the expression for the magnitude of the resultant electric force acting on the charge q.
(b) Find out the amount of the work done to separate the charges at infinite distance.



26. Draw a plot showing the variation of binding energy per nucleon with mass number A. Write two important conclusions which you can draw from this plot. Explain with the help of this plot, the release in energy in the processes of nuclear fusion and fission.

27. Using Rutherford model of the atom, derive the expression for the total energy of the electron in the hydrogen atom. What is the significance of total negative energy possessed by the electron?

28. The given figure shows three resistors of 2Ω and 4Ω and RΩ connected to a battery of EMF 2V and internal resistance 3Ω. A main current of 0.25 A flows through the circuit.



(a) What is the potential difference across the 4Ω resistor?
(b) Calculate the potential difference across the internal resistance of the cell.
(c) What is the potential difference across the RΩ or 2Ω resistors?
(d) Calculate the value of R.

Section –D (Case Based Questions)

Attempt any 4 sub parts from each question. Each question carries 1 mark.

29. Two bands namely valence band and conduction band which are generated by interaction of atoms. The conduction band at room temperature is always empty and valence band is filled. There exists a band gap between the two bands. The band gap greater than 3eV is insulation Eg between 0.2eV to 3eV is semiconductor but for metal energy gap is equal to zero no gap between bands is seen and that's why these are called good conductors. By doping we can change the characteristics of the element.

(i) What is the condition of n-type and p-type semiconductor?

(a) $n_e = n_h$ and $n_h >> n_e$
(b) $n_e << n_h$ and $n_h >> n_e$
(c) $n_e >> n_h$ and $n_h <<$ ne
(d) $n_e >> n_h$ and $n_h >> n_e$

(ii) What is the condition of overall neutrality?

(a) $n_e \times n_h = {n_i}^2$
(b) $n_e \times n_h = n_i$
(c) $n_e >> n_i$
(d) ${n_e}^2 = {n_i}^2$

(iii) Where does the fermi level lie at room temperature?

(a) the fermi level lies near valence band.
(b) the fermi level lies near conduction band.
(c) the fermi level lies near acceptor.
(d) the fermi level lies in the middle of VB and CB.

(iv) If two semiconductors are combined, then

(a) There is a formation of p-n junction.
(b) The two semiconductors behave like metal.
(c) The two semiconductors characteristic won't change.
(d) There is no conclusion.

(v) Does the reverse diode current depend on voltage?

(a) Yes
(b) No
(c) May be
(d) Depends on material

30. A lens is a portion of transparent medium bounded by two surfaces in one of the surface essentially spherical. It is used to converge or diverse the light incident on it. Power of a lens is the measure of its ability to Converge or diverge the light incident on it. Power of a lens depends on the refractive index of the material of lens with respect to the surrounding medium and the radii of curvature of its two surfaces.

(i)The power of a convex lens

(a) increases when the lens is dipped in water.
(b) increases when the wavelength of incident light decreases.
(c) decreases when another convex lens is placed in contact with it.
(d) increases when the lens is cut into two identical plano-convex lenses.

(ii)The focal length of a concave lens is 40 cm. The power of the lene is

(a) 0.025 D
(b) 2.5 D
(c) -0.025 D
(d) -2.5 D

(iii)The focal length of a concave lens (μ_g=1.5) in air is 20 cm. What should be the refractive index of the surrounding medium so that lens behaves as a converging lens of focal length 60 cm?

(a) 1.4
(b)1.8
(c)1.7
(d)1.2

(iv) Beams of red light, blue light, yellow light and violet light are incident on a convex lens, one-by-one. Which one of them converges nearest to the lens ?

(a)Blue light (c) Red light

(b)Violet light (d) Yellow light

(v) A beam of light coming parallel to the principal axis of a convex lens L_1 of focal length 15 cm is incident on it. Another convex lens L_2 of focal length 25 cm is placed coaxially at a distance d from L_1. For the final image to be formed at infinity, the value of d should be:

(a) 10 cm (c) 25 cm

(b) 15 cm (d) 40 cm

Section - E

31. (a). Draw a labelled ray diagram of compound microscope, when the final image forms at the least distance of distinct vision.

(b). Why is its objective of short focal length and of short aperture, compared to its eyepiece? Explain.

(c). The focal length of the objective is 4 cm while that of eyepiece is 10 cm. The object is placed at a distance of 6cm from the objective lens. Calculate the magnifying power of the compound microscope, if its final image is formed at the near point. Also calculate length of the compound microscope.

Or

(a)Use Huygen's geometrical construction to show how a plane wavefront at t = 0 propagates and produces a wavefront at a later time.

(b). Verify, using Huygen's principle, Snell's law of refraction of a plane wave propagating from a denser to a rarer medium.

(c). Illustrate with the help of diagrams the action of (i)convex lens and (ii) concave mirror, on a plane wavefront incident on it.

32. (a)Draw a schematic arrangement for winding of primary and secondary coil in a transformer when the two coils are wound on top of each other.

(b) State the underlying principle of a transformer and obtain the expression for the ratio of secondary to primary voltage in terms of the (i) number of secondary and primary windings and (ii) primary and secondary currents.

(c). Write any two reasons due to which energy losses may occur in actual transformers.

Or

(a) Draw a labelled diagram of AC generator and state its working principle.

(b) How is magnetic flux linked with the armature coil changed in a generator?

(c) Derive the expression for maximum value of the induced emf and state the rule that gives the direction of the induced.

33. (a) Use Gauss' law to derive the expression for the electric field (E) due to a straight uniformly charged infinite line of charge density λ C/m.

(b) Draw a graph to show the variation of E with perpendicular distance r from the line of charge.

(c) Find the work done in bringing a charge q from perpendicular distance r_1 to r_2 ($r_2 > r_1$)

Or

(i) Derive an expression for potential energy of electric dipole in a uniform electric field. Explain condition for stable and unstable equilibrium.

(ii) Is the electrostatic potential necessary zero at appointment electric field is zero? Give an example to support your answer.