ASN Senior Secondary School

Pre-Board 2019 – 20

Class XII

Physics

Time: 3 Hrs MM : 70

Instructions:-

1) *There are 37 questions in this paper. All questions are compulsory.*
2) *This question paper has four sections: Section A, Section B, Section C and Section D. Section A contains Q1-20 and are of 1 mark each, Section B contains Q21-27 and are of 2 marks each, Section C contains Q28-34 and are of 3 marks each and Section D contains Q35-37 and are of 5 marks each.*
3) *There is no overall choice. However, internal choices have been provided in two questions of one mark each, two questions 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.*
4) *You may use the following values of physical constants wherever necessary.* $c=3 \times 10^8$ *m/s* $e=1.6 \times 10^{-19}$ *C* $h=6.63 \times 10^{-34}$ *Js* $\mu_0=4\pi \times 10^{-7}$ *T mA*$^{-1}$ $\varepsilon_0=8.854 \times 10^{-12}$ *C*^{2} *N*$^{-1}$ *m*$^{-2}$ $1/4\pi\varepsilon_0=9 \times 10^9$ *N m*^{2} *C*$^{-2}$ *Mass of electron* (m_e)$=9.1 \times 10^{-31}$ *kg Mass of proton*$=1.673 \times 10^{-27}$ *kg Avogadro's number*$=6.023 \times 10^{23}$ *per gram mole Boltzmann constant*$=1.38 \times 10^{-23}$ *JK*$^{-1}$ *Mass of neutron*$=1.675 \times 10^{-27}$ *kg*

Section-A (Q 1 – Q 20) (One Mark Each)

Q1. Two charges Q_1 and Q_2 are placed in vacuum at a distance *d* and the force acting between them is *F*. If a medium of dielectric constant 4 is introduced around them, the force now will be:

a) 4F b) 2F c) F/2 d) F/4

Q2. If the direction of the initial velocity of the charged particle is neither along nor perpendicular to that of the magnetic field, then the path will be:

a) a straight line b) an ellipse c) a circle d) a helix

Q3.An electron and a proton enter in a region of uniform magnetic field in a direction at right angles to the field with the same kinetic energy. They describe circular paths of radius r_e and r_p respectively. Then:

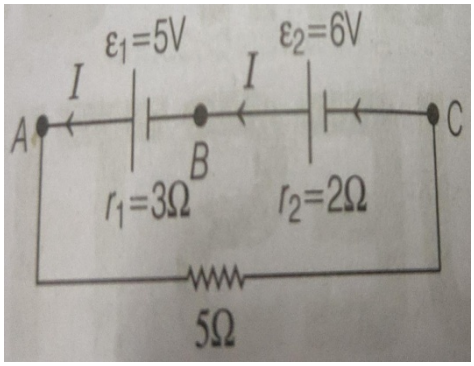
a) $r_e = r_p$ b) $r_e < r_p$ c) $r_e > r_p$

d) r_e may be less than or greater than r_p depending on the direction of the magnetic field.

Q4. When a dipole is placed with its dipole moment vector along external field, it is stable when its potential energy is:

a) minimum b) maximum c) not present d) None of these

Q5. In the fig alongside, the potential difference between the terminals *A* and *C* of the combination is:



a) V_{AC}=3.2V b) V_{AC}=1.1V

c) V_{AC} =5.5 V d) V_{AC} =11V

Q6. A point source of light is placed in front of a plane mirror, then:

a) All the reflected rays meet at a point when produced backward.

b) Only the reflected rays close to the normal meet at a point when produced backward.

c) Only the reflected rays making a small angle with the mirror, meet at a point when produced backward.

d) Light of different colours make different images.

Q7. Two sources are called coherent if they produce waves

a) of equal wavelength b) of equal velocity

c) having same shape of wave front d) having a constant phase difference.

Q8. Electrical conductivity of semiconductor:

a) Decreases with the rise in its temperature.

b) Increases with the rise in its temperature.

c) Does not change with the rise in its temperature.

d) First increases and then decreases with the rise in its temperature.

Q9.If the binding energy per nucleon in Li^7 and He^4 nuclei are respectively 5.60 MeV and 7.06 MeV, then energy of reaction $Li^7 + p \rightarrow 2\ {}_2He^4$ is:

a) 19.6 MeV b) 2.4 MeV c) 8.4 MeV d) 17.3 MeV

Q10. The radius of electron's second stationary orbit in Bohr's atom is *R*. The radius of the third orbit will be:

a) $3R$ b) $2.25\,R$ c) $9R$ d) $R/3$

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

Q11. When Boron nucleus ($_5B^{10}$) is bombarded by neutrons, α-particle are emitted. The resulting nucleus is of the element _____ and has the mass number _____.

Q12. If the radius of the first Bohr orbit of hydrogen atom is 0.5 Å, that of the third Bohr orbit is _____ Å.

Q13. Electric force acting between two charges also depends upon the _____ between them.

Q14. The phenomena of polarization demonstrate that light has _____ nature.

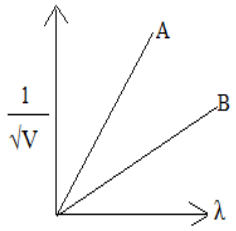
Q15. An electron passes undeflected through a region with electric and magnetic fields. When electric field is switched off its path will change to _____.

OR

When a coil carrying current is set with its plane perpendicular to the direction of magnetic field, then torque on the coil is _____.

(Q16 to Q20): Answer the following questions.

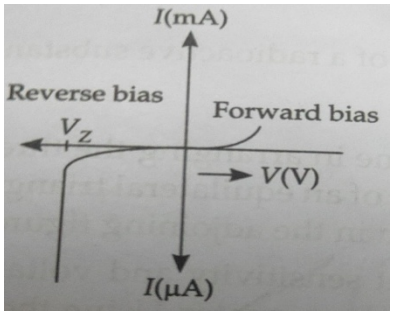
Q16. Given figure shows a plot of $1/\sqrt{V}$, where V is the accelerating potential .vs the de Broglie wavelength 'λ' in the case of two particles having same charge 'q' but different masses m_1 and m_2. Which line (A or B) represents a particle of large mass? **OR**



Define ionization energy. What is its value for hydrogen atom?

Q17. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10V. What is the potential at the centre of the sphere?

Q18. Given figure shows the V-*I* characteristic of a given device. Name the device and write where it is used?



Q19. How will the intensity of maxima and minima, in the Young's double slit experiment change, if one of the two slits is covered by a transparent paper which transmits only half of the light intensity?

Q20. A parallel combination of two cells of emf's E_1 and E_2, and internal resistances r_1 and r_2, is used to supply current to a load of resistance R. Write the expression for the current through the load in terms of E1, E_2, r_1 and r_2.

Section-B (Q 21 – Q 27) (Two marks each)

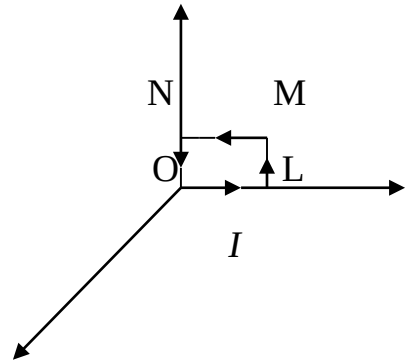
Q21. Calculate the half-life period of a radioactive substance if its activity drops to $1/6^{th}$ of its initial value in 30 years.

Q22. A plane wavefront is incident on (i) a prism (ii) a convex lens (iii) a concave mirror. Draw the emergent wavefront in each case.

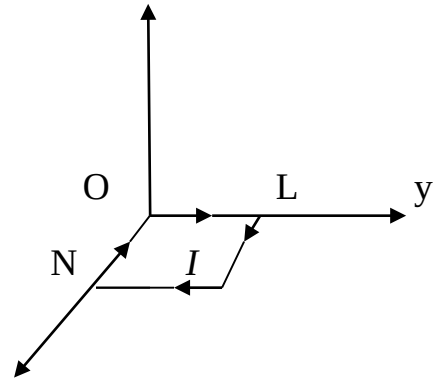
Q23. (i) If f = +0.5 m, what is the power of the lens?

(ii) The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. Its focal length is 12 cm when placed in air. Find refractive index of glass.

Q24. A given rectangular coil OLMN of area *A*, carrying a given current *I*, is placed in a uniform magnetic field $\vec{B} = Bk\hat{}$, in two different orientations (a) and (b) as shown. What is the magnitude of torque experienced by this coil in two cases?



(a)



(b)

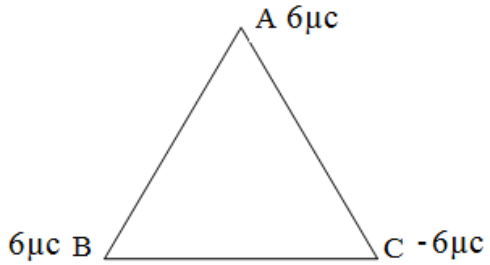
Q25. Name the electromagnetic waves used for the following and arrange them in increasing order of their penetrating power:

a) Water purification b) Remote sensing

OR

A light beam is incident on the boundary between two transparent media. At a particular angle of incidence the reflected ray is perpendicular to the refracted ray. Obtain an expression for this angle of incidence. Does this angle depend on the wavelength of light used?

Q26.Find the amount of work done in arranging the three point charges, on the vertices of an equilateral triangle ABC, of side 10 cm, as shown in the adjoining figure.

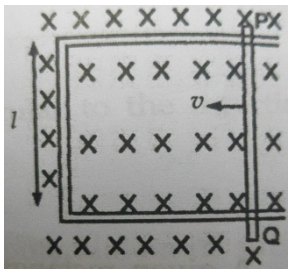


Q27. Write the relation for current sensitivity of a moving coil galvanometer. Using these relations, explain the fact that increasing the current sensitivity may not necessary increase the voltage sensitivity. **OR**

Using the relation for potential energy of a current carrying planar loop, in uniform magnetic field, obtain the expression for the work done in moving the planar loop from its unstable equilibrium position.

Section-C (Q 28 – Q 34) (Three marks each)

Q28.A straight conductor PQ is moving in a uniform and time independent magnetic field as shown alongside. Assuming that there is no loss of energy due to friction, deduce an expression for the power spent by an external agency to move the arm PQ, with a constant speed *v*, in terms of the magnetic field, the length PQ, and speed *v*.



Q29. A long solenoid, with 20 turns per cm, has a small loop of area4cm^2 placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 4A to 6A in 0.2 seconds, what is the (average) induced emf in the loop while the current is changing?

Q30. In the double slit experiment, the pattern on the screen is actually a superposition of single slit diffraction from each slit and the double slit interference pattern. In what way is the diffraction from each slit related to the interference pattern in a double slit experiment? Explain.

Hence, draw the intensity distribution curve, obtained on the screen, in the double slit experiment, when -

(a) The width of each slit is comparable to wavelength of monochromatic light used?
(b) The width of each slit is relatively large compared to wavelength of monochromatic light?

Q31. Which two main observations in photo electricity led Einstein to suggest the photon theory for the interaction of light with the free electrons in a metal? Obtain an expression for the threshold frequency for photoelectron emission in terms of the work function of the metal.

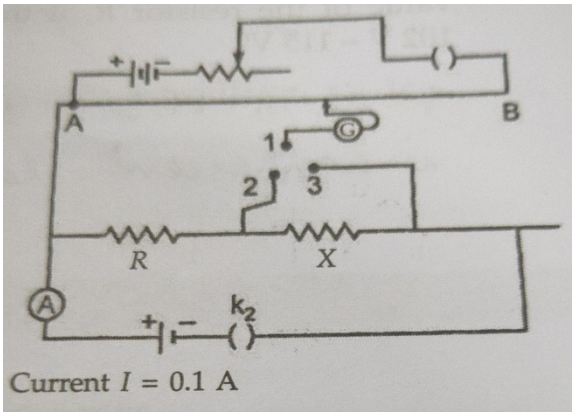
Q32. Derive the expression for the radius of the n^{th} orbit of hydrogen atom using Bohr's postulates. Show graphically the (nature of) variation of the radius of orbit with the principal quantum number *n*.

OR

What is the frequency of radiation emitted when a hydrogen atom de-excites from level *x* to level (*x*-1)? For large *x*, show that this frequency equals the classical frequency of revolution of the electron in the orbit.

Q33. A series LCR circuit is connected to an A.C source of voltage V and angular frequency ω. When only the capacitor is removed, the current lags behind the voltage by a phase angle 'ϕ' and when only the inductor is removed, the current leads the voltage by the same phase angle. Find the current flowing and the average power dissipated in the LCR circuit.

Q34. In a potentiometer circuit, shown alongside, potential gradient across the wire AB is 0.025 V/cm and the ammeter reads 0.1 A, when the two way key is completely switched off. The balance points, when the key between the terminals (i) 1 and 2, (ii) 1 and 3,



is plugged in, are found to be at lengths 40 cm and 100 cm respectively. Find value of R, *X*.

Section – D (Q 35 – Q 37) (Five marks each)

Q35. Find the expression for the electric field intensity, and the electric potential, due to a dipole at a point on the equatorial line. Would the electric field be necessary zero at a point where the electric potential is zero? Give an example to illustrate your answer. **OR**

Find the expression for the capacitance of a parallel plate capacitor of area *A* and plate separation *d* if (i) a dielectric slab of thickness *t*, and (ii) a metallic slab of thickness *t*, where (*t*<d) are introduced one by one between the plates of the capacitor. In which case would the capacitance be more and why?

Q36. Draw a ray diagram for a compound microscope. Derive an expression for the magnifying power when the final image is formed at the least distance of distinct vision. State the expression for the magnifying power when the image is formed at infinity. Why is the focal length of the objective lens of a compound microscope kept quite small? **OR**

Derive the lens formula giving the relation between *u, v* and *f* for thin convex lens. Define the term 'line magnification' and draw a graph showing the variation of linear magnification with image distance for a thin convex lens. How can this graph be used for finding the focal length of the lens?

Q37. Explain the formation of the depletion region for a *P*-*N* junction. How does the width of this region change when the junction is:

(i) Forward biased (ii) Reversed biased?

(iii)How does an increase in doping concentration affect the width of the depletion in the above two cases? **OR**

(a) Draw a block diagram of a full-wave rectifier along with its principal. Draw input and output voltage of rectifier.

(b) What is LED? Give its advantages over conventional incandescent lamps.