MODEL EXAMINATION, JANUARY - 2020
SUBJECT : PHYSICS

Class : XII **Time Allowed : 3 hours** **Maximum Marks: 70**

SET : A

General Instructions

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 and Section D.

iii) Section A contains 20 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, an internal choice has 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.

v) You may use the following values of the physical constants wherever necessary.

$c = 3x10^{8} ms^{-1}$

$e = 1.6x10^{-19} C$

$h = 6.63x10^{-34} Js$

$\varepsilon_0 = 8.85x10^{-12} C^2\ N^{-1}\ m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9x10^{9}\ \ N\ m^2\ C^{-2}$

$\mu_0 = 4\pi\ x\ 10^{-7}\ \ T\ m\ A^{-1}$

Mass of electron (m_e) = $9.1x10^{-31}$ kg

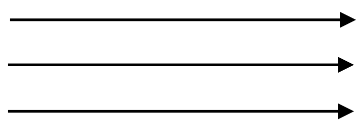
Mass of proton (m_p) = $1.673x10^{-27}$ kg

Mass of neutron (m_n) = $1.675x10^{-27}$ kg

SECTION : A

(Q1-Q10) Select the most appropriate option from those given below each question:

1. A , B and C are three points in a uniform electric field. The electric potential is



(a) maximum at A (b) maximum at B

(c) maximum at C (d) same at all three points A ,B and C

2. The drift velocity of the free electrons in a conducting wire carrying current I is v. If in a wire of the same metal, but of double the radius, the current be 2I, then the drift velocity of the electrons will be

(a) v/4 (b) v/2 (c) v (d) 4v

3. In a non- uniform electric field, electric dipole experiences
(a) torque only (b) torque as well as net force
(c) force only (d) none of these

4. Two bulbs each marked 100 W, 220 V are connected in series across 220 V supply. The power consumed by them, when lit, is:
(a) 220W (b)100W (c) 50 W (d)zero

5. In a current carrying long solenoid, the magnetic field produced does not depend upon
(a) number of turns per unit length (b) current flowing
(c) radius of the solenoid (d) all options are correct

6. A glass prism (μ = 1.5) of refracting angle 12° deviates a ray of light. The ray of light will deviate by:
(a) less than 5° (b) more than 3° but less than 6°
(c) 6° or more (d) 12°

7. To observe diffraction of light of wavelength λ, the size of aperture
(a) Should be much larger than λ
(b) should be exactly $\lambda/2$
(c) should be of the same order as that of λ
(d) has no relation with wavelength λ

8. If the focal length of objective lens is increased then magnifying power of

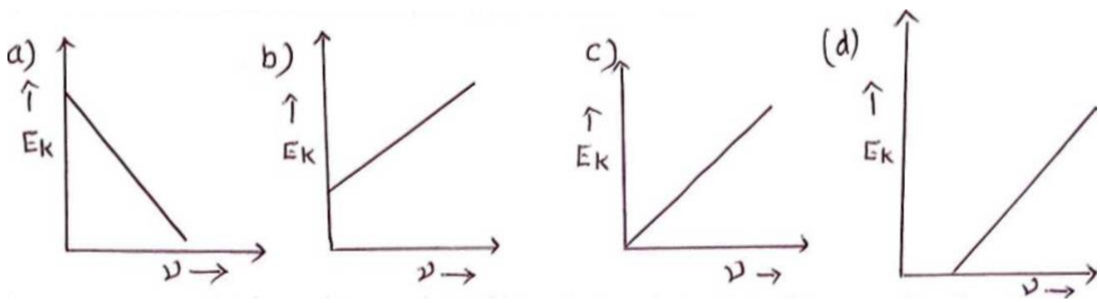
(a)microscope will increase but that of telescope decrease.

(b)microscope and telescope both will increase

(c)microscope and telescope will decrease

(d) microscope will decrease but that of telescope will increase.

9. According to Einstein's photoelectric equation, the graph between the kinetic energy(E_k) of photoelectrons ejected and the frequency (ϑ) of incident radiation is:



10. How many spectral lines will be available if the electron jumps from 6^{th} energy level to the permitted lower levels:

(a) 6 (b) 5 (c) Infinite (d) 36

(Q.11 – Q.15) Fill in the blanks with appropriate answer:

11. At a certain place, the horizontal component of earth's magnetic field is $\sqrt{3}$ times the vertical component. The angle of dip at that place is ---------. (1)

OR

The value of the intensity of magnetization of the magnetic material, when the magnetizing field is reduced to zero, is called its------------------.

12. When the current in a coil changes from 8A to 2A in 3×10^{-2} second, the emf induced in the coil is 2 volt. The self-inductance of the coil, in millihenry, is -------------------. (1)

13. Photoelectric emission from a given surface of metal can take place when the value of a 'physical quantity' is less than the energy of incident photon. The physical quantity is---------------. (1)

14. When trivalent impurity is mixed in a pure semiconductor, the conduction is mainly due to---------------. (1)

15. The potential difference V and current I across an instrument in an a.c. circuit are given by $V = 8 \sin 314t$ and $I = 3.5 \cos 314t$. Then the power dissipated is------. (1)

(Q16 – Q 20) Answer the following:

16. An isotope of carbon, ^{14}C , is radioactive. It decays to ^{14}N. Write the nuclear reaction. (1)

17. What happens to the width of depletion layer of a p-n junction when it is (i) forward biased, (ii) reverse biased? (1)

18. How does the angular separation between the fringes in single-slit diffraction experiment change when the distance of separation between the slit and the screen is doubled? (1)

19. Show the variation of photocurrent with collector plate potential for different frequencies but the same intensity of incident radiation. (1)

20. Name the electromagnetic waves, which (i) maintain the Earth's warmth and (ii) are used in aircraft navigation. (1)

OR

The charge on a parallel plate capacitor varies as $q=q_0 \cos 2\pi vt$. The plates are very large and close together (area = A, separation=d). Neglecting the edge effects, find the displacement current through the capacitor?

SECTION : B

Answer the following:

21. Derive an expression for equivalent capacitance of three capacitors when connected in series. (2)

22. A proton and an alpha particle are accelerated through the same potential. Which one of the two has greater value of de-Broglie wavelength associated with it? Justify your answer. (2)

23. Define the term current density of a metallic conductor. Obtain the expression for the current density in terms of relaxation time. (2)

24. In Young's double slit experiment, the two slits 0.15mm apart are illuminated by monochromatic light of wavelength 450nm. The screen is 1.0 m away from this slits. Find the distance of the second (a) bright fringe, (b) dark fringe from the central maximum. (2)

25. The susceptibility of a magnetic material is -2.6×10^{-5}. Identify the type of magnetic material and state its two properties. (2)

26. (a) Even though the current in the forward bias is known to be more than in the reverse bias, yet the photodiode works in reverse bias. What is the reason? (2)
    (b) Draw its I-V characteristics

OR

Draw the circuit diagram of Zener diode as a voltage regulator and briefly explain its working.

27. Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the region in which the nuclear force is (a) attractive (b) repulsive. (2)

OR

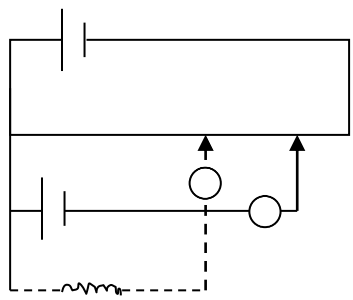
Derive an expression for the radius of n^{th} Bohr's orbit in Hydrogen atom.

SECTION : C

Answer the following:

28. (a) State the principle of working a potentiometer (3)

(b) Given figure shows a 2V potentiometer used for the determination of internal resistance of a cell 1.5V cell. The balance point of the cell in open circuit is 76.3 cm. when a resistor of 9.5Ω is used in the external circuit of the cell, the balance point shifts to 64.8 cm length of the potentiometer wire. Determine the internal resistance of the cell.

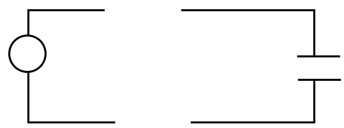


29. The figure shows a series LCR circuit with L= 5H, C= 80 μF, R= 40 Ω connected to a variable frequency 240 V source. Calculate : (3)

(a) The angular frequency of the source which drives the circuit at resonance.

(b) The current at the resonating frequency.

(c) The rms potential drop across the capacitor at resonance.



30. With the help of a circuit diagram, explain the working of a junction diode as a half wave rectifier. Draw its input and output waveforms. (3)

31. Define the term: Half life period and decay constant of a radioactive sample. Derive the relation between these terms. (3)

32. Draw a ray diagram showing the refraction of light through an equilateral glass prism. Hence derive the relation between the refractive index and angle of minimum deviation. (3)

OR

Draw a labelled ray diagram to obtain the real image formed by an astronomical telescope in normal adjustment position. Write the expression for magnifying power and tube length of a telescope.

33. Two long straight parallel conductors carry steady current I_1 and I_2 separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field set up in one produces an attractive force on the other. Obtain the expression for this force. Hence define one ampere. (3)

34. Using Huygen's wave theory, verify the laws of reflection. (3)

SECTION : D

35. (a) Define electric flux. Write its SI unit. (5)

(b) Using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it.

(c) How is the field directed if (i) the sheet is positively charged, (ii) negatively charged?

OR

(a) State Gauss theorem and express it mathematically.

(b) Apply this theorem to obtain the expression for the electric field at a point due to an infinitely long, thin, uniformly charged straight wire of linear charge density $\lambda C\ m^{-1}$.

36. (a) With the help of a diagram, show the formation of image of a point object due to refraction of light at a spherical surface separating two media of refractive indices n_1 and n_2 ($n_2>n_1$) respectively. Using this diagram, derive the relation. (5)

$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$$

(b) What happens to the focal length of convex lens when it is immersed in water?

OR

(a) State the essential condition for the diffraction of light to take place.

(b) A parallel beam of monochromatic light falls normally on a narrow slit and light coming out of the slit is obtained on the screen. Derive an expression for (i) angular width and (ii) linear width of the central bright maximum obtained on the screen.

(c) Give any two distinguishing factors of diffraction pattern comparison with interference pattern.

37. Write working principle of cyclotron and with a suitable diagram explain its working. Give any two applications of cyclotron. (5)

OR

a) Draw a schematic diagram of a step-up transformer. Explain its working principle. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils. In an ideal transformer, how is this ratio related to the currents in the two coils?

b) A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.

THE END

XII PA2, NOVEMBER 2019

NAME	SUBJECT	DATE