

# HALF YEARLY EXAM : 2019-20

Class : XII

FZB / 80

Subject : PHYSICS

Time : 3:00 Hrs.

M.M. : 70

## General Instructions :

- (i) All the 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 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 choice has been provided in seven questions of one mark, two questions of two marks, two questions of three marks, and Section-D contains three questions of five marks.
- (v) You can use the given constant as your requirement :  
( $c=3 \times 10^8$  m/s;  $h=6.6 \times 10^{-34}$  Js;  $k=1.38 \times 10^{-23}$  J/K;  $N_A = 6.023 \times 10^{23}$  mole<sup>-1</sup>;  $m_e=9.1 \times 10^{-31}$  kg.)

## SECTION-A

1. What is the effect of increasing temperature on the conductivity of the metallic conductor and on the semiconductor?  
OR  
Can the terminal p.d. of a cell exceed its emf?
2. Write down the ratio of speeds of ultraviolet rays and infrared waves in vacuum?
3. Why does the sun look reddish at sunset or sunrise?
4. On which factors does the number of photoelectrons emitted in a photoelectric experiment depend?
5. The power factor of an a.c. circuit is 0.5. What is the phase difference between voltage and current in this circuit?

OR

What is the phase difference between the voltage drops across L and C in a series L-C-R circuit connected to an AC source?

6. List down the factors on which resistivity of a material depends?

7. In the nuclear reaction,  ${}_{92}^{238}\text{U} \rightarrow {}_Z^A\text{Th} + {}_2^4\text{He}$ , the values of A and Z are :

- (a) A=234, Z=94                      (b) A=234, Z=90  
(c) A=238, Z=94                      (d) A=238, Z=90

OR

A nucleus represented by  ${}^A_Z\text{X}$  has :

- (a) Z protons and A neutrons                      (b) A protons and (Z-A) neutrons

8. Thermo-nuclear reactions are responsible for energy production :

- (a) at the centre of the earth    (b) in volcanoes  
(c) in modern spaceships    (d) Inside the stars

9. For rectifying action, we use :

- (a) choke                      (b) transformer                      (c) diode                      (d) condensor

10. A semiconductor is cooled from  $T_1\text{K}$  to  $T_2\text{K}$ . Its resistance :

- (a) will decrease                      (b) will increase  
(c) will first decrease then increase                      (d) will not change

11. If an electron has no initial velocity in a direction different from that of an electric field, the path of electron is :

- (a) a straight line                      (b) a parabola  
(c) a circle                      (d) an ellipse

12. A condensor of capacitance  $50\ \mu\text{F}$  is charged to 10 volt. Its energy is equal to :

- (a)  $2.3 \times 10^{-8}\ \text{J}$                       (b)  $1.4 \times 10^{-4}\ \text{J}$   
(c)  $25 \times 10^{-4}\ \text{J}$                       (d)  $5 \times 10^{-4}\ \text{J}$

OR

Two condensers of capacitance,  $2\mu\text{F}$  and  $4\mu\text{F}$  are connected in parallel. The resultant capacitance is :

- (a) 2.33      (b) 6      (c) 4      (d) 8

13. Three resistances of magnitudes  $2\Omega$ ,  $3\Omega$  and  $5\Omega$  are connected in parallel to a battery of 10 volt and of negligible resistance. The potential drop across the  $3\Omega$  resistor is :

- (a) 2 volt      (b) 3 volt      (c) 5 volt      (d) 10 volt

14. A coil of resistance  $R$  and inductance  $L$  are connected to a battery of emf  $E$  volt. The current in the coil is :

- (a)  $E/R$       (b)  $E/L$       (c)  $\sqrt{E/R(R^2+L^2)}$       (d)  $\sqrt{EL/(R^2+L^2)}$

15. A dynamo develops 0.5 current at 6 volt. The power produced is :

- (a) 3 watt      (b) 12 watt      (c) 0.083 watt      (d) none of these

17. An..... consists of a combination of two equal and opposite charges situated very close to each other.

18. Dimensional formula for electrostatic potential is .....

OR

..... is defined as the solid angle subtended at the centre, by a unit area of the surface of unit radius.

**Directions :** In the following questions (19-20) a statement of assertion is followed by a statement of reason. Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.  
(b) If both assertion and reason are true but reason is not the correct explanation of assertion.  
(c) If assertion is true but reason is false.  
(d) If both assertion and reason are false.

19. **Assertion :** A potentiometer is preferred over voltmeter for measurement of e.m.f. of a cell.  
**Reason :** Potentiometer does not draw any current from the cell.

20. **Assertion :** Generally heavy nuclei are unstable.  
**Reason :** Heavy nuclei have more neutrons and protons.

### SECTION-B

21. Out of the two magnetic materials, 'A' has relative permeability slightly greater than unity while 'B' has less than unity. Identify the nature of the materials 'A' and 'B'. Will their susceptibilities be.

22. It has been observed experimentally that radio waves :

(a) have a speed of  $3 \times 10^8$  m/s in vacuum

(b) can be polarised.

What can be concluded from the above given observations?

23. An electric field and a magnetic field both have a tendency to deflect a moving charged particle. What is the difference between the two deflections?

24. Write down the properties of the elements which are radioactive in nature?

25. A short bar magnet of magnetic moment  $m=0.3$ ; is placed in a uniform magnetic field of 0.15 the bar is free to rotate in the plane of the which orientation would correspond to it stable, and (b) unstable equilibrium? What is potential energy of the magnet in each case.

26. What is the difference between 'therm emission' and 'photoelectric emission'?

27. In the Rutherford scattering experiment distance of closest approach for an  $\alpha$ -particle if  $\alpha$  particle is replaced by a proton, much kinetic energy in comparison to  $\alpha$  particle will it require to have the same distance of closest approach  $r_0$ ?

### SECTION-C

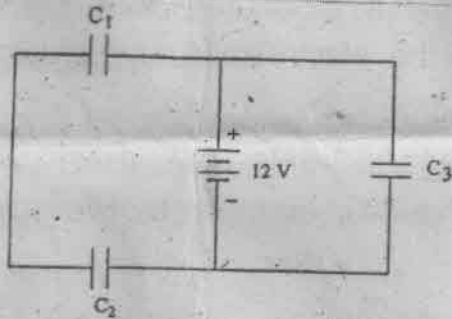
28. A proton and a deuteron are accelerated through the same accelerating potential. Which one of the two has :

- (a) greater value of de-Broglie wavelength associated with it, and
- (b) less momentum?

Give reasons to justify your answer.

29. State the underlying principle of workign a a moving coil galvanometer. Write two reasons why a galvanometer can not be used as such to measure current in a given circuit. Name nay two factors on which the current sensitivity of a galvanometer depends.

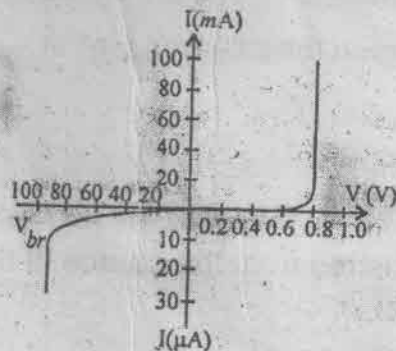
30. Three identical capacitors  $C_1$ ,  $C_2$  and  $C_3$  of capacitance  $6 \mu\text{F}$  each are connected to a  $12\text{V}$  battery as shown.



Find :

- (i) charge on each capacitor,
- (ii) equivalent capacitance of the network,
- (iii) energy stored in the network of capacitors.

31. The figure below shows the V-I characteristic of a semiconductor diode.





- (i) Identify the semiconductor diode used.
- (ii) Draw the circuit diagram to obtain the given characteristic of this device.
- (iii) Briefly explain how this diode can be used as a voltage regulator.

29. The work function of caesium metal is 2.14 eV. When light of frequency  $6 \times 10^{14}$  Hz is incident on the metal surface, photoemission of electrons occurs. What is the :
- (a) maximum kinetic energy of the emitted electrons,
  - (b) stopping potential, and
  - (c) maximum speed of the emitted photoelectrons?
33. A particle carrying charge  $q$  is accelerated by a potential difference  $V$  and is made to enter a region of space where a uniform magnetic field  $B$  exists. If the direction of the magnetic field is perpendicular to its path, derive the relation between the radius of the path travelled by the particle and the potential difference  $V$ .
34. Deduce the expression for the electrostatic energy stored in a capacitor of capacitance ' $C$ ' and having charge ' $Q$ '.  
How will the (i) energy stored and (ii) the electric field inside the capacitor be affected when it is completely filled with a dielectric material of dielectric constant  $K$ ?

OR

What is a conservative field? Give an example.

#### SECTION-D

35. (a) Consider a system of  $n$  charges  $q_1, q_2, \dots, q_n$  with position vectors  $\vec{r}_1, \vec{r}_2, \vec{r}_3, \dots, \vec{r}_n$  relative to some origin ' $O$ '. Deduce the expression for the net electric field  $\vec{E}$  at a point  $P$  with position vector  $\vec{r}_p$ , due to this system of charges.
- (b) Find the resultant electric field due to an electric dipole of dipole moment,  $2aq$ . ( $2a$  being the separation between the charges  $\pm q$ ) at a point distant ' $x$ ' on its equator.

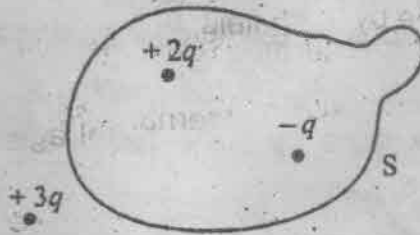
OR

- (a) A parallel plate capacitor is charged to a potential difference  $V$  by a DC source. The capacitor is then disconnected from the source. If the distance between

the plates is doubled what will be the effect on following parameters? Also give reason :

- (i) electric field between the plates,
- (ii) capacitance and
- (iii) energy stored in the capacitor.

- (b) Figure shows three points charges  $+2q$ ,  $-q$  and  $+3q$ . Two charges  $+2q$  and  $-q$  are enclosed within a surface 'S'. What is the electric flux due to this configuration through the surface 'S'?



- (c) In which orientation, a dipole placed in a uniform electric field is in (i) stable, (ii) unstable equilibrium?

36. (a) Draw a schematic sketch of an ac generator describing its basic elements. State briefly its working principle. Show a plot of variation of :

- (i) Magnetic flux and
- (ii) Alternating emf versus time generated by a loop of wire rotating in a magnetic field.

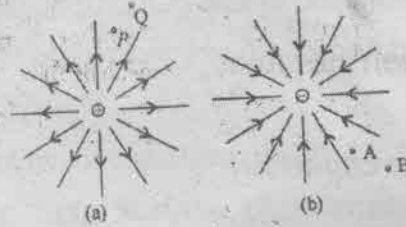
- (b) Why choke coil is needed with fluorescent tubes in ac mains?

OR

- (a) Derive an expression for the average power consumed in a series LCR circuit connected to a.c. source in which the phase difference between the voltage and the current in the circuit is  $\phi$ .

- (b) Define the quality factor in an a.c. circuit should the quality factor have high value receiving circuit? Name the factors on which it depends.

37. Figures (a) and (b) show the field lines of a positive and negative point charge respectively.



- Give the sign of the potential difference  $V_P - V_Q$ ;  $V_B - V_A$ .
- Give the sign of the potential energy difference of a small negative charge between the points Q and P; A and B.
- Give the sign of the work done by the field in moving a small positive charge from Q to P.
- Give the sign of the work done by the external agency in moving a small negative charge from B to A.
- Does the kinetic energy of a small negative charge increase or decrease in going from B to A?

OR

- A small conducting sphere of radius 'r' carrying a charge +q is surrounded by a large concentric conducting shell of radius R on which a charge +Q is placed. Using Gauss's law, derive the expressions for the electric field at a point 'x';
  - between the sphere and the shell ( $r < x < R$ ),
  - outside the spherical shell.
- Show that if we connect the smaller and the outer sphere by a wire, the charge q on the former will always flow to the latter, independent of how large the charge Q is.