

**SUBJECTIVE TEST FOR XII**

**PHYSICS**

Time allowed : 2 hrs.

Maximum marks : 50

**General Instructions**

- There are 20 questions in all. All questions are compulsory.
- The question paper has five sections: Section A, Section B, Section C, section D & section E
- Section-A has 7 multiple choice questions of one (1) mark each.
  - Section-B has 4 questions of two (2) marks each.
  - Section-C has 4 questions of three (3) marks each.
  - Section-D has 2 case study based questions of four (4) marks.
  - Section-E has 3 questions of five (5) marks each.
- There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.
- Wherever necessary, neat and properly labeled diagrams should be drawn.

**Section – A**

- The angle of minimum deviation for a prism is  $30^\circ$  and the angle of the prism is  $60^\circ$ . The angle of incidence in this position will be (1)  
  - $30^\circ$
  - $60^\circ$
  - $50^\circ$
  - $45^\circ$

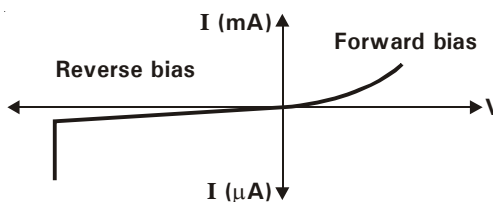
-  (1)

Which of the following Boolean expressions gives the output of the given circuit?

- $Y = A\bar{B}$
  - $Y = \bar{A}B$
  - $Y = A + \bar{B}$
  - $Y = \bar{A} + B$
- Which of the following statement is **True**? (1)  
    - If a current carrying circular loop of one turn is turned into a coil having 'n' turns, then magnetic field at the centre of the coil becomes n times.
    - Let a strong magnetic field be applied on a stationary electron. Then electron moves in the direction of the field.
    - A magnetic field exerts a force if the charged particle is moving across the magnetic field lines.
    - A beam of electrons and protons moving parallel to each other in the same direction attract each other magnetically.
  - The constituent radiation of electromagnetic spectrum which is used in satellite communication. (1)  
    - X-rays
    - Microwaves
    - Gamma
    - Ultra-violet
  - Which of the following statement is **False**? (1)  
    - Light waves can be polarised as they are transverse.
    - Refractive index of material is equal to  $\tan \theta$  where  $\theta$  is the polarising angle.
    - Angular width of central maximum of a diffraction pattern on a single slit depends upon distance between slit and source.
    - If the red light is replaced by blue light in diffraction experiment, then bands will be narrower.

6. **Assertion** : The energy of charged particle moving in a magnetic field does not change. (1)  
**Reason** : Work done by magnetic field on the charge is zero.
- Both Assertion and Reason are true and the reason is the correct explanation of the assertion
  - Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
  - Assertion is true statement but Reason is false
  - Assertion is false
7. **Assertion-A** : A p-n junction can not be made by physically joining one slab of a p-type semiconductor to another n-type semiconductor. (1)  
**Reason-R** : The junction behaves as a discontinuity for the flowing charge carriers as the roughness is much larger than the inter-atomic crystal spacing ( $\sim 2$  to  $3 \text{ \AA}$ ).
- Both Assertion and Reason are true and the reason is the correct explanation of the assertion
  - Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
  - Assertion is true statement but Reason is false
  - Assertion is false

### Section – B

8.  (2)

The figure shows V-I characteristics of a semiconductor device.

Identify semiconductor device used here. Briefly explain how this device is used as a voltage regulator.

9.
  - At what angle with horizontal will a dip needle placed in a plane perpendicular to magnetic meridian point? (1)
  - How does dip angle vary from equator to poles? (1)
10. Find de Broglie wavelength of an  $\text{H}_2$  molecule in hydrogen gas at 300 K. (2)

OR

The photoelectric cut-off voltage in a certain experiment is 1.5 V. What is the maximum kinetic energy of photoelectrons emitted, if the energy of incident photons is 3.4 eV?

11. Draw a labelled diagram of YDS experiment for interference of light. Write the expression for fringe width. (2)

### Section – C

12. Twenty seven drops of mercury are charged to the same potential of 10 V. What will be the potential if all the charged drops are made to combine to form one large drop? Assume the drops to be spherical. (3)

OR

Two point charges  $+q$  and  $+4q$  are separated by a distance of ' $6a$ '. Find a point on the line joining the two charges where the electric field is zero.

13. Explain  $\beta^-$  decay process with an example. Tritium has a half life of 12.5 year undergoing beta decay. What fraction of a sample of pure tritium will remain undecayed after 25 year? (3)

14. An average induced emf of 0.4 V appears in a coil when the current in it is changed from 10 A in one direction to 10 A in opposite direction in 0.4 second. Find the coefficient of self induction of coil. (3)

OR

A horizontal straight wire of length  $L$  extending from east to west is moved with constant speed ' $v$ ' vertically. Horizontal component of Earth's magnetic field is  $B_H$ .

- a. Write the expression for the e.m.f. induced in the wire. (1.5)
- b. Which end of the wire is at the higher potential? (1.5)
15. A semiconductor has equal electron and hole concentration of  $6 \times 10^8/\text{m}^3$ . On doping with certain impurity, electron concentration increases to  $9 \times 10^{12}/\text{m}^3$ .
- a. Identify new semiconductor obtained after doping. (1)
- b. Calculate the new hole concentration. (1)
- c. Write the expression for conductivity in this doped semiconductor. (1)

OR

- c. Draw energy band diagram for this doped semiconductor. (1)

### Section – D

**Question 16 and 17 are Case Study Based Question. Each question has an internal choice and carries four (4) marks each.**

16. One night Vaikunth was preparing for his physics exam. Suddenly the light in his room went off and he could not continue his studies. His cousin Vasu who had come to visit him was quick to react. Vasu using the torch installed in his mobile phone found that the fuse had blown out. He checked the wiring and located a short circuit. He rectified it and put a fuse wire. The lights came to life again. Vaikunth heaved a sigh of relief, thanked Vasu and continued his studies. (4)
- a. What is an electric fuse?
- b. What do you understand by a short circuit?
- c. Which elements are present in the alloy used to make an electric fuse?
- d. How is current rating of a fuse linked with its length?
17. An LCR series circuit with 100 ohm resistance is connected to an ac source of 200 V and angular frequency 300 rad/s. When only the capacitance is removed, the current lags behind the voltage by  $60^\circ$ . When only the inductance is removed, the current leads the voltage by  $60^\circ$ . (4)
- i. Peak value of AC voltage is
- |                |              |
|----------------|--------------|
| a. 200 volts   | b. 400 volts |
| c. 282.8 volts | d. 250 volts |
- ii. Frequency of AC is about
- |           |           |
|-----------|-----------|
| a. 300 Hz | b. 150 Hz |
| c. 90 Hz  | d. 48 Hz  |
- iii. The original circuit behaves like
- |                     |   |
|---------------------|---|
| a. purely inductive | b. purely capacitive                      |
| c. purely resistive | d. combination of inductive and resistive |

OR

- iii. The power dissipated in the original circuit will be
- |          |          |
|----------|----------|
| a. 100 W | b. 200 W |
| c. 400 W | d. zero  |

- iv. Current in the original circuit will be
- |        |        |
|--------|--------|
| a. 1 A | b. 2 A |
| c. 3 A | d. 4 A |

OR

- iv. Power factor of the original circuit is
- |                         |                  |
|-------------------------|------------------|
| a. 1                    | b. $\frac{1}{2}$ |
| c. $\frac{1}{\sqrt{2}}$ | d. zero          |

### Section – E

18. Draw a labelled diagram of a compound microscope. Derive the formula for its magnification when the image is formed. (2)
- a. at infinity (1.5)
- b. at least distance of distinct vision. (1.5)
19. a. Name the series of hydrogen spectrum lying in (2)
- i. the infrared region. ii. the visible region.
- b. The ground state energy of hydrogen atom is  $-13.6$  eV. What is the potential energy of the electron in this state? (1)
- c. The binding energies of deuteron ( ${}_1\text{H}^2$ ) and  $\alpha$ -particle ( ${}_2\text{H}^4$ ) are 1.25 and 7.2 MeV/nucleon respectively. Which nucleus is more stable? (2)

OR

- a. Discuss  $\alpha$ -decay process for a radioactive nucleus. Derive the expression for energy of  $\alpha$ -particle emitted in terms of Q value of reaction. (3)
- b. In a nuclear reactor, elaborate the role of moderator and control rods. (2)
20. a. If  $\sqrt{3}$  J of work is done by an external agent in slowly rotating an electric dipole from the direction of uniform electric field to direction making an angle of  $60^\circ$  with it, calculate the torque required to hold the dipole in this new position. (2)
- b. Separation between the plates of a parallel plate capacitor is 'd' and the area of each plate is A. When a slab of material of dielectric constant 'k', area A and thickness 't', ( $t < d$ ), is introduced between the plates, derive expression for its new capacitance. (3)

OR

Four charges  $q_A = 2\mu\text{C}$ ,  $q_B = -5\mu\text{C}$ ,  $q_C = 2\mu\text{C}$  and  $q_D = 2\mu\text{C}$  are located at the corners of a square ABCD of side 10 cm.

- a. Find the electric potential at the centre of the square. (2)
- b. Find the force on a charge of  $1\mu\text{C}$  placed at the centre of the square. (3)

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