

ST. XAVIER'S SCHOOL DORANDA
PHYSICS
PAPER- 1
(THEORY)
(Maximum marks: 70)
(Time allowed- Three hours)

All questions are compulsory.

This question paper is divided into 4 section, A, B, C,D

Section A

Question number 1 is of 12 marks. All parts of this question are compulsory

Section B

Question 2 to 12 carry 2 marks each with two questions having internal choice.

Section C

Question 13 to 19 carry 3 marks each with two questions having internal choice.

Section D

Question numbers 20 to 22 are long answer questions and carry 5 marks each. Each question has an internal choice

Section A

Answer all questions

Question 1

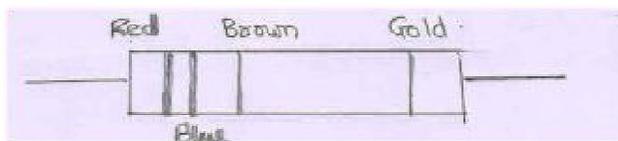
(A) Choose the correct alternative

i) A body has a positive charge of 8×10^{-19} C. It has

- a) an excess of 5 electrons
- b) a deficiency of 5 electrons
- c) an excess of 8 electrons
- d) A deficiency of 8 electrons

ii) A carbon resistor has colored bands

The resistance of the resistor is



- a) $R = 24 \times 10 \Omega \pm 20\%$
- b) $R = 12 \times 10^3 \Omega \pm 5\%$
- c) $R = 26 \times 10 \Omega \pm 5\%$
- d) $R = 22 \times 10^2 \Omega \pm 10\%$

iii) Which type of mirror forms a virtual image that is smaller than the object?

- a) plane
- b) concave

d) none of these

iv) **Which type of mirror forms a virtual image that is larger than the object?**

a) plane

b) concave

c) convex

d) none of these.

iv) **The level formed due to impurity atom in the forbidden gap very near to the valance band in p-type semiconductor is called**

a) a forbidden level

b) a conduction level

c) donor level

d) acceptor level

[B]

i) State one importance of Zener diode

ii) What type of wave front is generated from a line source of light

iii) According to Bohr 'angular momentum of an orbiting electron is quantized' What is meant by this statement?

iv) What is the focal length of a plane mirror?

v) What kind of mirror is used in vehicles?

vi) What is the effect of heating a conductor on the drift velocity of free electrons?

vii) A capacitor is charged and the charging battery is removed. A slab of dielectric material is then inserted between the plates of the capacitor. How will the electric field be affected

Section B

Answer all questions

Question 2

Sketch electric field lines due to two similar charges of equal magnitude. State one characteristic of electric lines of force [2]

Question 3

Define electrical resistivity of a material. Write its SI unit. [2]

Question 4

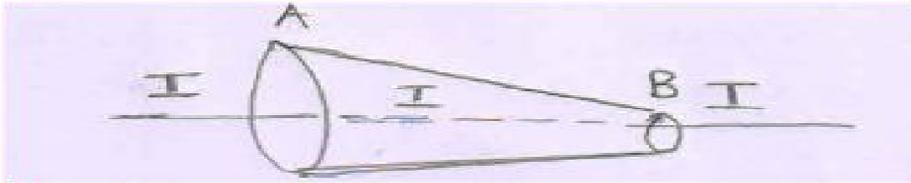
State Gauss Theorem in electrostatics. Apply this theorem to find electric field strength due to conducting sphere such that the point lies outside the sphere

OR

A parallel plate capacitor with air between the plates has a capacitance of 8pF. What will the capacitance if the distance between the plates is reduced by half and the space between them is filled with a substance of dielectric constant 6? [2]

Question 5

A metallic plug AB is carrying a current I in the direction as shown in figure



State how the drift velocity of free electrons varies, if at all, from end A to end B

OR

Write the relation between the focal length and radius of curvature of a spherical mirror. Does the focal length of the spherical mirror depend on the color of the light incident on it? [2]

Question 6)

Can a convex mirror form a real image of an object? Why? [2]

Question 7

An object is placed at the centre of curvature of a concave mirror. Where will its image formed and what will be its nature? [2]

Question 8

Mention two applications of a concave mirror. [2]

Question 9

In a Young's double slit experiment, using light of wavelength 600nm the interference pattern was obtained on a screen 1.5m away from the plane of the slits. Calculate the distance between the two slits if fringe width was found to be 1mm [2]

Question 10

The energy E of a hydrogen atom with principal quantum number n is given by

$$E = -13.6/n^2 \text{ eV}$$

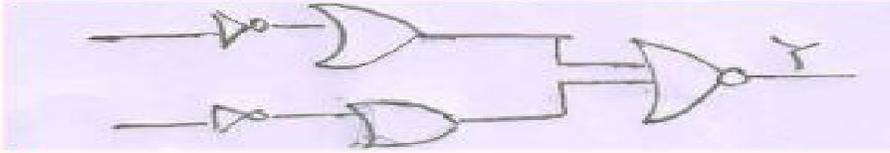
What is the energy of a photon ejected when the electron jumps from n=3 to n=2 state? [2]

Question 11

What is LED? Explain how radiations are given out by LED [2]

Question 12

Write the truth table of the following circuit. Name the gate represented by this circuit



[2]

SECTION C

Answer all questions

Question 13

Define potential energy of a point charge in a uniform electric field E. Obtain the expression for the electric potential due to a point in a uniform electric field E [3]

Question 14

When potential difference of 3V is applied between the two ends of a 60cm metallic wire, current density in it is found to be $1 \times 10^{-7} \text{ A/m}^2$. Find the conductivity of the wire in SI system. [3]

Question 15

If you were driving a car, what type of mirror would you prefer for observing the traffic behind and why? [3]

Question 16

Using a neat labelled diagram establish the relation $f = r/2$

OR

An object is placed at a distance of 20cm from a convex mirror at a distance of 20cm from a convex mirror and its image is formed at a distance of 12cm from the mirror. Find the radius of curvature of the mirror [3]

Question 17

Draw neatly labelled circuit diagram of a full wave rectifier using two junction diodes

OR

Draw a labelled diagram of a common emitter amplifier. [3]

Question 18

Draw the energy level diagram for hydrogen atom, showing four energy levels corresponding to $n=1,2,3,4$. Show the transition responsible for a) absorption spectrum in Lyman series b) emission spectrum in Balmer series [3]

Question 19

Show by drawing labelled diagram the nature of output voltage in case of i) half wave rectifier ii) full wave rectifier

[3]

Section D
Answer all questions

Question 20

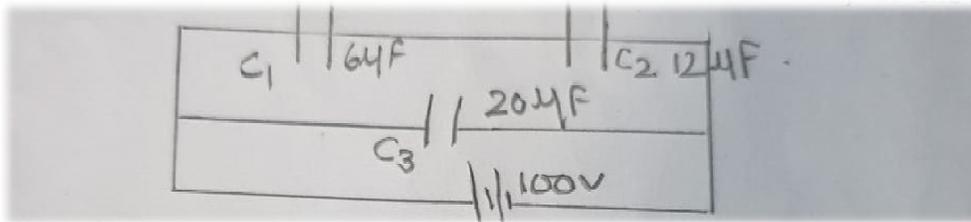
Describe the co ordinate sign convention for image formed by a mirror

OR

Establish the relation $1/u + 1/v = 1/f$ for image formation by a concave mirror. Symbols have their usual meanings [5]

Question 21

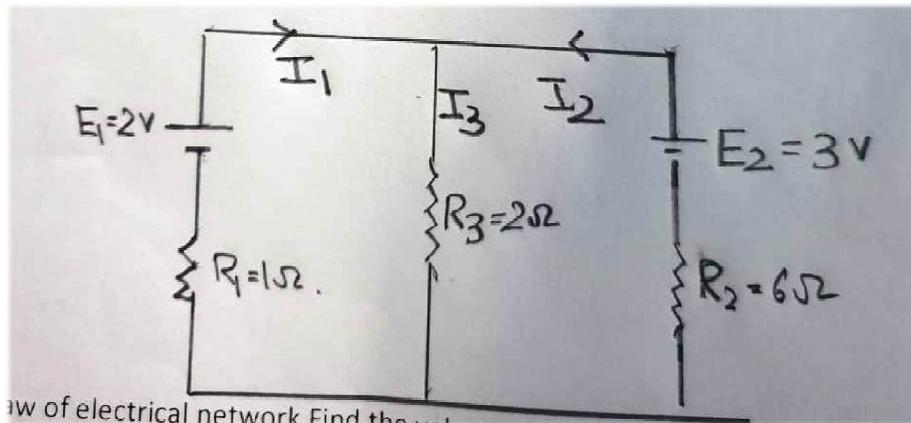
Three capacitors $C_1 = 6\mu\text{F}$, $C_2 = 12\mu\text{F}$ and $C_3 = 20\mu\text{F}$ are connected to a 100V battery' as shown in figure



Calculate a) charge on each plate of C_1 b) electrostatic potential energy stored by capacitor C_3

OR

In the circuit diagram shown E_1 and E_2 are two cells having emf 2V and 3V respectively



Applying Kirchoff's law of electrical network Find the values currents I_1 , I_2 , I_3 flowing through resistors R_1 , R_2 and R_3 respectively. [5]

Question 22

With the help of a labelled diagram show the fringe separation $\beta = \lambda D/d$, where symbols have their usual meanings

OR

On the basis of Huygens wave theory prove Snell's law of refraction of light

[5]