

Class: XII Session: 2020-2021

Subject: Physics

Question Paper (Theory)

Maximum Marks: 70 Marks

Time Allowed: 3 hours

General Instructions:

- (1) All questions are compulsory. There are 33 questions in all.
 - (2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
 - (3) Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.
 - (4) There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.
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SECTION A

All questions are compulsory. In case of internal choices, attempt any one of them.

- 1) Which physical quantity has SI Unit Cm (Coloumb meter)?
- 2) What is the ratio of speed of Gama Rays and Radio Waves in vaccume?

OR

What is the nature of waves used in RADAR?

- 3) 50 cm long solenoid has a radius of 1 cm and is made up of 500 turns. If it carries a current of 5 A then, find the magnitude of magnetic field inside the solenoid.
- 4) A length of wire carries a steady current. It is bent first to form a circular plane coil of one turn. The same length is now bent more sharply to give a double loop of smaller

radius. Find the magnetic field produced at the centre produced by same current.

OR

An alternating voltage $V=200\sin 300t$ is applied across a series combination of $R=10\Omega$ and $L=800$ find the impedance of the circuit.

- 5) Define ionisation energy. What is its value for a hydrogen atoms?
- 6) The stopping potential in an experiment on photoelectric effect is 1.5 V. What is the maximum kinetic energy of the photoelectrons emitted?
- 7) State two characteristic properties of nuclear force.

OR

Two nuclei have mass number in the ratio 1 : 3. What is the ratio of their nuclear densities?

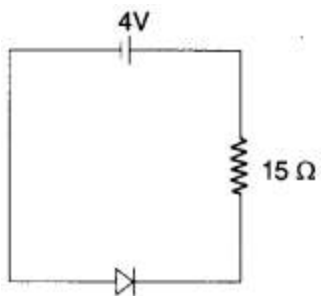
- 8) Write the two uses of the photo diode.

OR

What happens to the width of depletion layer of a p-n junction when it is

- (i) forward biased?
- (ii) reverse biased?

- 9) In the circuit shown if current for the diode is $20\ \mu\text{A}$, find the potential difference across the diode.



- 10) What do you understand by a dynamic resistance of p-n junction diode.

For question numbers 11, 12, 13 and 14, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- a) Both A and R are true and R is the correct explanation of A
- b) Both A and R are true but R is NOT the correct explanation of A

- c) A is true but R is false
- d) A is false and R is also false

11) Assertion(A) If the bob of a simple pendulum is kept in a horizontal electric field, its period of oscillation will remain same.

Reason (R) If the bob is charged and kept in horizontal electric field, then the time period will be decreased.

12) Assertion (A) Electric potential of earth is taken zero

Reason(R) No electric field exists on earth surface

13) Assertion (A) The edges of the images of white object formed by concave mirror on screen appear white.

Reason (R) Concave mirror does not suffer from chromatic aberration.

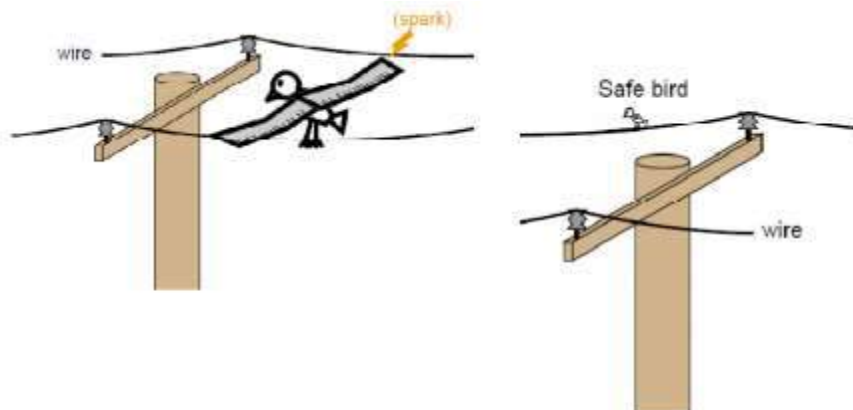
14) Assertion (A) If the objective and eyepiece of a microscope are interchanged then it can work as telescope.

Reason (R) The objective lens of telescope has small focal length.

SECTION B

Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.

15)



Raghav lives in an area where birds in large groups play around producing pleasing humming sounds. One day he notices that the high power lines soon after a strong wind

have come too close which may prove fatal for the birds that would sit on them and flutter their wings for some reason or other. He complained to the authorities and the lines were set at the proper distance once again.

- i) What is the danger that can happen to the birds in Raghava's view?
 - (a) The birds may get electrocuted
 - (b) The birds may get earthed.
 - (c) The birds may get uncharged
 - (d) The birds can not fly.
- ii) How did distancing the lines may solve the problem?
 - (a) Avoid flight of the birds
 - (b) Avoid the sparking
 - (c) Avoid the charging
 - (d) Avoid the earthing
- iii) The transmission of electric power is done at
 - (a) High voltage, low current
 - (b) Low voltage, high current
 - (c) Combination of series wires
 - (d) None of these
- iv) By which of the following method electric power may be transmitted from one location to another location?
 - a) UnderGround System
 - b) Overhead system
 - c) Both 1 and 2
 - d) None of the above
- v) If the length of the cable is doubled, its capacitance C will become
 - a) Doubled
 - b) Half
 - c) One-fourth
 - d) Remain Unchanged

16)



The whole class was excited as they were on their way to Kavalur in TamilNadu, an observatory, housing the largest telescope in India. The teacher was explaining type of telescope, the diameter of the objective (2.34m) and other details. The children were looking forward to see through the telescope.

- (i) What type of telescope is the teacher referring to
- (a) Binocular
 - (b) Refracting type telescope
 - (c) Reflecting type telescope
 - (d) Compound microscope
- (ii) In astronomical compare to eye piece, objective lens has
- a) negative focal length
 - b) zero focal length
 - c) small focal length
 - d) large focal length
- (iii) If f_o is the focal length of the objective and f_e is the focal length of the eyepiece, then magnification of a refracting (M) telescope can be determined as
- a) $M = f_o/f_e$
 - b) $M = f_o + f_e$
 - c) $M = f_o - f_e$
 - d) $M = f_e/f_o$
- (iv) A telescope can make stars look

- a) bigger
 - b) brighter
 - c) smaller
 - d) all of above
- (v) A telescope that uses two converging lenses is called
- a) reflecting telescope
 - b) refracting telescope
 - c) simple telescope
 - d) compound microscope

SECTION C

All questions are compulsory. In case of internal choices, attempt anyone.

- 17) A straight wire extending from east to west falls with a speed v at right angles to the horizontal component of the Earth's magnetic field. Which end of the wire would be at the higher electrical potential and why?
- 18) A narrow slit is illuminated by a parallel beam of monochromatic light of wavelength λ equals to 6000 \AA and the angular width of the central maxima in the resulting diffraction pattern is measured. When the slit is next illuminated by light of wavelength λ' , the angular width decrease to half. Calculate the value of the wavelength λ' ?

OR

What will be the angular separation of the first order fringe from the central maximum, when a light of wavelength 500 nm is diffracted at a slit of width 0.5 mm ?

- 19) A $500 \mu\text{C}$ charge is at the centre of a square of side 10 cm . Find the work done in moving a charge of $10 \mu\text{C}$ between two diagonally opposite points on the square.

OR

A point charge Q is placed at point O as shown in the figure.



Is the potential difference $V_A - V_B$ positive, negative or zero, if Q is

- (i) positive
- (ii) negative?

- 20) Name one impurity each, which when added to pure Si produces (i) n-type and (ii) p-type semiconductor
- 21) Current in a circuit falls from 5.0A to 0.0A in 0.1s. If an average emf 200V is induced, give an estimate of the self-inductance of the coil.
- 22) State two conditions to obtain sustained interference of light
- 23) Distinguish between a metal and an insulator on the basis of energy band diagram.
- 24) Define the following:
 - (i) magnetic declination and
 - (ii) angle of dip.

OR

The horizontal component of the earth's magnetic field at a place is B and angle of dip is 60° .

What is the value of vertical component of earth's magnetic field at equator?

- 25) State the conditions for the phenomenon of total internal reflection to occur.

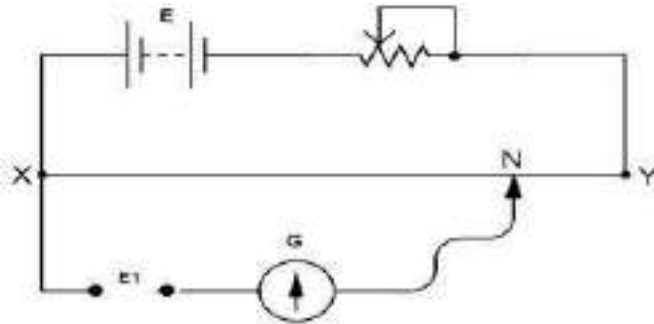
Section -D

All questions are compulsory. In case of internal choices, attempt any one.

- 26) How does the mutual inductance of a pair of coils change when:
 - (i) The distance between the coils is increased?
 - (ii) The number of turns in each coil is decreased?
 - (iii) thin iron sheet is placed between the two coils, other factors remaining the same?Explain each case.
- 27) A 9 V battery is connected in series with a resistor. The terminal voltage is found to be 8 V. Current through the circuit is measured as 5 A. What is the internal resistance of the battery?

OR

The diagram below shows a potentiometer set up. On touching the jockey near to the end X of the potentiometer wire, the galvanometer pointer deflects to left. On touching the jockey near to end Y of the potentiometer, the galvanometer pointer again deflects to left but now by a larger amount. Identify the fault in the circuit and explain, using appropriate equations or otherwise, how it leads to such a one-sided deflection.



28) Write the expression for the de-Broglie wavelength associated with a charged particle having charge q and mass m , when it is accelerated by a potential

OR

A proton and an electron have same kinetic energy. Which one has greater de-Broglie wavelength and why?

29) Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom.

30)(a) Calculate the energy released in MeV in the following nuclear reaction:

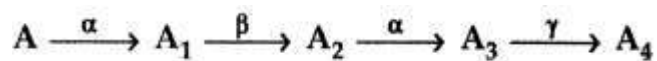


[Mass of ${}_{92}^{238}\text{U} = 238.05079 \text{ u}$,

Mass of ${}_{90}^{234}\text{Th} = 234.043630 \text{ u}$,

Mass of ${}_2^4\text{He} = 4.002600 \text{ u}$, $1\text{u} = 931.5 \text{ MeV}/c^2$]

(b) A radioactive nucleus 'A' undergoes a series of decays according to the following scheme:

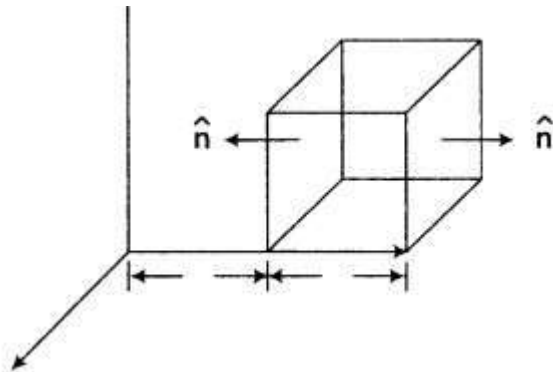


The mass number and atomic number of A are 190 and 75 respectively. What are these numbers for A_4 ?

Section – E

All questions are compulsory. In case of internal choices, attempt any one.

- 31) (a) State Gauss' law in electrostatics. A cube which each side a is kept in an electric field given by $E = Cx$ as shown in the figure, where C is a positive dimensional constant. Find out



- (i) the electric flux through the cube
(ii) the net charge inside the cube.

- (b) Define Electric Flux. Is it scalar or vector? Give its SI Units.

OR

- (a) Derive an expression for the torque experienced by an electric dipole kept in a uniform electric field.
(b) In which orientation, a dipole placed in a uniform electric field is in

- stable,
- unstable equilibrium ?

- 32) (a) In a series LCR circuit connected across an ac source of variable frequency, obtain the expression for its impedance and draw a plot showing its variation with frequency of the ac source.

(b) What is the phase difference between the voltages across inductor and the capacitor at resonance in the LCR circuit ?

(c) When an inductor is connected to a 200 V dc voltage, a current of 1A flows through it. When the same inductor is connected to a 200 V, 50 Hz ac source, only 0.5 A current flows. Explain, why ? Also, calculate the self inductance of the inductor

OR

(a) Draw the diagram of a device which is used to decrease high ac voltage into a low ac voltage and state its working principle. Write four sources of energy loss in this device.

(b) A small town with a demand of 1200 kW of electric power at 220 V is situated 20 km away from an electric plant generating power at 440 V. The resistance of the two wire line carrying power is 0.5Ω per km. The town gets the power from the line through a 4000-220 V step-down transformer at a sub-station in the town. Estimate the line power loss in the form of heat.

33) (a) Draw a labelled ray diagram of compound microscope, when final image forms at the least distance of distinct vision.

(b) Why is its objective of short focal length and of short aperture, compared to its eyepiece ? Explain.

OR

(a) With the help of a labeled ray diagram, explain the construction and working of a Cassegrain reflecting telescope.

(b) An amateur astronomer wishes to estimate roughly the size of the Sun using his crude telescope consisting of an objective lens of focal length 200 cm and an eyepiece of focal length 10 cm. By adjusting the distance of the eyepiece from the objective, he obtains an image of the Sun on a screen 40 cm behind the eyepiece. The diameter of the Sun's image is measured to be 6.0 cm. Estimate the Sun's size, given that the average Earth-Sun distance is 1.5×10^{11} m.