Class: XII Session: 2020-2021

Subject: Physics (Theory)

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

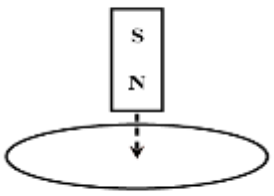
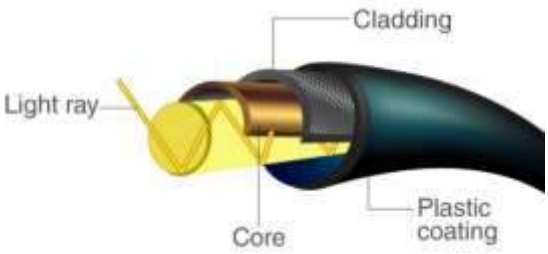
General Instructions:

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.

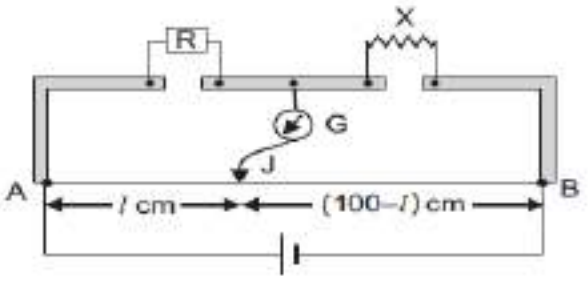
You may use the following values of physical constants wherever necessary.
$c = 3 \times 10^8$ m/s
$h = 6.63 \times 10^{-34}$ Js
$e = 1.6 \times 10^{-19}$ C
$\mu_o = 4 \times 10^{-7}$ T m A-1
$\varepsilon_0 = 8.854 \times 10^{-12}$ C2 N-1 m-2
$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N m2 C-2
$m_e = 9.1 \times 10^{-31}$ kg
mass of neutron = 1.675×10^{-27} kg
mass of proton = 1.673×10^{-27} kg
Avogadro's number = 6.023×10^{23} per gram mole
Boltzmann constant = 1.38×10^{-23} JK^{-1}

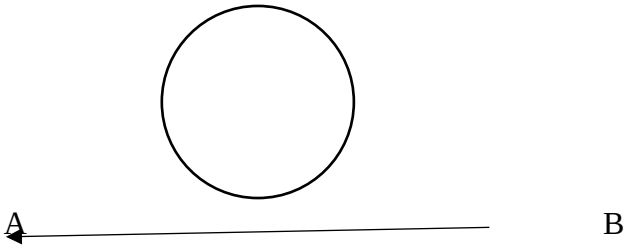
Sr.No.		Marks
	Section – A **All questions are compulsory. In case of internal choices, attempt any one of them.**	
1.	When 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is?	1
2.	Two infinite plane parallel sheets separated by a distance *d* have equal and opposite uniform charge densities σ. What will be the electric field at a point between the sheets? OR A point charge of +10μC is at the centre of a cube of side 10cm, what is the magnitude of electric flux through one surface of the cube.	1
3.	What happens to the resistance of a semiconductor when temperature is increased? OR What happens to potential barrier of a p-n junction during forward biasing?	1
4.	Which spectral line may appear in both emission and absorption spectrum of hydrogen?	1
5.	In which biasing light emitting diode works?	1
6.	What will be the effect on the photoelectric current if we increase the frequency of incident radiation and keep intensity of incident radiation constant?	1

7.	Through what potential difference should an electron be accelerated that its de Broglie wavelength becomes 0.4 Å? OR A particle is dropped from a height H. the de Broglie wavelength of the particle as a function of height is proportional to-	1
8.	Two long straight wires are set parallel to each other. Each carries a current in the same direction and the separation between them is 2*r*. The intensity of the magnetic field midway between them is	1
9.	Which part of electromagnetic spectrum has largest penetrating power? OR The electric field intensity produced by the radiation coming from 100 W bulb at 3m distance is E, the electric field intensity produced by the radiation coming from 50 W bulb at the same distance is:	1
10.	A closely wound solenoid of 800 turns and area of cross section 2.5×10^{-4} m^2 carries a current of 3.0 A. what is its associated magnetic moment?	1
	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):** To convert a galvanometer in to ammeter a small resistance (shunt) is connected in parallel to the coil of galvanometer. **Reason(R):** An ideal ammeter has infinite resistance.	1
12.	**Assertion(A):** The wire of potentiometer is made by constantan and manganin. **Reason(R):** Constantan and manganin are alloys and dependence of resistivity of alloys in temperature is negligible.	1
13.	**Assertion(A):** A particle will follow helical path in magnetic field if its velocity v and direction of magnetic field B are at angle of ϕ. **Reason(R):** The component $v\sin\phi$ will provide the centripetal force and magnetic field will not apply any force on the component $v\cos\phi$.	1
14.	**Assertion(A) :** In a metallic wire if we increase the temperature of wire the resistance of the wire also increases. **Reason(R):** on increasing the temperature thermal velocity of electrons decreases and relaxation time period increases in this way number of collision decreases.	1
	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.**	
	Eddy currents When magnetic flux linked with a coil of metal like copper changes, induced e.m.f. is produced in it and the induced current flows through the wire forming the coil. Focault	4

15	found that when magnetic flux linked with a metallic conductor changes induced currents are set up in the form of closed loops, these currents look like eddies or whirl pools and known as eddy currents. These currents can be used in many ways like induction motors, induction furnace, electric brakes and dead beat galvanometers etc. there are some drawback of eddy currents also because it produce heating effect in conductor so in an order to reduce these currents we use thin iron strips instead of a thick iron plate.	
	1. Which of the following material can be used to make a coil in which e.m.f can be induced? a) Plastic b) Glass c) Copper d) Wood	
	2. use of eddy currents is done in the following , except a) induction motor b) dynamo c) electric brake d) moving coil galvanometer	
	3. eddy currents are produced in a) induction furnace b) electromagnetic brakes c) speedometer d) all of these	
	4. whenever a magnet is moved either towards or away from a conducting coil, an e.m.f. is induced the magnitude of which is independent of a) The strength of the magnetic field. b) The speed of magnet with which it is moved. c) The number of turns in the coil. d) The resistance of the coil.	
	5. A copper ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring, the acceleration of the falling magnet inside the cylinder will be a) less than acceleration due to gravity. b) equal to acceleration due to gravity. c) larger than acceleration due to gravity d) none of the above. 	
16.	**Optical Fibres** optical fibres are used as a guided medium for transmission of optical signals. A optical fibre consist three main parts core, cladding and buffer coating the refrective index of the core is slightly greater than cladding so that total internal reflaction can take place. The working of optical fibres is based on the phenomenon of total internal reflection as  there is no loss of energy in total internal reflection so the signal can be transmit without any loss of energy. the only condition is that the angle of incidence of light must be	

	greater then critical angle for the fibre material w.r.t its coating. In optical fibres LEDs are used to convert electrical signal into optical signals.	
	1. For total internal reflection to take place the incident angle should be: a) greater then critical angle b) smaller then critical angle c) equal to the critical angle d) None of the above.	
	2. If refractive index of core is μ_1 and refractive index of cladding is μ_2 then: a) $\mu_1 < \mu_2$ b) $\mu_1 > \mu_2$ c) $\mu_1 = \mu_2$ d) Both (a) and (b)	
	3. The working of optical fibres is based on the phenomenon of a) Total internal reflection b) Reflection c) Refraction d) Dispersion	
	4. Which device is used to convert electrical signal in to optical signal to transmit signals using optical fibres a) Photodiodes. b) Zener diodes. c) Light emitting diodes. d) Solar cell	
	5. total internal reflection of light will take place if light ray travels a) Rarer medium to denser medium. b) Denser medium to rarer medium.. c) Both (a) and (b) d) None of the above.	
	Section – C **All questions are compulsory. In case of internal choices, attempt anyone.**	
17.	Explain the working of light emitting diode. Or Explain the formation of bands and using band theory distinguish among conductors, semiconductors and insulators.	2
18.	Find the wavelength of Hα line of Blamer series. Value of Rydberg constant $R=1.1\times10^{7}m^{-1}$.	2
19.	Using Gauss's theorem prove Coulomb's law of electrostatic force. Or If the electric field is given by $6\hat{i} + 3\hat{j} + 4k$ calculate the electric flux through a surface of area 20 units lying in YZ-plane.	2
20.	Can a metal sphere of radius 1 cm hold a charge of 1 coulomb?	2
21.	Using Huygens principle prove the refraction of light.	2
22.	Draw a graph showing the variation of stopping potential with frequency of the incident radiation. What does the slope of the line indicate?	2
23.	How electromagnetic waves are produced? Draw a sketch of linearly polarised e-m waves propagating in Z-direction.	2
24.	Explain the term 'drift velocity' of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of 'drift velocity'. Or	2

	Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell.	
25.	State Biot savart's law, using this find the expression for magnetic field at the centre of a current carrying circular loop.	2
	Section -D **All questions are compulsory. In case of internal choices, attempt any one.**	
26	Draw V – I characteristics of a p–n junction diode. Answer the following questions, giving reasons: (i) Why is the current under reverse bias almost independent of the applied potential up to a critical voltage? (ii) Why does the reverse current show a sudden increase at the critical voltage?	3
27	(a) Derive the expression of lens maker's formula for convex lens. (b) The redii of curvature of the surfaces of a double convex lens are 20cm and 40cm respectively, and its focal length is 20 cm. what is the refractive index of the material of the lens? Or (i) Draw a neat labelled ray diagram of a compound microscope. Explain briefly it's working. (ii) Why must both the objective and the eye-piece of a compound microscope have short focal lengths?	3
28.	Calculate the electric field due to a solid sphere of charge- (a) When point P lies outside the sphere. (b) When point P lies inside the sphere. (c) Draw the graph of electric field intensity v/s distance for a charged sphere	3
29	A resistance $R = 2\Omega$ is connected to one of the gaps in a metre bridge, which uses a wire of length $1\ m$.An unknown resistance $X > 2\Omega$ is connected in the other gap as shown in the figure. The balance point is noticed at 'l' from the positive end of the battery. On interchanging R and X, it is found that the balance point further shifts by 20 cm (away from end A). Neglecting the end correction, calculate the value of unknown resistance X used. 	3
30	Deduce the magnetic field at a point on the axis of a current carying loop. Or (a) State Ampere's circuital law and prove this law for a circular path. (b) Deduce the formula for magnetic field due to a long straight solenoid.	3
	Section – E **All questions are compulsory. In case of internal choices, attempt any one.**	
31	(a) State the importance of coherent sources in the phenomenon of interference. (b) In Young's double slit experiment to produce interference pattern, obtain the conditions for constructive and destructive interference. Hence, deduce the expression for the fringe width. (c) How does the fringe width get affected, if the entire experimental apparatus of Young is immersed in *water*?	

	Or (a) State Huygen's principle. Using this principle explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a narrow beam coming from a monochromatic source of light is incident normally. (b) Show that the angular width of the first diffraction fringe is half of that of the central fringe. (c) If a monochromatic source of light is replaced by white light, what change would you observe in the diffraction pattern?	5
32.	(a) Write Bohr's postulates of hydrogen atomic model. (b) Explain the origin of spectral lines using Bohr's atomic model. (c) Write De Broglie's explanation of Bohr's second postulate of quantization. Or (a) Explain nuclear binding energy. (b) Draw a plot showing the variation of binding energy per nucleon versus the mass number A. (c) calculate mass defect, binding energy and binding energy per nucleon for lithium ($_3Li^7$) nucleus taking its mass 7.000000 a.m.u. mass of proton 1.007825 a.m.u. and mass of neutron 1.008665 a.m.u. Take 1 a.m.u. 931.5 MeV.	5
33	(a)Derive an expression for the impedance of a series LCR circuit connected to an AC supply of variable frequency. (b) Plot a graph showing variation of current with the frequency of the applied voltage. (c) Explain resonance in series LCR- series circuit and deduce the formula for resonance frequency. Or (a) The electric current in a wire is in the direction from B to A is increasing. What is the direction of induced current in a metallic loop?  (b) Explain mutual induction. Calculate the mutual induction of two long solenoids. (c) Draw a schematic diagram of ac generator and explain its working. Deduce the formula of induced e.m.f. in a coil of ac generator.	5

KENDRIYA VIDYALAYA SANGATHAN
JAMMU REGION
Pre - Board Examination (2020-21)
Marking Scheme (042)

Q. No.	Expected Answer / Value Points	Marks
1	+1.6 C	1
2	σ/ε_0 or $1.88\times10^5\ m^2c^{-1}$	1
3	Decreases. or potential barrier decreases	1
4	Lyman series	1
5	Forward	1
6	Constant	1
7	941.0 V or $\lambda \propto \frac{1}{\sqrt{H}}$	1
8	Zero	1
9	Gamma rays or $\frac{E}{2}$	1
10	$0.60\ TJ^{-1}$	1
11	C	1
12	A	1
13	A	1
14	C	1
15	1. C 2. B 3. D 4. D 5. A	1
16	1. A 2. B 3. A 4. C 5. B	1
17	Correct explanation	2
18	$\lambda = 6.545 \times 10^{-7}$ m	2
19	Correct derivation Or 120 units	2

20	No, Electric field at the surface of the sphere E= $\frac{1}{4\pi\varepsilon_0}\frac{q}{r2}$ =9× 10^{13} N/C This is much larger then dielectric strength of air so the surrounding air will get ionised and sphere will leak the charges to the surroundings.	2
21	Correct explanation	2
22	Correct graph. Slope of the line = $\frac{h}{e}$	1 1
23	Correct explanation Correct diagram	1 1
24	Definition of drift velocity *Fig 3.4 NCERT PART – I (PAGE - 98)* Let *n* be the number density of free electrons in a conductor of length *l* and area of cross-section '*A*'. Total charge in the conductor,$Q = Ne = (n\,Al)\,e$ Time taken at average velocity $v_d$is$t = \frac{l}{v_d}$ So, by definition,$I = \frac{Q}{t} = \frac{(n\,Al)\,e}{\frac{l}{v_d}} \Rightarrow I = neAv_d$ **Or** *Fig 3.28 NCERT PART – I (PAGE - 123)* If key k_1 is closed, (while key k_2 is open), galvanometer shows null deflection at balancing length l_1.So, $E = k\,l_1$ ……(1) If both keys k_1 and k_2 are closed and R is the resistance of resistance box, galvanometer now shows null deflection at balancing length $l_2 (l_2 < l_1)$. So, $V = k\,l_2$ ……(2) (1) From relation, $r = \left(\frac{E}{V} - 1\right) R$, We have, $r = \left(\frac{l_1}{l_2} - 1\right) R$	1 1 ½ ½ 1
25	Biot savart's law Correct derivation	1 1
26	V – I characteristics of a p–n junction diode (a) At any temperature the number of minority carriers is constant so there is the small current at any applied potential. This is the reason for the current under reverse bias to be almost independent of applied potential. Thus there is a sudden increase in the current at the critical voltage. (b) It is not measurable at high temperature	1 1 1
27	(a) Correct derivation (b) μ=5/3	2

	or (i)Ray diagram for compound microscope Derivation for magnification NCERT PART – 1 (PAGE - 340) (ii)For large magnification power, *f*o & *f*e both have to be small.	1 1 1½ ½
28	(a) Correct derivation (b) Correct derivation (c) Correct graph	1 1 1
29	From 'metre bridge' formula $X = \frac{(100-l)R}{l} = \frac{(100-l)}{l} \times 2\Omega$ ... ... (1) On interchanging *R* and *X*, the balance point is obtained at a distance (l + 20) cm from end *A*, so $$X = \frac{l+20}{100-(l+20)} = \frac{l+20}{80-l} \times 2\Omega \text{ ... ... (2)}$$ Equating (1) and (2) $\frac{(100-l)}{l} \times 2\Omega = \frac{l+20}{80-l} \times 2\Omega$ Solving we get $l = 40\ cm$ Therefore, Unknown resistance, $X = \frac{(100-l)}{l} \times 2\Omega = \frac{(100-40)}{40} \times 2\Omega = 3\Omega$	½ ½ 1 1
30	Correct derivation Or (a) Correct statement of Ampere's circuital law Prove of the law (b) Correct derivation	3 1 1 1
31	**(a)** If coherent sources are not taken, the phase difference between two interfering waves, will change continuously and a sustained interference pattern will not be obtained. Thus, coherent sources provide sustained interference pattern. **(b)** experimental interference patternfig. 10.12 *NCERT PART – II (PAGE – 363)* Conditions for constructive and destructive interference Expression for the fringe width. *NCERT PART – II (PAGE – 364)* **(c)**When entire apparatus is immersed in water, the fringe-width decreases ($\lambda w < \lambda a$). **OR** **(a)** Statement of Huygen's principle Diffraction pattern, Explanation and derivation fig. 10.15 *NCERT PART – II (PAGE – 369)* **(b)** Angular width of central maximum $(\beta_\theta)c = \frac{2\lambda}{a}$ Angular width of first maximum, $(\beta_I) = \frac{2\lambda}{a} - \frac{\lambda}{a} = \frac{\lambda}{a}$	1 ½ 2 1 ½ ½ 1+2 1

	$\frac{(\beta_I)}{(\beta_\theta)c} = \frac{1}{2}$ Hence, the fringe width of the first diffraction fringe is half that of the central fringe. **(c)** If monochromatic light is replaced by white light, each diffraction band gets splited into the number of coloured bands, the angular width of violet is least and that of red is maximum.	½
32	(a) Correct postulates (b) Correct explanation (c) Correct explanation Or (a) Correct explanation (b) Correct graph (c) BE/ Nucleon = 7.736 MeV/N	1½ 1½ 2 1½ 2 1½
33.	(a) LCR series circuit and phasors diagram NCERT PART – I (PAGE - 245) Expression for impedance **(b)** Graph fig 7.16 NCERT PART – I (PAGE - 248) **(c)** Correct explanation Correct derivation for frequency f = $\frac{1}{2\pi\sqrt{LC}}$ Or (a) Current in loop will flow in anticlockwise direction (b) Correct explanation Mutual inductance of two solenoids (c) Schematic diagram and working Derivation of the Formula of induced emf in coil of generator	1 1½ ½ 1 1 1 ½ 1½ 1 2

Kendriya Vidyalaya Sangathan Jammu Region
Blue Print of Question Paper (042)
Class XII
Pre-Board Examination (2020 – 21)

Sr. No.	Name of Unit	VSA (1 Mark)	Case study (4 Marks)	SA-I (2 Marks)	SA-II (3 Marks)	LA (5 Marks)	Total
1	Electrostatics	2	***	2	1	***	16
2	Current and electricity	2	***	1	1	***	
3	Magnetic effect of electric current and magnetism	3	***	1	1	***	17
4	Emi and alternating current	***	1	***	***	1	

5	Electromagnetic waves	2	***	1	***	***	18
6	Optics	***	1	1	1	1	
7	Dual nature of matter & radiation	2	***	1	***	***	12
8	Atom & nuclei	1	***	1	***	1	
9	Semi-conductors	2	***	1	1	***	7
	Total	14×1	2×4	9×2	5×3	3×5	70