

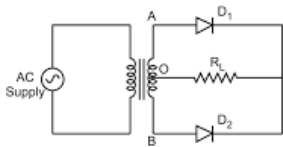
Class XII
Subject: Physics
Marking Scheme

Question No.	Suggestive Answer	Weightage of Marks	Total Marks
1	B	1	1
2	C	1	1
3	B	1	1
4	A	1	1
5	A	1	1
6	C; $\frac{\lambda_N}{\lambda_C} = 2:1$	1	1
7	A	1	1
8	D	1	1
9	A: 2 B: 1 C: 0 D: 0	Max- 2 marks Min- 0 marks	2
10	A: 1.5 B: 1 C: 2 D: 0	Max- 2 marks Min- 0 marks	2
11	A: 2 B: 1 C: 1.5 D: 0	Max- 2 marks Min- 0 marks	2
12	A: 2 B: 1 C: 0.5 D: 0	Max- 2 marks Min- 0 marks	2
13	No, it depends upon the nature of material, its length and area of cross-section.	1	1
14	When an electron moves normal to the magnetic field. $F = e(B \times v) = eBv \sin\theta$ The above expression has maximum value, when $\theta = 90^\circ$.	1	1
15	i. Increase the number of turns per unit length ii. Place a soft iron core inside a solenoid	$\frac{1}{2}$ mark $\frac{1}{2}$ mark	1
16	i. Use light of shorter wavelength ii. Increase aperture size	$\frac{1}{2}$ mark $\frac{1}{2}$ mark	1
17	A current-carrying solenoid behaves like a bar magnet, which means both produce a similar kind of magnetic field pattern. Each can be modelled as a magnetic dipole with defined north and south poles.	1 mark	1
18	Observation 3 suggests that ferromagnetic materials have strong internal magnetic domains that create	1 mark	1

	noticeable magnetic fields even without an external source.		
19	The field lines do not provide any information about material properties or internal magnetic domain effects influencing the actual magnetic field.	1 mark	1
20	The coefficient of mutual inductance between two coils is the amount of magnetic flux linked with one coil when a unit current flows in the other coil. Mutual Inductance; $M_{12} = \frac{\phi_{12}}{I_2}$	1 mark	1
21	The dimensional formula for magnetic flux is: $\phi = [M^1 L^2 T^{-2} I^{-1}]$	1 mark	1
22	i. Decrease the slit width ii. Adjust the prism such that light enters at the angle of minimum deviation iii. Use an arrangement of prisms of different materials (Anyone)	1 mark	1
23	Mass defect is the difference between the sum of the total mass of the individual protons and neutrons in a nucleus and the actual mass of the nucleus. Its mathematical relation to calculating it: $\Delta m = (A \cdot m_p + B \cdot m_n) - M_{Nucleus}$ Where: Δm = mass defect; m_p = Mass of Proton; m_n = Mass of Neutron; A = No. of protons in a nucleus; B = No. of neutrons in a nucleus; $M_{Nucleus}$ = Actual mass of the nucleus	1 mark	1
24	It will fall on the nucleus due to electrostatic force. In that case, no atom will be stable.	1 mark	1
25	To resolve the issue: i. The glass fibre could be coated with material of refractive index less than glass. ii. Increase the angle of incidence of light inside the glass fibre to make it greater than the critical angle	1 mark	1
26	The task should be shared equally among the three students, based on their skills or interests. A possible division of work could be as follows: Student 1 can derive the relationship between the energy stored in a capacitor and the applied voltage. They can also prepare the model of the experimental setup and outline the assumptions required for the experiment. Student 2 can handle the circuit connections, take the measurements, and record all observations neatly in a data table.	1 mark 1 mark	3

	Student 3 can analyse the recorded data to calculate the energy–voltage points and plot the graph. They will also interpret the graph to check whether it follows the expected relationship. This is only a suggested distribution of work. Any other reasonable or logical plan that divides the task fairly and ensures equal participation from all students will also be considered correct.	1 mark	
27	The % change in resistance is ~1%. i. Use of relation of resistance. $R = \rho\left(\frac{L}{A}\right)$, and Calculation of new length $L' = 1.005 L$ ii. Calculation of change in area of cross-section, using the relation of volume conservation of $L \times A = L' \times A'$ iii. Calculation of new resistance by formula. $R' = \rho\left(\frac{L'}{A'}\right)$ & change in resistance $\Delta R = \frac{R' - R}{R} \times 100$	1 mark 1 mark 1 mark	3
28	i. Impedance in a series LCR circuit is combination of resistance, inductive reactance and capacitive reactance, not only dependent on the inductive reactance. Total impedance $(z) = \sqrt{R^2 + (X_L - X_C)^2}$ ii. At resonance, the inductive reactance cancels capacitive reactance. i.e. $X_L = X_C$, the net reactance becomes zero. iii. The increase of inductance shifts resonance but does not necessarily increase impedance near resonance. Thus, with a larger inductor, if frequency is close to resonance, the impedance decreases and at resonance frequency impedance become, $Z = R$.	1 mark 1 mark 1 mark	3
29	i. Atmospheric conditions near oceans like the air is more humid and forms smoother layers with greater density and temperature gradients. ii. Atmospheric conditions in mountainous regions, the air is thinner, colder, and more irregularly layered. iii. Comparison of atmospheric conditions in both the regions and their effect on refraction, like the higher moisture content increases the refractive index near oceans, bending sunlight	1 mark 1 mark 1 mark	3

	more before sunrise. While, the refractive bending of light is comparatively weaker in mountainous regions due to thin air, making the effect less noticeable.		
30	a. Surface X has the higher work function. Because electrons are emitted with zero kinetic energy, that means, the incident frequency (f) is exactly equal to its threshold frequency (f_0); $f = f_0$. b. If the frequency is slightly reduced, surface X stops emitting electrons since the radiation falls below its threshold. Surface Y may or may not show photoemission. If photoemission occur, the kinetic energy of emitted photoelectron be lower than before.	1 mark 2 marks	3
31	i. $r_3 = 4.76 \times 10^{-10} \text{ m}$ Radius of 3rd orbit: $r_n = n^2 \times r_0$ For third orbit; $n = 3$ ii. $E_3 = -1.51 \text{ eV}$ For energy of electron in the 3rd orbit: $E_n = -\frac{13.6}{n^2} \text{ eV}$	1 mark 2 marks	3
32	Students can discuss among themselves and use a scientific approach to resolve the disagreement. They can first check for the value of radiation emitted by the radioactive sources and then check for its permissible limit. School laboratory sources usually have very low activity, which can be checked through a GM counter reading and compared with safety limits. They are safe to use only when standard precautions (minimising exposure, using tools, proper storage) are followed. Or any other response around the similar lines.	3 marks	3
33	Electric flux through a closed is always equals to the $\frac{1}{\epsilon_0}$ times of the total charge enclosed by the closed surface. $E \cdot ds = Q/\epsilon_0$ Prove of above expression of Gauss' law in electrostatic for a spherically symmetric charge Derivation of coulomb's law of electrostatic from Gauss' law	½ mark ½ mark 2 marks 2 marks	5
34	The working principle of this projection system, a condenser concentrates light on the object. The projection lens collects rays from each point on the object and forms a real image on the distant screen. Because the projection lens projects rays from each object point to a corresponding image point, the screen shows an enlarged reproduction. Prisms are	1 mark	5

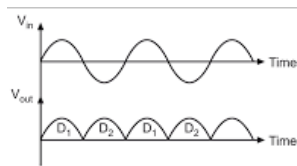
	inserted after the objective lens to rotate/flip the image and fold the path. Ray Diagram Working - the condenser lens collects the divergent light and produces a more uniform beam that illuminates the object. - Light reflected from each point of the object enters the projection lens. Rays from any object point are refracted by the projection lens to meet at a corresponding image point on the screen; a real, inverted, and magnified image is formed. - If the projection lens produces an inverted image, a pair of right-angle prisms placed along the emergent beam can rotate/flip the image, so the observer sees an erect image.	1 mark 3 marks	
35	a. Diffraction is the bending of light waves when they pass through an aperture whose size is comparable to the wavelength of the light. b. i. central maxima will get narrower and brighter. ii. Each wavelength presented in the white light produces its own diffraction pattern. Though, central maximum remains while due to overlap of all wavelengths. Away from centre, the fringes are spectrally coloured. c. The slit width is $1.2 \times 10^{-5} \text{ m}$.	1 mark 1 mark 1 mark 2 marks	5
36	a. A p-n junction diode allows current to pass only when it is forward biased and blocks current when reverse biased. Because of this property, it converts alternating current into direct current. - During the positive half cycle of AC, the diode becomes forward biased and conducts current. - During the negative half cycle, it becomes reverse-biased and does not conduct. Thus, the diode allows current only in one direction, producing a unidirectional output, and therefore acts as a rectifier. b. Working:  During the positive half cycle of alternating current, the upper half of the secondary becomes positive, D1 is forward-biased and conducts. While D2 is reverse-biased and does not conduct.	1 mark 3 marks	5

Commented [VG1]: Redraw the image

During the negative half cycle of alternating current, the lower half of the secondary becomes positive, D2 is forward-biased and conducts. While D1 is reverse-biased and does not conduct.

Thus, both halves of the AC input produce output, making it a full-wave rectifier.

c. Input-Output Waveform



1 mark

Commented [VG2]: Redraw the image.