INDIAN SCHOOL MUSCAT

FIRST PRE-BOARDEXAMINATION

JANUARY 2021

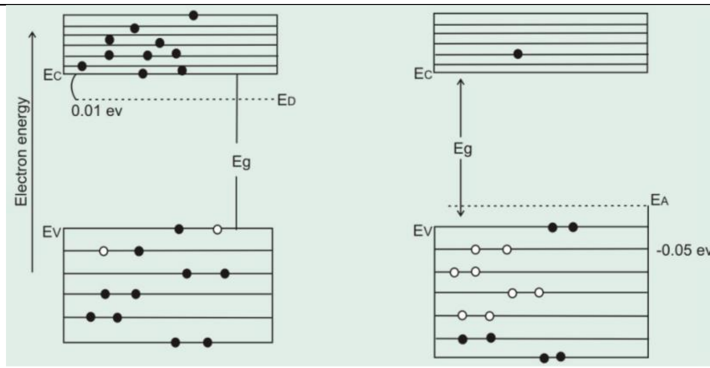
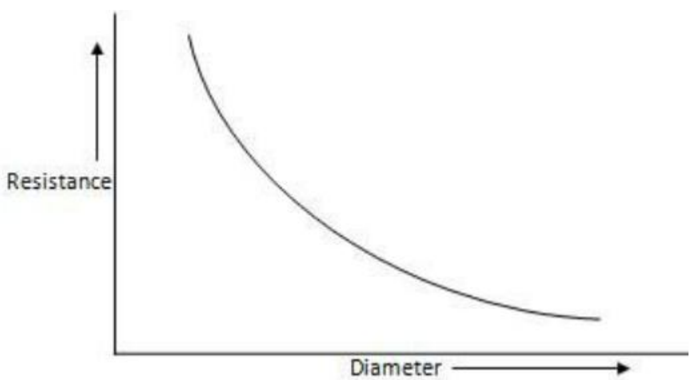
SET A

CLASS XII

Marking Scheme – SUBJECT[THEORY]

Q.NO.	Answers	Marks (with split up)
1.	$\vec{P} = \chi\vec{E}$	1
2.	$\vec{F} = q(\vec{V} \times \vec{B})$ Here q is the magnitude of the moving charge. The direction of the magnetic force is perpendicular to the plane containing the velocity vector $\vec{V}$ and the magnetic field vector $\vec{B}$. OR Magnetic equator	½+ ½ OR 1
3.	$\tan\delta = \frac{Bv}{Bh} = \sqrt{3}$ $\delta = 60°$	1
4.	Negative	1
5.	Remains same **OR** $3\sqrt{2}\ A$ or 4.24 A (1/2 mark for formula)	1 OR ½ + ½
6.	(i) UV (ii) IR	½+ ½
7.	Infrared waves are produced by hot bodies and molecules, so are referred to as heat waves. **OR** 5×10^{14} Hz, visible region.	1 OR ½ + ½
8.	Convex lens	1
9.	Curves *a* and *b* have different intensities but same stopping potential, so curves '*a*' and '*b*' have same frequency but different intensities. OR KE=$2 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-19}$ J	1 OR ½+ ½
10.	Depletion region widens under reverse bias.	1
11.	a	
12.	d	
13.	a	
14.	a	1
15.	1. C The drift speed decreases on moving from A to B	1 mark

	2. C i /2 3. C does not change 4. A 16:1 5. B 6.25×10^{18}	each (Any 4)
16.	1. (b) Diffraction fringes become narrower and crowded 2. (b) should be of the order of wavelength. 3. (b) sharper and brighter 4. (a)Diffraction of sound 5. (a)interfere constructively at the centre of the shadow	1 mark each (Any 4)
17.	Derivation $U=Q^2/2C$ Energy density of the capacitor is the energy stored in a capacitor per unit volume. OR Derivation ɩ= p E sinθ with diagram The electric dipole will attain stable equilibrium when the dipole moment is in the direction of the electric field	1 ½ ½ 1 ½ ½
18.	(a) A toroid is a solenoid bent into the form of a closed ring. The magnetic field lines of solenoid are straight lines parallel to the axis inside the solenoid. (b) Inside a given solenoid the magnetic field may be made strong by (i) passing large current and (ii) using laminated coil of soft iron.	1 1
19.	Diagram showing magnetic elements of earth (i) magnetic declination -definition (ii) angle of dip-definition OR Formula Calculation Answer (60^0)	1 ½ ½ ½ ½ 1
20.	(i) Capacitive reactance increases, impedance increases and so current decreases, brightness of the bulb reduces. (ii) When frequency decreases capacitive reactance increases, impedance increases and so current decreases, brightness of the bulb reduces.	½+ ½ ½+ ½
21.	Gamma ray has the highest frequency in the electromagnetic waves. These rays are of the nuclear origin and are produced in the disintegration of radioactive atomic nuclei and in the decay of certain subatomic particles. They are used in the treatment of cancer and tumours. UV rays	½ ½ ½ ½
22.	schematic ray diagram of a reflecting type telescope with labelling	2
23.	Focal length will be doubled. Power will be halved. If the student has applied len's maker's formula, reward ½ mark	1 1

24.	Any two advantages of a light emitting diode over conventional incandescent lamps. OR any two differences between intrinsic and extrinsic semiconductors.	1+1 1+1
25.	 n-type p-type	1+1
26.	(i) Principle of working of potentiometer $\frac{E_1}{E_2} = \frac{l_1}{l_2}$ $E_2 = \frac{63}{35} \times 1.25 = 2.25$ emf of the second cell is 2.25V.  OR (i) Principle of working of metre bridge (ii) $\frac{X}{Y} = \frac{l_1}{100 - l_1}$ $X = 12.5 \times \frac{39.5}{100 - 39.5} = 8.2$	1 ½ ½ 1 1 ½ ½

	resistance of resistor X is 8.2Ω. (iii) The connection between resistors in a Wheatstone or metre bridge is made of thick copper strips to minimize the resistance of connection, which is not taken into consideration in the formula.	 1
27.	(i)getting the equation $$\lambda = \frac{h}{\sqrt{2meV}}$$ (ii) $$v_0 = \frac{\phi_0}{h} = \frac{2.14eV}{6.63 \times 10^{-34} Js}$$ $$= \frac{2.14 \times 1.6 \times 10^{-19} J}{6.63 \times 10^{-34} Js} = 5.16 \times 10^{14} Hz$$ OR Einstein's Photoelectric equation, $h\nu = \phi_0 + k_{max}$ (i) For a given photosensitive material and frequency of incident radiation (above the threshold frequency), the photoelectric current is directly proportional to the intensity of incident light. (ii) For a given photosensitive material and frequency of incident radiation, saturation current is found to be proportional to the intensity of incident radiation whereas the stopping potential is independent of its intensity. Or any other two Energy of one photon $= h\nu$ $= (6.6 \times 10^{-34}) \times (6.0 \times 10^{14})$ Number of photons emitted per sec $$= \frac{\text{Power}}{\text{Energy of one photon}}$$ $$n = \frac{2 \times 10^{-3}}{(6.6 \times 10^{-34}) \times (6.0 \times 10^{14})} \quad \therefore n = 5 \times 10^{15}$$	2 ½+ ½ ½ ½ ½ ½ ½ ½
28.	(i)	½ ½

$R = R_0 A^{1/3}$

$$\therefore \quad \text{Density } \rho = \frac{mA}{\frac{4}{3}\pi\left(R_0 A^{1/3}\right)^3}$$

$$= \frac{m}{\frac{4}{3}\pi R_0^3}$$

Hence p is independent of A. ½+ ½

(Here m is the mass of the nucleus.) ½+ ½

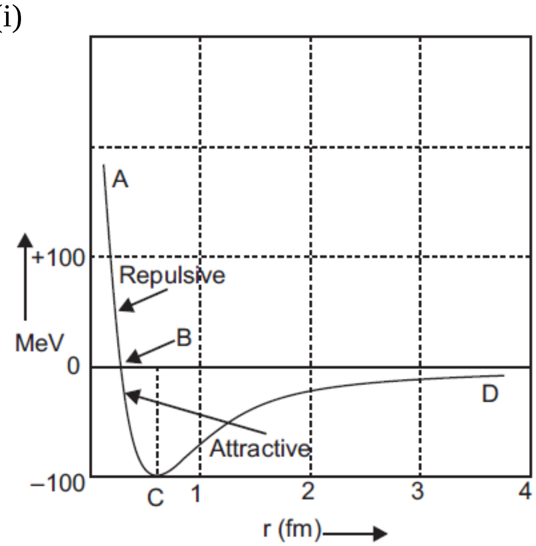
(ii)

Isotopes	Isobars
The nuclides having the same atomic number Z but different atomic masses (A) are called isotopes. Examples : $_1^1H$, $_1^2H$, $_1^3H$	The nuclides having the same atomic mass (A) but different atomic numbers (Z) are called isobars. Examples : $_1^3H$, $_2^3He$

OR

(i) 1graph

½+ ½ labelling

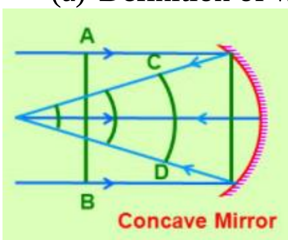
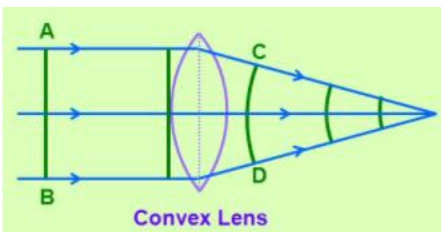
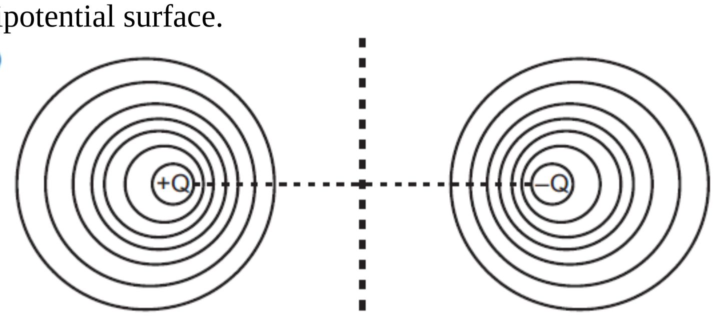


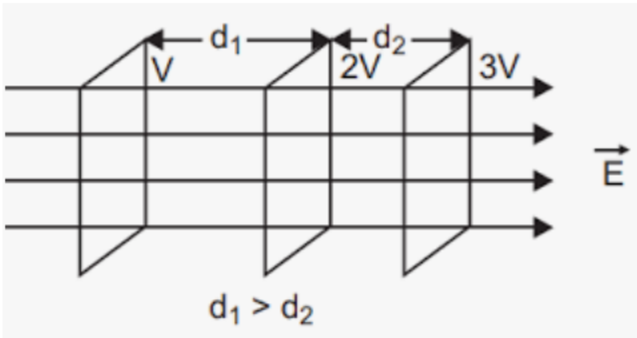
(i) If the distance *r*>0.8 fm, the nuclear force is attractive. ½

(ii) If the distance between the nucleons *r* <0.8 fm. The nuclear force is repulsive. ½

29.
(i) schematic diagram of a step-up transformer. 1
(ii) Definition of mutual induction 1
(iii) Expression for the secondary to primary voltage in terms of the number of turns in the two coils. Vs/Vp=Ns/Np 1

30.	According to Bohr's postulates, in a hydrogen atom, a single electron revolves around a nucleus of charge +e. For an electron moving with a uniform speed in a circular orbit on a given radius, the centripetal force is provided by the Coulomb force of attraction between the electron and the nucleus. Therefore, $\frac{mv^2}{r} = \frac{1}{4\pi\epsilon_o}\frac{(Ze)\ (e)}{r^2}$ ... (1) $\Rightarrow mv^2 = \frac{1}{4\pi\epsilon_o}\frac{Ze^2}{r}$ So, Kinetic energy, K.E. $= \frac{1}{2}mv^2$ $K.E = \frac{1}{4\pi\epsilon_o}\frac{Ze^2}{r}$ Potential energy is given by, P.E $= \frac{1}{4\pi\epsilon_o}\frac{(Ze)\ (-e)}{r} = \frac{1}{4\pi\epsilon_o}\frac{(Ze)\ (-e)}{r}$ Therefore, total energy is given by, E = K.E + P.E $= \frac{1}{4\pi\epsilon_o}\frac{Ze^2}{2r} + \left(-\frac{1}{4\pi\epsilon_o}\frac{Ze^2}{r}\right)$ $E = -\frac{1}{4\pi\epsilon_o}\frac{Ze^2}{2r}$, is the total energy. $\Rightarrow r_n = \frac{\epsilon_0 h^2 n^2}{\pi m Z e^2}$ Now, putting value of rn in equation (2) $E_n = -\frac{1}{4\pi\epsilon_0}\frac{Ze^2}{2\left(\frac{\epsilon_0 h^2 n^2}{\pi m}\right)}$ $= -\frac{mZ^2e^4}{8\epsilon_0 h^2 n^2}$	 1 ½ ½ ½ ½
31.	(a) Definition- mutual inductance and S.I. unit-Henry (b) Deriving an expression for the mutual inductance of two long co-axial solenoids of same length wound oneover the other. $\frac{\mu_0 N_1 N_2 A_2}{l}$ Given, $\mathbf{radius = 15cm, cross - section = 12cm^2, N = 1200}$ **The self inductance of toroid is given by:** $\mathbf{l = \frac{\mu_0 N^2 A}{2\pi r} = \frac{2 \times 10^{-7}(1200)^2 \times 12 \times 10^{-4}}{0.15} = 0.000023 = 2.3\ mH}$	½ + ½ 2 1+1

	OR (*a*) Statement of the principle of an a.c. generator. (*b*) labelled diagram, working and obtaining the expression for the emfgenerated in the coil. (*c*) $e = \frac{d\phi}{dt} = \frac{d}{dt}(BA) = A\frac{d}{dt}\left(\mu_0 \frac{N}{l} i\right) = A\mu_0\left(\frac{N}{l}\right)\frac{di}{dt} = \left(2 \times 10^{-4}\right) \times 4\pi \times 10^{-7} \times 15$ $e = 7.5 \times 10^{-6} V$	1 1+1+1 1+1
32.	(a) Definition of wavefront   diagram showing the propagation of a plane wavefront from denser to a rarer medium verifyingSnell's law of refraction. OR (a) Obtaining the conditions for obtaining constructive and destructive interference fringes at a point on the screen. (b) Draw the intensity distribution for (i) the fringes produced in interference and (ii) the diffraction bands produced due to single slit.	1 1 1 1 1 1 ½ +1 ½ 1+1
33.	(*a*) A surface around a point charge (or group of charges) with a constant value of potential at all points onthe surface is called an equipotential surface. If the electric field is not normal to the equipotential surface, then to move a charge *q* against thedirection of the component of the field, some work would have to be done. But this work done is incontradiction to the definition of an equipotential surface.If there is no potential difference, there is no work done.Hence, electric field is directed normally to the equipotential surface. (*b*)  	 1 1 1

	$dr = -\dfrac{dV}{\lvert E \rvert}$	
	As the value of *E* decreases, it results increase in the separation of equipotential surfaces from each other.	1
		1
	OR	
	(a) proving theelectric field.	
	(i) in the outer regions of both the plates is zero.	1 ½
	(ii) is σ/ε_0 in the inner region between the charged plates.	1 ½
	(b)	
	(i) the electric field decreases by k	1
	(ii) the capacitance of the capacitor increases by a factor k	1