Roll No. | | | | | | | |

Candidates must write the Code on the title page of the answer book.

- Please check that this question paper contains **14** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer book by the candidate.
- Please check that this question paper contains **33** questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minutes time has been allotted to read this question paper. The students will read the question paper only and will not write any answer on the answer-book during this period.

II PRE-BOARD EXAMINATION : 2023-24

CLASS : XII

PHYSICS (THEORY) (042)

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

General Instructions:

(i) ***There are 33 questions in all. All questions are compulsory.***

(ii) ***This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.***

(iii) ***Section A contains sixteen questions, twelve MCQ and four Assertion Reason based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, section D contains two case-study based questions of four marks each and Section E contains three long answer questions of five marks each.***

(iv) *There is no overall choice. However, an internal choice has been provided in one question in section B, one question in section C, one question in each CBQ in section D and in all three questions in section E. You have to attempt only one of the choice in such questions.*

(v) *Use of calculators is not allowed.*

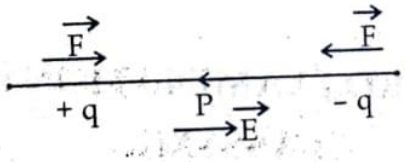
(vi) *You may use the following values of physical constants where ever necessary -*

$C = 3 \times 10^8$ m/s, $m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C, $\mu_0 = 4\pi \times 10^{-7}$, TmA^{-1},

$h = 6.63 \times 10^{-34}$ Js, $\epsilon_0 = 8.854 \times 10^{-12} C^2 N^{-1} m^{-2}$

SECTION A:

1. When an electric dipole (P) is placed in uniform electric field (E) then at what angle between $\vec{P}$ and $\vec{E}$ the value of torque will be maximum ? 1



(a) 90° (b) 0°

(c) 180° (d) 45°

2. $V_P - V_R = \frac{U_P - U_R}{q}$, this expressions is the formula for : 1

(a) work done by external force in bringing a unit positive charge from point P to R.

(b) work done by the internal force in bringing a unit positive charge from point R to P.

(c) work done by external force in bringing a unit negative charge from R to P.

(d) work done by external force in bringing a unit positive charge from point R to P.

3. The capacitance of a capacitor becomes $\frac{7}{6}$ times its original value if a dielectric slab of thickness $t = \frac{2d}{3}$ is introduced in between the plates, where d is the plate seperation. The di-electric constant of the slab is : 1

(a) $\frac{14}{11}$ (b) $\frac{11}{14}$

(c) $\frac{7}{11}$ (d) $\frac{11}{7}$

4. If E and B denote electric and magnetic field respectively. Which of the following is dimensionless ? 1

(a) $\sqrt{\mu_0 \epsilon_0} \cdot \frac{E}{B}$ (b) $\mu_0 \epsilon_0 \cdot \frac{E}{B}$

(c) $\mu_0 \epsilon_0 \left(\frac{B}{E}\right)^2$ (d) $\frac{\mu_0}{\epsilon_0} \frac{E}{B}$

5. A square loop of side 10 cm and resistance 0.5 Ω is placed vertically in the east-west plane. A uniform magnetic field of 0.10 T is set up across the plane in the north-east direction. The magnetic field is decreased to zero in 0.70 s at a steady rate. The current during this time interval will be : 1

(a) 3 m A (b) 4 m A

(c) 5 m A (d) 2 m A

6. Force on a current carrying conductor in a magnetic field is : 1

(a) BIL tan θ

(b) BI/L sin θ

(c) BIL sin θ

(d) BIL cos θ

7. If the transformer is assumed to be 100% efficient then : 1

(a) the power input is less than to the power output.

(b) the power input is greater than to the power output.

(c) the power input is equal to the power output

(d) none of these

8. In a half wave rectifier circuit operating from 50 Hz mains frequency, the fundamental frequency in the ripple would be : 1

(a) 25 Hz (b) 50 Hz

(c) 70.7 Hz (d) 100 Hz

9. What is radius of Fe^{125} nucleus if that of Al^{27} is 3.6 fermi ? 1

(a) 4.8 Fermi

(b) 6.0 Fermi

(c) 6.8 Fermi

(d) 2.5 Fermi

10. The work function for a metal surface is 4.14 eV. The approximate threshold wavelength for this metal surface is : 1

(a) 4125 Å

(b) 2062.5 Å

(c) 3000 Å

(d) 6000 Å

11. Two particles A_1 and A_2 of masses m_1 and m_2 ($m_1 > m_2$) have the same de-Broglie wavelength. Then - 1

(a) their momenta are the same

(b) their energies are the same.

(c) energy of A_1 is greater than the energy of A_2.

(d) momentum of A_2 is more than momentum of A_1.

12. Two slits are made one millimetre apart and the screen is placed one metre away. A light of wavelength 500 nm is used. What should be width of each slit to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern : 1

(a) 0.26 mm

(b) 0.20 mm

(c) 0.22 mm

(d) 0.24 mm

For Q. 13 to Q. 16, two statement are given one labelled Assertion (A) and other labelled. Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) is given below :

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and 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.

13. **Assertion (A):** The total energy of revolving electron in any stationary orbit is negative. 1

Reason (R) : Energy is a scalar quantity. It can have positive and negative values.

14 **Assertion (A):** In interference, only redistribution of light energy occurs. 1

Reason (R) : Average energy in the interference pattern is the same as that, if there is no interference.

15 **Assertion (A):** There is an experimental proof of light quantum to be associated with particle nature. 1

Reason (R) : The definite value of energy and momentum is strong proof.

16 **Assertion (A):** Diamagnetic materials can exhibit magnetism. 1

Reason (R) : Diamagnetic materials have permanent magnetic dipole moment.

SECTION-B

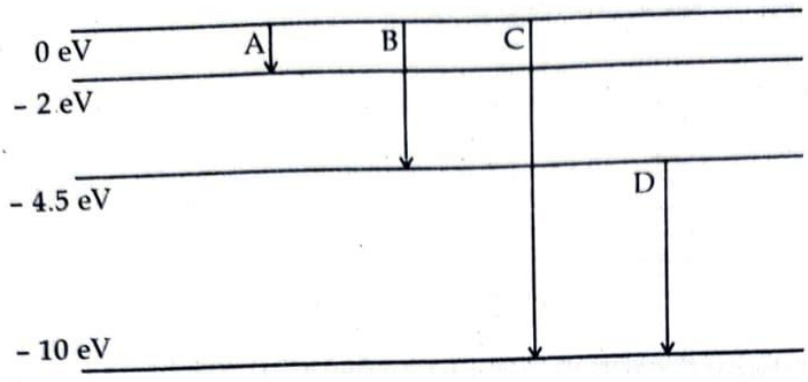
17. Identify the part of electromagnetic spectrum used in (i) radar and (ii) eye surgery. Write their frequency range. [2]

18. A light bulb and a solenoid are connected in series across an AC source of voltage. Explain how the glow of the light bulb will be affected when an iron rod is inserted in the solenoid. 2

19. The emission transitions of an atom are as shown below :

(a) Which of them will result in the transition of a photon of wavelength 275 nm ?

(b) Which transition corresponds to the emission of radiation of maximum wavelength ?



OR

Find the energy equivalent of one atomic mass unit in (a) joules (b) MeV.

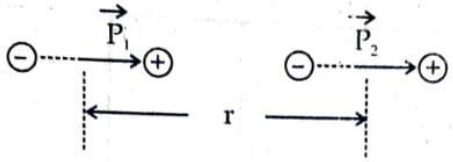
20. Show that in a.c. circuit containing a pure inductor, the voltage leads the current by a phase of $\pi/2$. 2

21. Using the data given below, state which two of the lenses will be preferred to construct a (i) telescope (ii) microscope. Also indicate which is to be used as objective and as eyepiece in each case. 2

Lenses	Power (P)	Aperture (A)
L_1	6 D	1 cm
L_2	3 D	8 cm
L_3	10 D	1 cm

SECTION-C

22. Find the electrostatic force acting between two small electric dipoles of dipole moments $\vec{P_1}$ and $\vec{P_2}$ respectively, kept at a distance of 'r' as shown below. Assume 'r' is very large. 3



23. Plot a graph showing the variation of current density (j) versus the electric field (E) for two conductors A and B of different materials. What information from this plot regarding the properties of the conducting materials, can be obtained which can be used to select suitable materials for use in making (i) standard resistance and (ii) connecting wires in electrical circuits. 3

24. A conductor of length 'ℓ' is rotated about one of its ends at a constant angular speed 'ω' in a plane perpendicular to a uniform magnetic field B. Plot graph to show variation of the Emf induced across the ends of the conductor with 3

(i) angular speed ω

(ii) length of the conductor ℓ.

OR

Two concemic circular loops of radius 2 cm and 20 cm are placed coaxially.

(i) Find mutual inductance of the arrangement.

(ii) If the current passed through the outer loop is changed at a rate of 5A/ms, find the emf induced in the inner loop.

25. (a) Two particle A and B of do Broglie wavelengths λ_A and λ_B combine to form a particle C. The process conserves momentum. Find the de-Broglie wavelength of the particle C (the motion is one dimensional). 3

(b) A proton, a deutron and an particle have the same kinetic energy. Which one has the shortest wavelength. Show the required calculation.

26. The work function of a metal is 2.14 eV. When light of frequency 6×10^{14} Hz is incident on the metal surface, photo emission of electrons occurs. What is the : 3

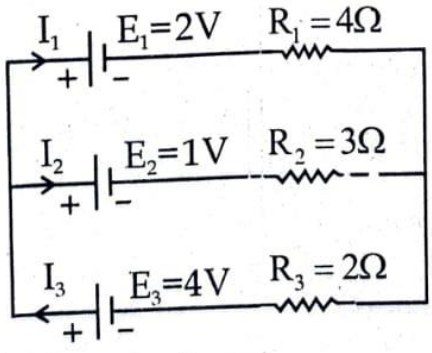
a) Maximum kinetic energy of the emitted electrons.

b) Stopping potential.

c) Maximum speed of the emitted electrons.

27. A galvanometer of resistance 50 Ω , gives full scale deflection for a current of 0.05 A. Calculate the length of shunt wire required to convert the galvanometer into an ammeter of range 0.5 A. The diameter of shunt wire is 2 mm and its resistivity is 50×10^{-7} Ω– meter. 3

28. State Kirchhoff's rules. Use these rules to find the currents I_1, I_2 and I_3 in the circuit diagram shown . 3



SECTION- D

Case Study Based Questions.

29. **Read the paragraph and answer the following questions.** 4

When a plane wavefront of monochromatic light is incident on a narrow slit, each point of slit behaves as a new source and emits secondary wavelets which travel in different directions. Wavelets emitted by different parts of slit superpose. This gives a broad pattern with central bright region. On both sides there are alternate bright and dark regions. Thus, intensity distribution on screen is redistributed. This phenomena is called as diffraction of light due to narrow slit.

(i) What is the ratio of central maximum width to other maxima width ?

(a) 1 : 2 (b) 2 : 1

(c) 3 : 2 (d) 2 : 3

(ii) When slit width is increased, how would it affect width of central maxima ?

(a) Increases (b) Remain same

(c) Decreases (d) May increase or decrease

(iii) On what principle is diffraction of light due to narrow slit is based ?

(a) Law of reflection

(b) Principle of YDSE

(c) Law of refraction

(d) Huygen's principle

OR

If secondary waves are travelling in a direction making an angle of 'θ', then what is the condition for nth secondary diffraction maxima ?

(a) Path difference = $(n\lambda)$

(b) Path difference = $2n\,\lambda$

(c) Path difference = $(2n+1)\frac{\lambda}{2}$

(d) Path difference = $(n+1)\frac{\lambda}{2}$

(iv) Colours of thin film result from :

(a) dispersion of light

(b) interference of light

(c) absorption of light

(d) scattering of light

30. **Read the paragraph and answer the following questions.** 4

In forward bias arrangement, the p-side of a p-n function is connected to the positive terminal of battery and n-side to negative terminal of battery. The current first increases very slowly till a certain threshold voltage is reached. Beyond this value, the current increases exponentially even for a very small increment in diode bias voltage. In reverse bias, the current the current suddenly increases at very high reverse bias. This is called breakdown voltage.

(i) What is approximate value of energy band gap for silicon dicode ?

(a) 1.1 eV

(b) 1.3 eV

(c) 0.7 eV

(c) 0.3 eV

(ii) If the energy band gap is greater than 3 eV then such materials are called as :

(a) conductors

(b) semiconductors

(c) insulators

(d) super conductors

(iii) When a p-n function is forward based, then.

(a) The depletion region is reduced and barrier height increases

(b) The depletion region is widened and barrier height decreases

(c) both the depletion region and barrier height reduce

(d) both the depletion region and barrier height increase

OR

The cause of potential barrier in p-n junction diode is :

(a) depletion of positive charge near the junction.

(b) concentration of positive charge near the junction.

(c) depletion of negative charge near the junction.

(d) concentration of positive and negative ions near the junction.

(iv) When p-n junction is reversed biased, then :

(a) no current flows.

(b) concentration of positive charge near the junction is increased.

(c) height of potential barrier is reduced.

(d) none of these

SECTION-E

31. (a) State Gauss's law in electrostatics. Use this law to derive an expression for the electric field due to an infinitely long straight wire of linear charge density λ cm^{-1}. 5

(b) A wire AB of length 'L' has linear charge density $\lambda=Kx$, where x is measured from the end A of the wire. This wire is enclosed by a Gaussian hollow surface. Find the value of electricf flux linked with this surface.

OR

(a) Show that area under charge q and potential difference V gives energy stored by a capacitor.

(b) (i) Net capacitance of three identical capacitors in series is 24 μF. What will be their net capacitance if connected in parallel ?

(ii) Find the ratio of the energy stored in the two configurations ie series and parallel combination of the capacitors in part (i) when connected to same d.c. source of 20 volt. 5

32. (a) Write Bohr's postulates of hydrogen atom.

(b) Explain the origin of spectral lines using Bohr's atomic model.

(c) Write de-Broglie's explanation of Bohr's postulate of quantization of angular momentum.

OR

(a) Explain nuclear binding energy.

(b) Draw a plot showing the variation of binding energy per nucleon versus the mass number.

(c) Calculate mass defect, binding energy and binding energy per nucleon for lithium $_3Li^7$ nucleus. Given :

mas of $_3Li^7$ nucleus = 7.000000 a.m.u.

mass of proton = 1.007825 a.m.u.

mass of neutron = 1.008665 a.m.u

33. A convex lens of focal length 20.0 cm made up of glass of refractive index 1.5 is dipped, in turn (i) a medium of refractive index 1.65 (ii) a medium of refractive index 1.33.

(a) Will it behave as a converging or a diverging lens in the two cases.

(b) What will be focal length of the lens in the two media ? 5

OR

(a) Determine the 'effective focal length' of the combination of two lenses of focal length 30 cm and -20 cm, if they are placed 8.0 cm apart with their principal axis coincident. Does the answer depend on which side a beam parallel light is incident ? Is the notion of effective focal length of this system useful at all ?

(b) An object 1.5 cm in size is placed on the side of the convex lens in the arrangement (a) above. The distance between the object and the convex lens is 40 cm. Determine the magnification produced by the two -lens system, and the size of the image.

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Solution from next page

1. (a) 2. (d) 3. (a) 4. (a) 5. (d) 6. (c) — 1 mark each

7. (c) 8. (b) 9. (b) 10. (c) 11. (a) 12. (b)

13 (b) 14 (b) 15 (a) 16 (d) 17

Section B

17. RADAR → Microwave 10^9 to 10^{12} Hz — 1
Eye Surgery → Ultraviolet 10^{16} to 10^{17} Hz — + 1

18 $X_L = \sqrt{R^2 + 4\pi^2 \nu^2 L^2}$, due to insertion of Fe rod L ↑es so X_L ↑ — 1
hence i ↓es so bulb become dim. — + 1

19 (a) $\Delta E = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{275 \times 10^{-9} \times 1.6 \times 10^{-19}} = 4.5 \text{ eV} = 7.23 \times 10^{-19} \text{ J}$ — 1

which is corresponds to transition B

(b) ΔE is minimum for transition A, hence wavelength will be maximum for this transition. — 1

OR

$1 \text{ amu} = \frac{1}{12}$ Mass of ${}_6C^{12}$ atom $= \frac{1}{12} \frac{12}{N_A} = 1.660565 \times 10^{-27} \text{ kg}$ — 1

$$E = \frac{1.660565 \times 10^{-27} \times (3 \times 10^8)^2}{1.6 \times 10^{-13}} \text{ MeV} = 931 \text{ MeV}$$ — 1

20. Let Eq. of voltage $V = V_0 \sin\omega t$
since only L is in the circuit hence

$V_L = V$ — 1

$L \frac{dI}{dt} = V_0 \sin\omega t$

$dI = \frac{V_0}{L} \sin\omega t \, dt$ — +

Integrating both sides

$I = \frac{V_0}{L} \left(\frac{-\cos\omega t}{\omega}\right)$

$I = \frac{V_0}{\omega L} \sin\left(\omega t - \frac{\pi}{2}\right)$ — 1 { since $\omega L = X_L$ & $\frac{V_0}{X_L} = I_0$

$I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$

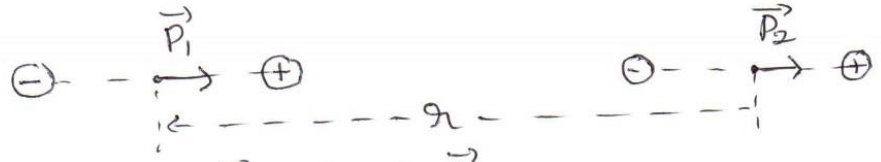
hence current lags behind the voltage by $\pi/2$

21- (I) Telescope → L_1 as objective and L_3 as eye piece 1

(II) Microscope → L_3 as objective and L_2 as eye piece 1

Section - C

22-



Electric field at $\vec{P_2}$ due to $\vec{P_1}$

$$E = \frac{1}{4\pi\epsilon_0}\frac{2p_1}{r^3}$$ 1

hence $$\frac{dE}{dr} = \frac{2p_1}{4\pi\epsilon_0}\frac{d}{dr}r^{-3} = \frac{2p_1}{4\pi\epsilon_0}(-3r^{-4})$$

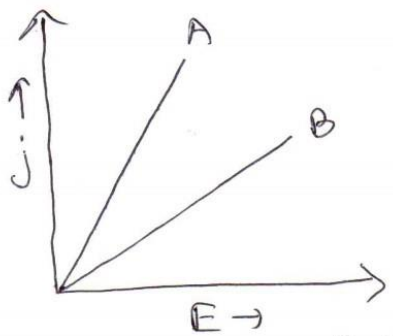
Force between the dipoles

$$F = p_2\frac{dE}{dr} = p_2 \times \frac{2p_1}{4\pi\epsilon_0}(-3r^{-4})$$ 1

Taking numerical value

$$F = \frac{1}{4\pi\epsilon_0}\frac{6p_1p_2}{r^4}$$ 1

23- As $j = \sigma E$ i.e. $j \propto E$ so graph b/w j and E will be straight line 1



Slope of graph = conductivity (σ)

The material B with less slope (smaller conductivity or higher resistivity) is used for making standard resistances while the material A with greater slope (higher conductivity) for making connecting wires. 2

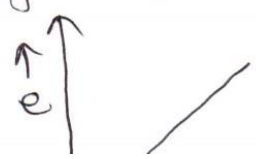
24- Induced emf

$$e = \int de$$

$$= \int_0^l B v\, dl$$

$$= \int_0^l B\omega l\, dl$$

(I) $e \propto \omega$, so graph of e versus ω will be straight line 1



1

(ii) $e \propto l^2$ so graph of e versus l will be parabola

1

OR

(i) Mutual inductance b/w two coils:

$$M = \frac{\mu_0 \pi r_1^2}{2 r_2} = \frac{4\pi \times 10^{-7} \times \pi (2\times10^{-2})^2}{2 \times 20 \times 10^{-2}} = 4\pi^2 \times 10^{-10}\ H$$

$$= 39.48 \times 10^{-10}\ H = 3.948 \times 10^{-9}\ H$$

1½ + 1½

(ii) Emf $e = -M\frac{dI}{dt} = -3.948\times10^{-9} \times \frac{5}{10^{-3}}\ V = 19.74\times10^{-6}\ V$

$= 1.974 \times 10^{-5}\ V$

25- (a) $\lambda_A = \frac{h}{p_A} \Rightarrow p_A = \frac{h}{\lambda_A}$, and $\lambda_B = \frac{h}{p_B} \Rightarrow p_B = \frac{h}{\lambda_B}$

Since momentum remains conserve hence

$$p_C = p_A + p_B$$

1½

so wavelength $\lambda_C = \frac{h}{p_C} = \frac{h}{p_A + p_B} = \frac{h}{\frac{h}{\lambda_A} + \frac{h}{\lambda_B}} = \frac{\lambda_A \lambda_B}{\lambda_A + \lambda_B}$

(b) $\lambda = \frac{h}{\sqrt{2mE_K}}$

1½

$\lambda_p : \lambda_d : \lambda_\alpha = \frac{h}{\sqrt{2mE_K}} : \frac{h}{\sqrt{2\times2mE_K}} : \frac{h}{\sqrt{2\times4mE_K}} = 1 : \frac{1}{\sqrt{2}} : \frac{1}{2}$

so α-particle has shortest wavelength.

26- (a) $E_K = \frac{h\nu_a}{1.6\times10^{-19}} - W = \frac{6.63\times10^{-34}\times6\times10^{14}}{1.6\times10^{-19}} - 2.14 = 0.35\ eV$ 1

(b) $V_0 = \frac{E_K}{e} = \frac{0.35\ eV}{e} = 0.35\ Volt$ 1

(c) $v_{max} = \sqrt{\frac{2E_K}{m}} = \sqrt{\frac{2\times0.35\times1.6\times10^{-19}}{9.1\times10^{-31}}} = 3.5\times10^5\ ms^{-1}$ 1

27- $S = \frac{I_g}{I - I_g} G = \frac{0.05}{0.5 - 0.05} \times 50 = \frac{0.05}{0.45} \times 50 = \frac{50}{9}\ \Omega$ — 1½

$l = \frac{S \times \pi r^2}{\rho} = \frac{50}{9} \times \frac{3.14 \times (10^{-3})^3}{50 \times 10^{-7}} = 3.49\ m$ — 1½

28 By Kirchhoff's rule

$I_3 = I_1 + I_2$ —— (I)

For upper loop $3I_2 - 4I_1 = 2 - 1 \Rightarrow 3I_2 - 4I_1 = 1$ —— (II) — 2

For lower loop $3I_2 + 2I_3 = 4 - 1 \Rightarrow 3I_2 + 2I_3 = 3$ —— (III) — +

By solving equations (I), (II) and (III) — 1

$I_1 = \frac{2}{13} A$, $I_2 = \frac{7}{13} A$ and $I_3 = \frac{9}{13} A$

Section D

29- (I) (b) (II) (c) (III) (d) or (c) (IV) (b) — 1 mark each

30- (I) (c) (II) (c) (III) (c) or (d) (IV) (d)

Section E

31 (a) Definition of Gauss theorem — 1

Proving of $E = \frac{\lambda}{2\pi\epsilon_0 r}$ with diagram — 2

(b) Charge on the element of length dx

$dq = \lambda \cdot dx = kx\,dx$

Charge on the wire

$q = \int_0^L dq = k\int_0^L x\,dx = k\left[\frac{x^2}{2}\right]_0^L = \frac{kL^2}{2}$ — 2

hence net electric flux

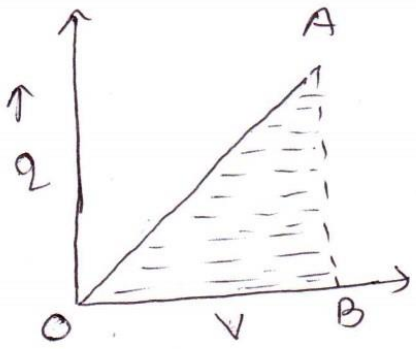
$\phi = \frac{q}{\epsilon_0} = \frac{kL^2}{2\epsilon_0}$

OR

(a) From $q = CV$

$q \propto V$

so graph b/w q & V will be straight line



Area under charge q & potential difference V

$= \frac{1}{2} OB \times AB$

$= \frac{1}{2} V \cdot q$

$= \frac{1}{2} V CV$

$= \frac{1}{2} CV^2$

which is the formula of energy. 1 + 2

(b) (I) $\frac{1}{C} + \frac{1}{C} + \frac{1}{C} = \frac{1}{24} \Rightarrow C = 24 \times 3\ \mu F = 72\ \mu F$ 1

when connected in parallel then

$C' = c + c + c = 72\mu F + 72\mu F + 72\mu F = 216\mu F$ 1

(II) $\frac{U_S}{U_P} = \frac{\frac{1}{2} \times 24 \times 10^{-6} (20)^2}{\frac{1}{2} \times 216 \times 10^{-6} (20)^2} = \frac{1}{9}$ 1

32- (a) Bohr's postulates

(b) Origin of spectral lines

(c) Bohr's quantum condition from de Broglie hypothesis 2 + 2 + 1

OR

(a) Definition and formula of nuclear binding energy 1 + 2

(b) Graph of B.E/nucleon versus mass number 2

(c) mass defect $\Delta m = (3 \times 1.007825 + 4 \times 1.008665 - 7.000000)$ amu

$= 0.058135$ amu

Nuclear Binding energy $= 0.058135 \times 931$ MeV $= 54.12$ MeV

$\frac{54.12}{7}$ MeV $= 7.73$ MeV

33. (a) $a^n_g = 1.5$ and

(I) $a^n_\ell = 1.65$ 1

since $a^n_\ell > a^n_g$, hence lens behave as diverging lens

(II) $a^n_\ell = 1.33$ 1

since $a^n_\ell < a^n_g$, hence lens behave as converging lens

(b) $f_\ell = \dfrac{(a^n_g - 1)a^n_\ell}{a^n_g - a^n_\ell} f$

(I) $f_\ell = \dfrac{(1.5-1)\times 1.65}{(1.5-1.65)} \times 20 = -110\,cm$ $1\frac{1}{2}$

(II) $f_\ell = \dfrac{(1.5-1)\times 1.33}{1.5-1.33} \times 20 = 78.24\,cm$ $1\frac{1}{2}$

OR

(a) When II^{al} beam incident from convex side then $f_1 = 30\,cm$ & $u_1 = \infty$

(I) hence from $\frac{1}{f_1} = \frac{1}{v_1} - \frac{1}{u_1} \Rightarrow v_1 = 30\,cm$

This image acts as virtual object for 2^{nd} lens hence

$f_2 = -20\,cm$, $u_2 = 30 - 8 = 22\,cm$

From $\frac{1}{f_2} = \frac{1}{v_2} - \frac{1}{u_2} \Rightarrow v_2 = -220\,cm$ $1\frac{1}{2}$

The parallel incident beam appears to diverge from a point $220 - 4 = 216\,cm$ from the centre of the two lens system.

(II) When II^{al} beam incident from concave side then $f_1 = -20\,cm$ and $u_1 = \infty$ hence from $\frac{1}{f_1} = \frac{1}{v_1} - \frac{1}{u_1} \Rightarrow v_1 = -20\,cm$

This image acts as real object for 2^{nd} lens hence

$f_2 = +30\,cm$, $u_2 = -(20+8) = -28\,cm$ $1\frac{1}{2}$

From $\frac{1}{f_2} = \frac{1}{v_2} - \frac{1}{u_2} \Rightarrow v_2 = -420$

Thus the II^{al} incident beam appear to diverge from a point $420 - 4 = 416\,cm$ on the left of the centre of the two lens system so answer will depend on which side of the lens system II^{al} beam is incident. The notion of effective focal length therefore does not seem to be

(b) $u_1 = -40\,cm$, $f_1 = 30\,cm$

From $\frac{1}{f_1} = \frac{1}{v_1} - \frac{1}{u_1} \Rightarrow \frac{1}{30} = \frac{1}{v_1} - \frac{1}{-40} \Rightarrow v_1 = 120\,cm$

Magnification due to Convex lens

$$m_1 = \frac{v_1}{|u_1|} = \frac{120}{40} = 3$$ 1

This image become virtual object for 2nd lens so that $u_2 = 120 - 8 = 112\,cm$, $f_2 = -20\,cm$

From $\frac{1}{f_2} = \frac{1}{v_2} - \frac{1}{u_2} \Rightarrow \frac{1}{-20} = \frac{1}{v_2} - \frac{1}{112} \Rightarrow v_2 = -24.9\,cm$

Magnification due to concave lens.

$$m_2 = \frac{|v_2|}{u_2} = \frac{24.9}{112} = \frac{20}{92}$$ 1

magnitude of magnification

$$m = m_1 \times m_2 = 3 \times \frac{20}{92} = 0.652$$

Size of image $h_2 = m h_1$

$= 0.652 \times 1.5\,cm$

$= 0.98\,cm$