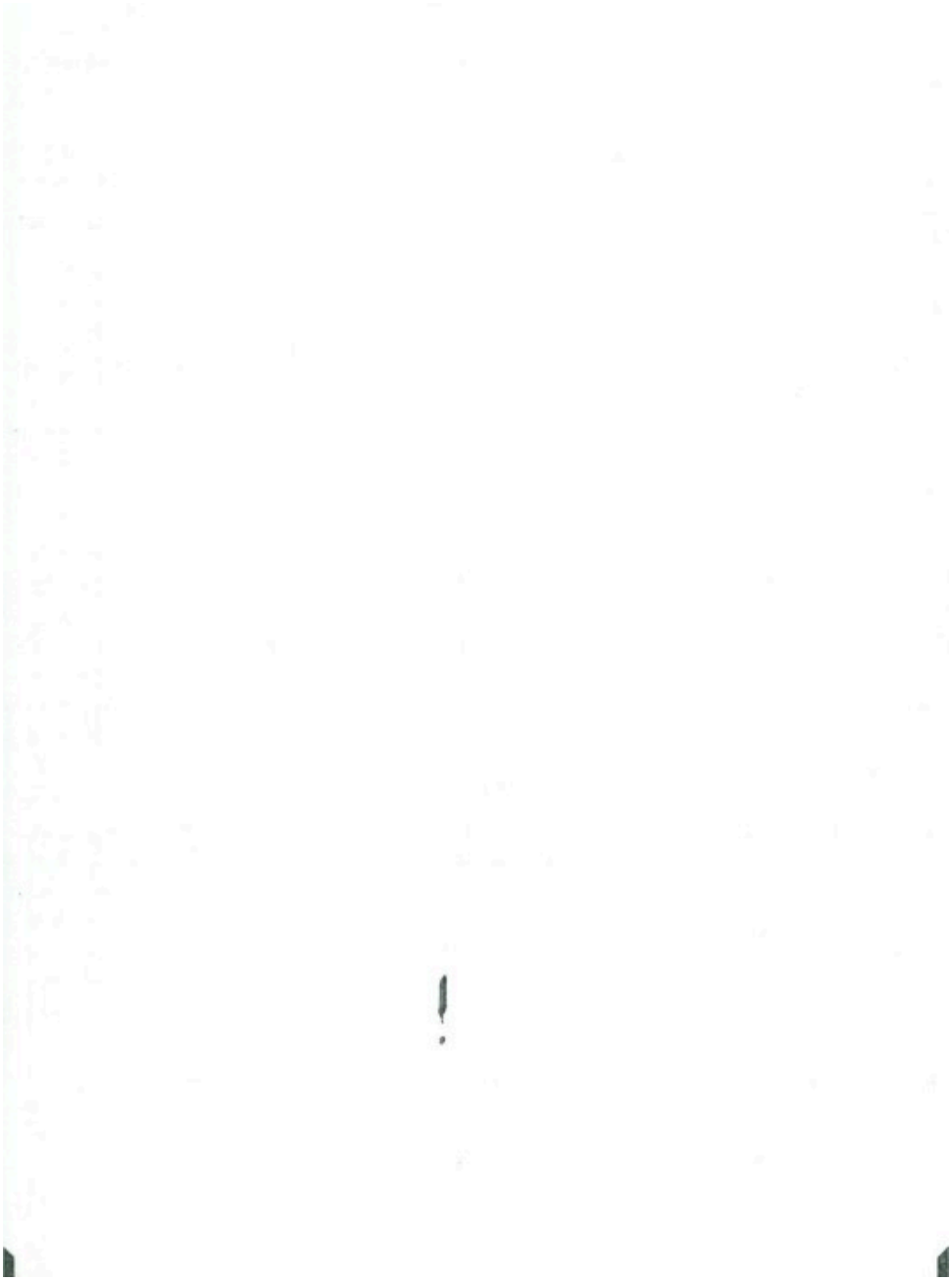
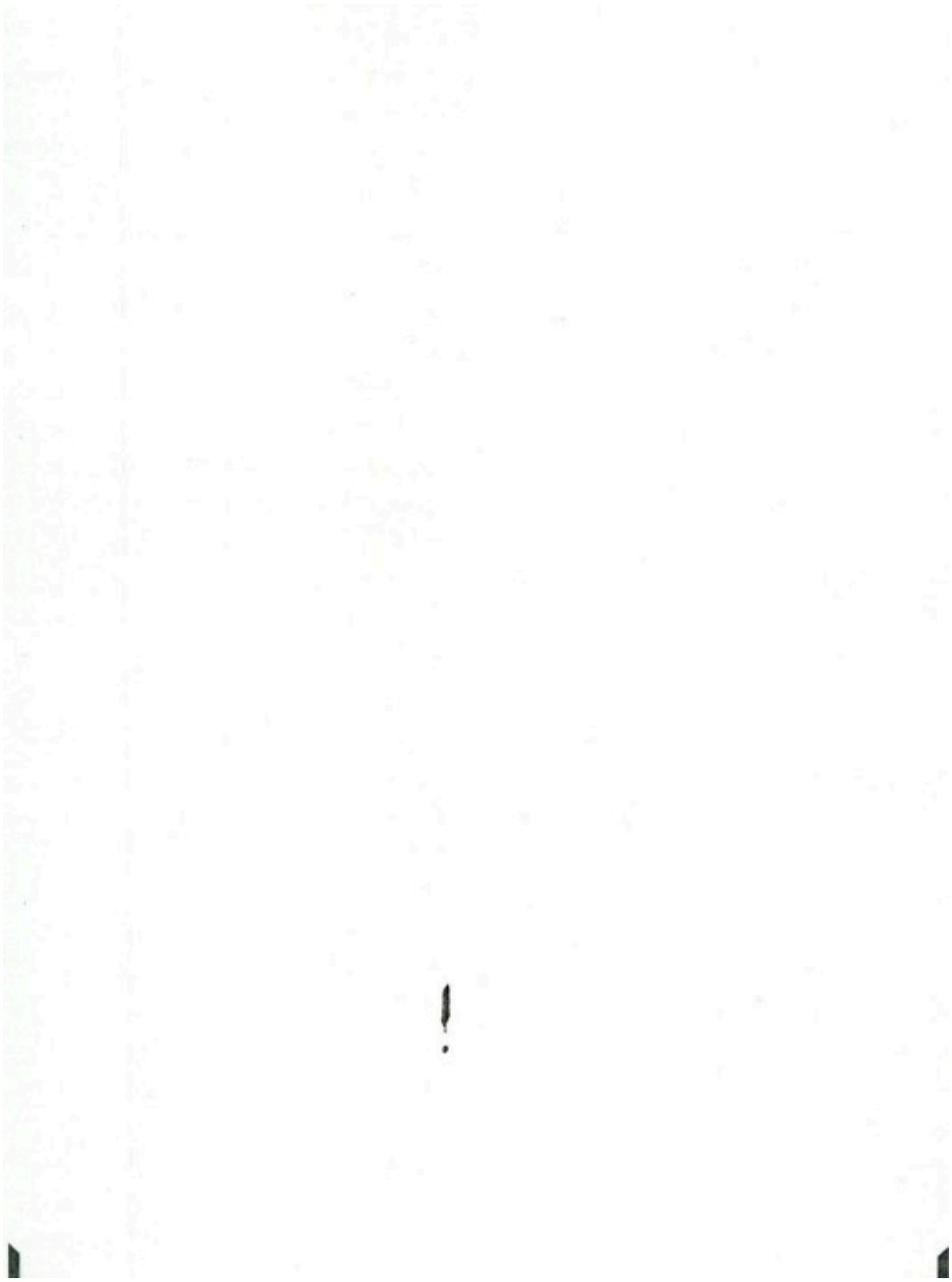
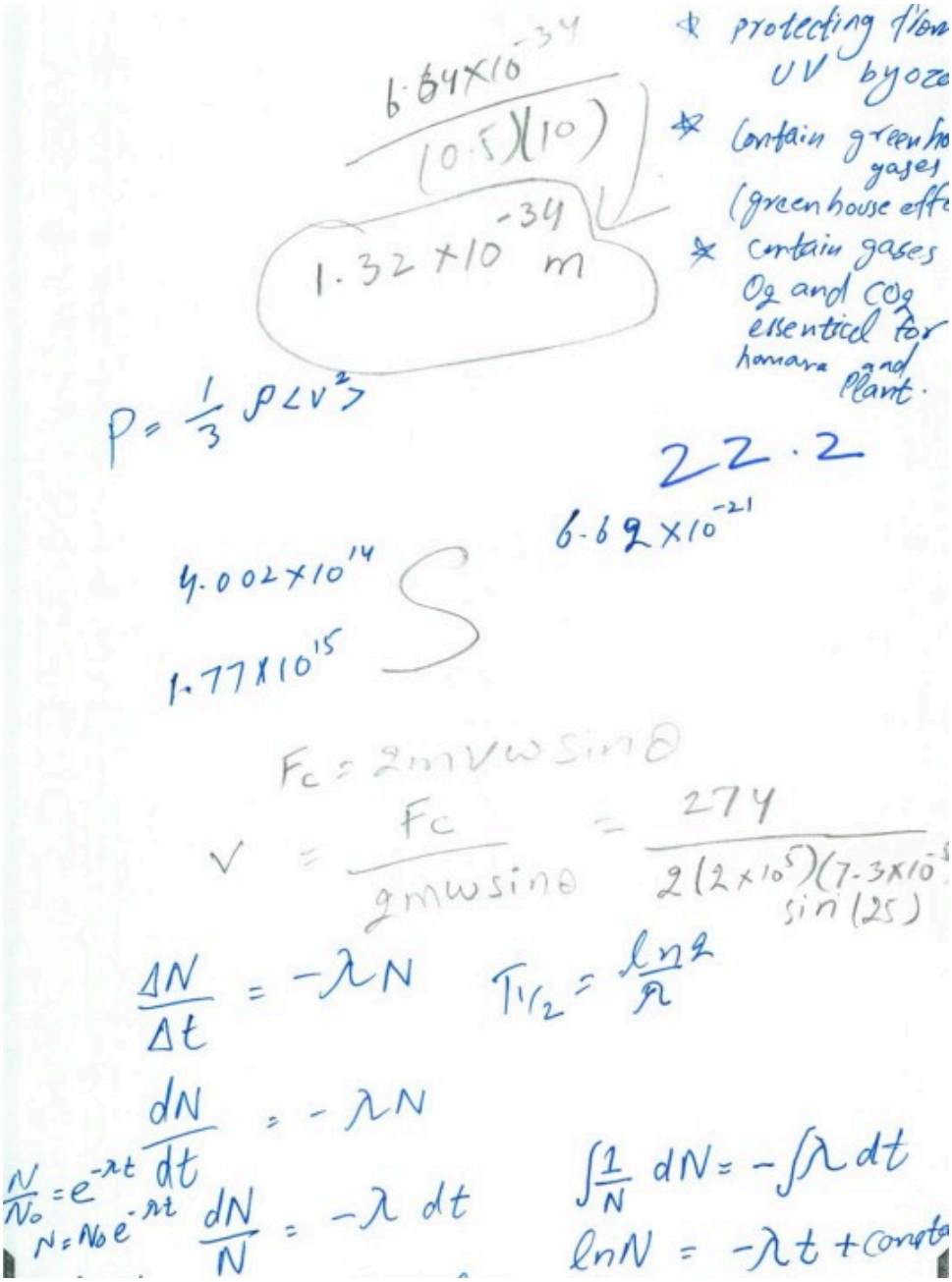





$\frac{6.64\times10^{-34}}{(10.5)(10)}$
1.32×10^{-34} m
* protecting from UV byoze
* Contain greenho gases (greenhouse effe
* Contain gases O2 and CO2 essential for humans and plant.
$P = \frac{1}{3}\rho\langle v^2\rangle$
22.2
6.62×10^{-21}
4.002×10^{14}
1.77×10^{15}
$F_c = 2mvw\sin\theta$
$v = \frac{F_c}{2mw\sin\theta} = \frac{274}{2(2\times10^{5})(7.3\times10^{-5})\sin(25)}$
$\frac{\Delta N}{\Delta t} = -\lambda N$
$T_{1/2} = \frac{\ln 2}{\lambda}$
$\frac{dN}{dt} = -\lambda N$
$\frac{N}{N_0} = e^{-\lambda t}$
$N = N_0 e^{-\lambda t}$
$\frac{dN}{N} = -\lambda\, dt$
$\int \frac{1}{N} dN = -\int \lambda\, dt$
$\ln N = -\lambda t + \text{Const}$

(Section B)

Q. No. 2 Part (i) Effect on orbital velocity?

Ans: When a satellite is put into a lower orbit (closer to Earth), then its orbital velocity will increase. As near the surface of Earth, the valve of "g" will be more. As distance between Earth and satellite decreases, then orbital velocity will increase, as orbital velocity is inversly related with distance "r".

Mathematically: $V_o = \sqrt{\frac{GM_E}{r}}$

(orbital velocity) $V_o \propto \frac{1}{\sqrt{r}}$ $\therefore r = R_E + h$

So when distance decreases (mean when satellite is put into lower orbit), its orbital velocity increases.

.....

Q. No. 2 Part (ii) "Relation of pressure and density"

Pressure is directly related with density of gas. As pressure increases, the molecules of gas will come close together, so number of molecules per unit volume increases, hence density will increases and vice versa.

$P = \frac{mN}{3V} \langle v^2 \rangle$

$\therefore \frac{mN}{V} = \rho$ (density)

So $P = \frac{1}{3} \rho \langle v^2 \rangle$

$\{P \propto \rho\}$ Direct relation — As pressure increases, density also increases.

(Section B)

Q. No. 2 Part (iii) Role of resonance in Radio

Resonance plays an important role in tuning of radio station. When we turn the knob of radio to tune a station, we are actually changing the natural frequency of radio station to make it it equal to transmission frequency of another station. When both frequencies match, resonance occurs, thus energy absorbtion occurs, and this is the only channel we hear.

In this way resonance plays a crucial role in tuning of radio station.

.....

Q. No. 2 Part (iv) Given

$h = 35700\ Km$

To find

(Gravitational field strength) $g = ?$

Solution

$$g = \frac{G M_E}{(R_E + h)^2} = \frac{(6.67 \times 10^{-11})(6 \times 10^{24})}{((6.4 \times 10^6) + (35700 \times 10^3))^2}$$

$$\boxed{g = 0.22\ ms^{-2}}$$ Ans...

The gravitational field strenght at 35700 Km will be "0.22 ms^{-2}".

(Section B)

Q. No. 2 Part (v) Given

$C = 0.5\ \mu F$

$V = 16 \sin(2\times10^3 t)\ V$

To find

(capacitive reactance) $X_C = ?$

Solution

X_C = 1 $V = V_0 \sin \omega t$

$V = 16 \sin 2\times10^3 t$

$\omega = 2\times10^3\ rads^{-1}$

$$X_C = \frac{1}{\omega C} = \frac{1}{(2\times10^3)(0.5\times10^{-6})}$$

$\boxed{X_C = 1000\ \Omega}$ Ans...

★ Capacitive reactance is "1000 Ω".

.....

Q. No. 2 Part (vi) Role of atmosphere:

1) Protection from UV-rays: Atmosphere contain a layer of ozone, which help in protection of living organisms on Earth by reflecting UV-rays back into space.

2) Greenhouse effect: Atmosphere contain gases like CO_2 and CH_4, which help in warming of Earth by greenhouse effect. Without it, the average temperature of Earth would be 20 C°.

3) Overall climate balance: Atmosphere possess gases like O_2 and CO_2, helpful for human respiration and plant photosynthesis. So atmosphere maintains overall climate balance and make the Earth habitable.

(Section B)

Q. No. 2 Part (vii) Pair annihilation: It is a process by which a particle and its antiparticle annihilate and convert into gamma rays photons. Example: Electron and positron annihilation give two gamma ray photons.

↳ **Conservation of Energy:** Energy is conserved in this process. The energy of particle (like electron and positron) is converted into two gamma ray photons. $2m_e c^2 + 2K.E = 2\gamma$ (Gamma ray photons)

↳ **Conservation of momentum:** Momentum is also conserved in this process. The two photons formed, move in opposite direction to conserve momentum. So in pair annihilation, energy and momentum are conserved.

Q. No. 2 Part (viii) Applications of ultrasounds

1) **Breaking kidney stones:** In medical technology, ultrasounds are used to break kidney and gallbladder stones. Ultrasounds are bombarded on body from outside.

2) **Body Imaging:** Ultrasounds are also used in Imaging of body parts to detect diseases in body.

3) **Measure blood flow rate and blood clotting:** By using technique SONAR, ultrasounds are used to measure blood flow rate and detect blood clotting in blood vessels.

(Section B)

Q. No. 2 Part (ix) Given

$R = 20\ \Omega$, $f = 50\ Hz$

$V_{rms} = 220\ V$

To find

$V_o = ?$, $I_o = ?$

Solution

$V_o = V_{rms} \times \sqrt{2} = 220\ V \times \sqrt{2} = 311.12\ V$

$\boxed{V_o = 311.12\ V}$ peak voltage.

$\therefore V_o = I_o R$

$I_o = \frac{V_o}{R} = \frac{311.12}{20} = 15.55\ A$

$\boxed{I_o = 15.55\ A}$ Peak current

.....

Q. No. 2 Part (x) Wien's displacement law

Wien's displacement law states that the peak wavelenght (λ_{max}) is inversly proportiond to absolute temperature. We can use this law to easily calculate temperature of star. If λ_{max} is known then temperature can easily be calculated.

$\lambda_{max} \propto \frac{1}{T}$

$\boxed{\lambda_{max} = \frac{\text{constant}}{T}}$ — (1) $\Rightarrow$ $\boxed{T = \frac{\text{constant}}{\lambda_{max}}}$

(Wien's displacement constant) $= 2.9 \times 10^{-3}\ mk$ (meter kelvin).

So by using the above formula temperature of body can easily calculated by knowing its "λ_{max}".

(Section B)

Q. No. 2 Part (xi) **Control rods:** Control rods in nuclear reactors are used to control the extent of reaction. It contain cadmium and Boron, which absorbs excess neutrons to prevent the uncontrolled reaction. They help maintaining ↓ constant supply of energy by controlling fission chain reaction.

Moderators: Moderator is used to slow down the speed of neutrons. To do fission reactions, neutrons with only (0.025 eV) energy are needed, while during fission chain reaction, neutrons with MeVs of energy are released. To slow down or reduce the energy of neutrons, moderator is used. Moderator contain water or graphite.

.....

Q. No. 2 Part (xii)

Given

$T = 47C^\circ = 47 + 273 = 320\ K$

To find

$K.E_{av} = ?$

Solution

$$T = \frac{2}{3k} \langle K.E \rangle$$

$$\langle K.E \rangle = \frac{3KT}{2} = \frac{3(1.38 \times 10^{-23})(320)}{2}$$

$$\boxed{\langle K.E \rangle = 6.62 \times 10^{-21}\ J}$$ Ans-

This is average translational Kinetic energy of gas molecule.

(Section B)

Q. No. 2 Part (xiii)

Peak value	rms value of AC voltage
1) The maximum value of alternating voltage is called peak value.	1) RMS value of AC voltage is that steady or effective value of DC, which when flowing through resistor produces same amount of heat, as that of AC, when flowing through same resistor in same time.
2) Peak value doesnot represent effective value.	2) It represents effective value.
3) Peak value has maximum value.	3) rms value has not maximum value.
4) $V_o = V_{rms} \times \sqrt{2}$ $\left\{ I_o = I_{rms} \times \sqrt{2} \right.$	4) $V_{rms} = \frac{V_o}{\sqrt{2}}$ $\left\{ I_{rms} = \frac{I_o}{\sqrt{2}} \right.$

Q. No. 2 Part (xiv) How can we increase fringe spacing:

1) We can increase fringe spacing by increasing wavelenght of light (λ).

2) Fringe spacing also increases, if distance between slits and screen (L) is increased.

3) By reducing distance between slits (d), we can increase fringe spacing.

Mathematically:

$$\Delta y = \frac{\lambda L}{d}$$

$$\Delta y \propto \lambda$$

$$\Delta y \propto L$$

$$\Delta y \propto \frac{1}{d}$$

(Section C)

Q. No. 3 (Page 1) Derivation for Kinetic energy.

The energy possessed by a body during motion is called kinetic energy.

$$K.E = \frac{1}{2}mv^2 \quad \text{---} (1)$$

$$\therefore v = \omega\sqrt{x_0^2 - x^2}$$

By putting value of "v" in eq (1).

we get $K.E = \frac{1}{2}m(\omega\sqrt{x_0^2 - x^2})^2$

$$K.E = \frac{1}{2}m\omega^2(x_0^2 - x^2)$$

As $\omega^2 = \frac{k}{m}$, so $\boxed{k = m\omega^2}$

So $\boxed{K.E = \frac{1}{2}k(x_0^2 - x^2)}$ Kinetic energy.

At mean position ($x = 0$), so $K.E = \frac{1}{2}kx_0^2$ is maximum.

At extreme position ($x = x_0$), So $\boxed{K.E = 0}$.

Potential Energy

The ~~total change~~ ~~in~~ ~~average~~ workdone is equal to potential energy.

$$W = P.E$$

$$W = F_{av} \cdot x$$

$$F_{av} = \frac{F_1 + F_2}{2}$$

$F_1 = 0$, $F_2 = kx$ so $F_{av} = \frac{0 + kx}{2} = \frac{1}{2}kx$

(Section C)

Q. No. 3 (Page 2) By putting its value we get:

$$W = P.E = F_{av} \cdot x = \left(\frac{1}{2}Kx\right)(x)$$

$$\boxed{P.E = \frac{1}{2}Kx^2}$$

At mean position ($x=0$), so $P.E = 0$.
At extreme position ($x = x_0$), so $P.E$ = maximum.

Total energy

T.E is the sum of K.E and P.E.

$$T.E = K.E + P.E$$

$$T.E = \frac{1}{2}K(x_0^2 - x^2) + \frac{1}{2}Kx^2$$

$$T.E = \frac{1}{2}Kx_0^2 - \frac{1}{2}Kx^2 + \frac{1}{2}Kx^2$$

$$\boxed{T.E = \frac{1}{2}Kx_0^2}$$

(1) At mean position, $P.E = 0$ and K.E is maximum.

So $T.E = P.E + K.E = 0 + \frac{1}{2}K(x_0^2 - 0)$

$$\boxed{T.E = \frac{1}{2}Kx_0^2}$$

(2) At extreme position, $P.E$ = maximum, $K.E = 0$

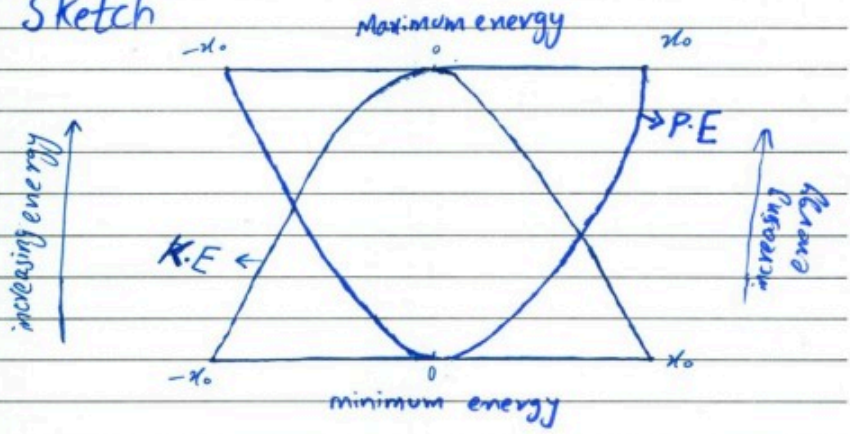
So $T.E = P.E + K.E = \frac{1}{2}Kx_0^2 + 0$

$$\boxed{T.E = \frac{1}{2}Kx_0^2}$$

(Section C)

Q. No. 3 (Page 3) So it is cleared that, the total energy in every condition, remains constant, while K.E and P.E are interconvertible.

"Sketch"



(Section C)

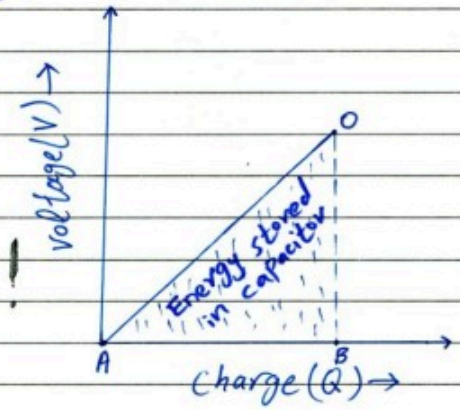
Q. No. 4 (Page 1)

Electric Potential energy Stored in capacitor:

The energy which is stored in capacitor is called electric potential energy.

The energy stored in the capacitor is in the form of electric field. Electric potential energy stored in a capacitor can be calculated using graph.

Graph:



The electric potential energy stored in a capacitor is equal to the

(Section C)

Q. No. 4 (Page 2) area under line (Graph) in ~~eqv~~ triangle.

PE = U = Area of triangle ΔAOB.

$U = \frac{1}{2}$ Base x height

$U = \frac{1}{2} Q \times V$

① $\boxed{U = \frac{1}{2} QV}$ → This is EP.E ~~stored~~ in capacitor

→ As $V = \frac{Q}{C}$, so $U = \frac{1}{2} Q\left(\frac{Q}{C}\right)$

$$\boxed{U = \frac{1}{2}\frac{Q^2}{C}}$$

→ As $Q = CV$, so by putting value in eq ①.

$U = \frac{1}{2}(CV)(V) = \frac{1}{2} CV^2$

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

(Section C)

Q. No. 4 (Page 3) Numerical

Given

$Q = 5C$

$V = 15V$

To find

(Energy) $U = ?$

Solution

$U = \frac{1}{2} QV$

$U = \frac{1}{2}(5C)(15V)$

$\boxed{U = 37.5\ J}$

37.5 J energy is stored in capacitor.

(Section C)

Q. No. 5 (Page 1)

Photoelectric effect

↳ Photoelectric effect is the process of emmiting electrons from metal surface, when metal is exposed to a light of suitable freqjuency.

→ Threshold freqjuency is the minimum freqjuency of light reqjuired to emit electrons.

Work function

The minimum amount of energy reqjuired to emit electrons from metal, is called work function of a metal.

↳ If energy of photons is less than work function, then photoelectric effect will not occur.

↳ If energy of photons is equal or more than work function, then photoelectric effect will occur.

Einstein Photoelectric equation

Einstein explained the photoelectric effect. He told that photons of light acts as particles which collide

(Section C)

Q. No. 5 (Page 2) with the electrons, as a result they transfer energy and momentum to e^-. So electrons absorb it and released. The some energy is used by electron to release and rest of energy appears as kinetic energy of electron:

Equation:

$E = \Phi + K.E$ → Kinetic energy

Total energy → energy used to emit e^-

$\Phi = hf_0$ → Threshold frequency

$E = hf_0 + K.E$

$K.E = E - hf_0 \Rightarrow eV = hf - hf_0$

[redacted]

Effect of frequency on K.E of photoelectrons:

Frequency is directly related with K.E of photoelectrons If we increase the frequency of radiation the K.E of photoelectrons also increases, and vice versa.

$K.E = hf - hf_0$

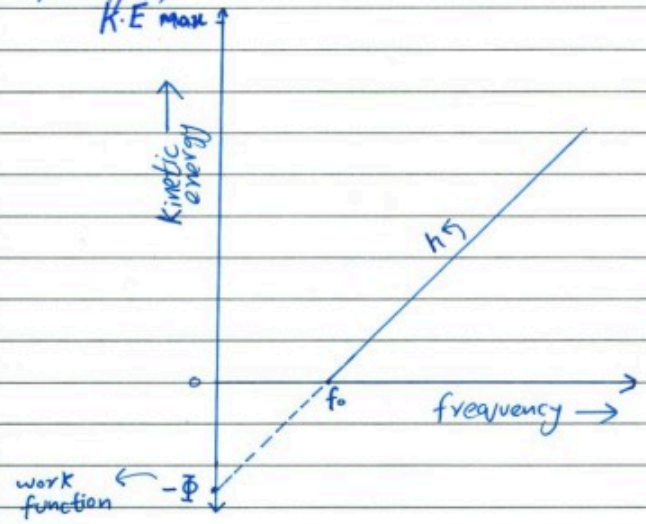
If we increase "f", then K.E also increases

(Section C)

Q. No. 5 (Page 3)

$K.E \propto f$

Graph



(Section C)

Q. No. 6 (Page 1)

Derive and Show that decay of nucleus is exponential with time.

The decay of nucleus is exponential with time.

The rate of disintegration $\left(\frac{\Delta N}{\Delta t}\right)$ is proportional to number of nuclei (N) present at time t:

$$\frac{\Delta N}{\Delta t} \propto -N$$

$$\frac{\Delta N}{\Delta t} = -\lambda N$$

λ = Decay constant.

For very small Change:

$$\frac{dN}{dt} = -\lambda N$$

By change of variable formula:

we get $\frac{1}{N} \times dN = -\lambda \times dt$

By taking integration on both sides

$$\int \frac{1}{N} \times dN = -\int \lambda \times dt$$

(Section C)

Q. No. 6 (Page 2)

$$\ln N = -\lambda t + \text{constant} \quad \text{—(1)}$$

At initial stage, $N = N_0$ and $t = 0$.

So $\ln N_0 = 0 + \text{constant}$

$$\text{constant} = \ln N_0$$

By putting its value in equation (1).

$$\ln N = -\lambda t + \ln N_0$$

$$-\lambda t = \ln N - \ln N_0$$

$$-\lambda t = \ln \frac{N}{N_0}$$

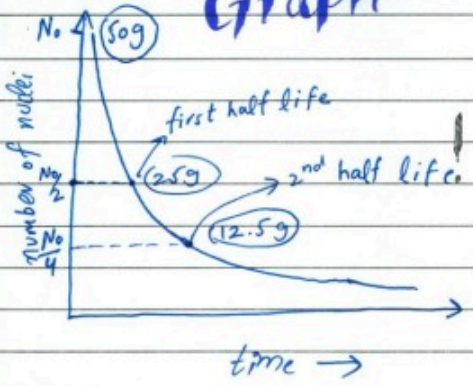
By taking exponent on both sides.

$$e^{-\lambda t} = \frac{N}{N_0}$$

$$N = N_0 e^{-\lambda t}$$

It shows that the decay of nucleus is exponential with time.

Graph



(Section C)

Q. No. 6 (Page 3) ~~Num~~

(b) **Numerical**

Given

$T_{1/2} = 9.70 \text{ hours} = 34920 \text{ sec}$

To find

(decay constant) $\lambda = ?$

solution

$$T_{1/2} = \frac{\ln 2}{\lambda}$$

$$\lambda = \frac{0.693}{T_{1/2}} = \frac{0.693}{34920}$$

$$\boxed{\lambda = 0.0000198\ s^{-1}}$$ Ans..

So the decay constant of Sr.91 is "$0.0000198\ s^{-1}$".