WAKISSHA JOINT MOCK EXAMINATIONS
MARKING GUIDE
Uganda Advanced Certificate of Education
UACE August 2018
PHYSICS P510/1

SECTION A

1. (a) (i) - Speed is the rate of change of distance while velocity is the rate of change of displacement.
- Speed is a scalar, Vel is a vector. (02)

(ii) from distance = average speed × time;

$$S=\left(\frac{U+V}{2}\right)\times t \text{ ;but } t=\frac{v-u}{a}$$

$$\therefore\ S=\left(\frac{U+V}{2}\right)\left(\frac{V-U}{a}\right)=\frac{uv-u^2+v^2-u^2}{2a}=\frac{v^2-u^2}{2a}$$

OR: $S=Ut+\frac{1}{2}at^2, t=\frac{v-u}{a}$ (03)

$$\therefore\ S=u\left(\frac{v-u}{a}\right)+\frac{1}{2}\left(\frac{v-u}{a}\right)^2 a=\frac{uv-u^2}{a}+\frac{v^2+2uv+u^2}{2a}$$

$$S=\frac{V^2-U^2}{2a}$$

(iii) $S=\frac{V^2-U^2}{2a}$

$$[S]=L;\ \left[\frac{v^2-u^2}{2a}\right]=\frac{\left[v^2-u^2\right]}{[2a]}=\frac{L^2}{L}=L$$

Since $[L.H.S]=[R.H.S.]$; then the equation is dimensionally consistent. (02)

(b) $a=\frac{F}{m}=\frac{6000}{800}=7.5ms^{-2}$

Distance covered after reaction time s= 30-(0.40×21) =21.6m

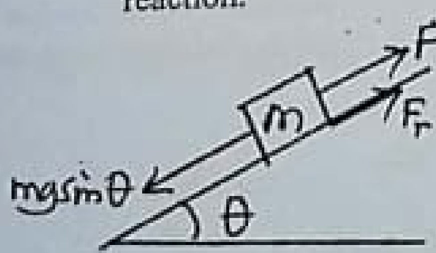
From $V^2 = U^2-2as$; $V=\sqrt{u^2-2as}$

$=\sqrt{21^2-2\times7.5\times21.6}$

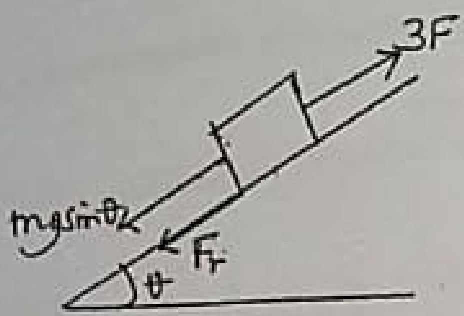
$=11.1ms^{-1}$ (04)

(c) (i) Limiting friction is the **max** frictional force that opposes relative motion between two surface in contact
When one surface **just slides** relative to the other. (01)

(ii) increase in normal reaction increases the pressure at the welded joints. This leads to a greater degree of interlocking; and hence a bigger force is required to cause motion. This friction increases with increase in normal reaction. (03)

(d) 

At the verge of sliding down:
$F + F_r = mgsin\theta$
$\therefore F = mgsin\theta - F_r$; $F_1 = \mu mgcos\theta$
$= mgsin\theta - \mu mgcos\theta$



$F = mg(\sin\theta - \mu\cos\theta)$

At the verge of sliding up the plane

$3F = mg\sin\theta + F_r$

$= mg\sin\theta + \mu mg\cos\theta$

$= mg(\sin\theta + \mu\cos\theta)$

$\rightarrow 3mg(\sin\theta - \mu\cos\theta) = mg(\sin\theta + \mu\cos\theta)$

$\therefore 3\sin\theta - 3\mu\cos\theta = \sin\theta + \mu\cos\theta$

$\rightarrow 2\sin\theta = 4\mu\cos\theta$

From which $\mu = \frac{1}{2}\tan\theta$

(04)

(c) friction causes
- wear and tear
- unnecessary noise
- unnecessary heat
- wastes energy

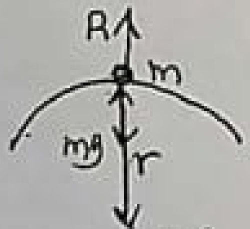
(01) (any two)

TOTAL MARK = 20

2. (a) (i) Centripetal force is the force that acts on a body moving in a circular path and is directed towards the centre of the circular path.

(ii) Angular vel. Is the rate of change of angular displacement of a body moving in a circular path. (01)

(b) (i)



$mg - R = \frac{mv^2}{r}$ (01)

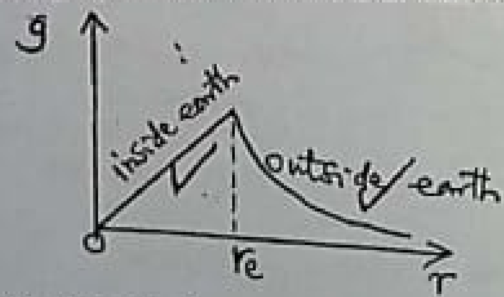
(ii) From $mg - R = \frac{mv^2}{r}$; if the wheels just torch the surface

$\rightarrow mg = \frac{mv^2}{r}$ or $V = \sqrt{rg} = \sqrt{0.5 \times 9.81}$

$= 2.21\ ms^{-1}$ (03)

(c) (i) - Planets describe elliptical orbits about the sun as one focus
- the imaginary line joining the sun to a moving planet sweeps out equal areas in equal times.
- the squares of periods of revolution of the planets about the sun are directly proportional to the cubes of their mean distances from the sun. (03)

(ii) (02)



(iii) - Inside the earth; i.e. $r < r_e$; g is directly proportional to r because the earth is assumed to have a uniform density or (g increases as r increases)

- Out side the earth, i.e $r < re$;g is inversely proportional to r^2 $\left(g \times \frac{1}{r^2}\right)$

→(g reduces as v increases) (02)

(d) (i) Grav. Potential is the work done in moving a body of mass 1kg from infinity to a given point in the grav. field of a planet. (01)

(ii) Work done to move a body through a small distance δr towards the earth, $\delta W = F\,\delta_r$

If the body has a mass of 1kg, $F = \frac{GM}{r^2} \delta r$ or $F = \frac{GM_m}{r^2}$

$$\therefore \frac{GM}{r^2} \delta r\, r^2$$

∴ Total work done to move the body from infinity to a given point a distance r_e from the centre of the earth, $W = \int_{\infty}^{r_e} \frac{GM}{r^2} dr$

$$= -\frac{GM}{r_e}$$ (03)

(iii) $W = GM_e m\left(\frac{1}{r_n} - \frac{1}{r_e}\right)$; $r_n = r_e + h$

$= 6.4 \times 10^6 + 6.0 \times 10^5$

$= 7.0 \times 10^6$m

$6.67 \times 10^{-11} \times 5.97 \times 10^{24} \times 5.0 \times \left(\frac{1}{7.0 \times 10^6} - \frac{1}{6.4 \times 10^6}\right)$

(03)

$= {}^-2.6 \times 10^7$ J

(03)

Total Marks = 20

3. (a) (i) Tensile stress is the force per unit cross- sectional area on a material. Tensile strain is the extension per unit original length of a material. (02)

(ii) $E = \frac{Fl}{Ae} \Rightarrow [E] = \frac{[Fl]}{[Ae]} = \frac{MLT^{-2}.L}{L^2.L} = ML^{-1}T^{-2}$ (03)

(b) (i) – Original length, l_0 of the test wire
- Average diameter, d of the test wire
- Extension, e produced in the test wire (03)

(ii) – long – to produce measurable extension
- Thin – so that a small mass or weight can produce a large stress. (02)

(c) Work done in stretching the rubber = average force ×extension

i.e $w = \frac{1}{2}F.e$

But $F = \frac{EAe}{l_o}$; $\Rightarrow w = \frac{1}{2}\frac{EAe^2}{l_o}$

∴ work done per unit vol= energy stored per unit vol.

$$= \frac{w}{Al_0} = \frac{1}{2}\frac{EAe^2}{Alolo} = E\frac{e^2}{l_0^2}$$

But $e = l - l_0$

$\therefore$ energy stored per unit vol $= \frac{E(l-l_o)^2}{l_0^2}$ (04)

(d) $l_o = 15cm = 0.15m$, $A = 2.5mm^2 = 2.5\times10^{-9}m^2$, $l = 18cm = 0.18m$
$M = 6.0g = 0.006kg$, $\rightarrow e = 0.18 - 0.15 = 0.03m$

(i) Energy stored in the rubber cord when pulled $= \frac{1}{2}\frac{EAe^2}{l_o}$

What becomes k.e $= \frac{95}{100}\times\frac{1}{2}EA\frac{e^2}{l_0} = \frac{1}{2}mv^2$

i.e $\frac{1}{2}\times0.006\times v^2 = \frac{95}{100}\times\frac{1}{2}E\times\frac{2.5\times10^{-9}\times(0.03)^2}{0.15}$

$v = 7.71\times10^{-4}\sqrt{E}\ ms^{-1}$ (05)

(ii) Energy stored in the stretched catapult turns into k.e of the store and heat only. And not into other forms e.g sound. (01)

Total Marks = 20

4. (a) (i) A floating body displaces its own weight of the fluid on which it floats. (01)

(ii) - A sinker is attached the floating body and the apparent weight W_1 is got when the sinker is immersed in water but the solid is out.

- The displaced water is collected in an empty beakers and its weight X_1 is determined.

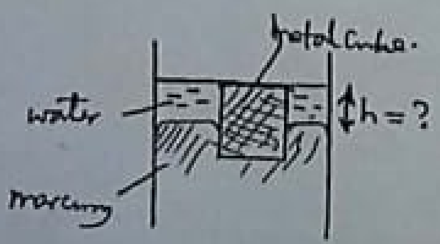
- Also the apparent weight W_2 when both the solid and the sinker are completely immersed is got and the weight of the displaced water X_2 is determined.

- The weight of the solid Wa in air is also obtained.

- The upthrust on the floating body is obtained as $W_2 - W_1$. (04)

- It is found out that:
$W_2 - W_1 = X_2 - X_1 = W_a$ – thus law of flotation verified.

(b) $l = 12$ cm $S_m = 7800kgm^{-3}$, $S_m = 13600kgm^{-3}$, h=?



Vol. of water displaced $= 12\times12\times h = 144hcm^3$
$= 144h\times10^{-6}m^3$

$\therefore$ weight of water displ. $= 144h\times10^{-6}\times1000\times g$.N.

Vol of mercury displaced $= 12\times12\times(12-h)$
$= 144(12-h)\ cm^3$
$= 144\ (12-h)\times10^{-6}m^3$

Weight of mercury displaced = 144 (12–h) ×10^{-6}× 1360 × g.N

But weight of metal block = weight of water + weight of mercury displaced
= 12×12×12×10^{-6}×7800g = 144h×10^{-6}×1000×g+ 144 (12–h)×10^{-6}×13600g
From which h = 5.52cm (05)

(c) (i) Viscosity is the frictional force between two fluid layers in contact and are in relative motion. (01)

(ii)
- For liquids, viscosity is due to the existence of molecular forces of attraction.
- As the temp. Increases, the intermolecular attraction weakens, which consequently causes an increase in molecular speeds and separation. So viscosity of the liq. Decreases with increasing temp.

(02)

(d) Density of sphere = σ, radius = r , density of liq = ϑ
Coeff. of viscosity = η

Let μ = up thrust on the sphere
Fv= Viscous force
W = weight of the sphere
At terminal vel; W = U+ Fv

$$= \frac{4\pi r^3}{3}\sigma g = \frac{4\pi r^3}{3} J g + 6\pi r n v_t$$

$$\Rightarrow v_t = \frac{2r^3(\sigma - j)g}{9n\eta}$$ (04)

(e) $\eta = \frac{2r^3(\sigma - \vartheta)g}{9vt}$; but $V_t = \frac{20.0\times10^{-2}}{0.56} = 0.357ms^{-1}$

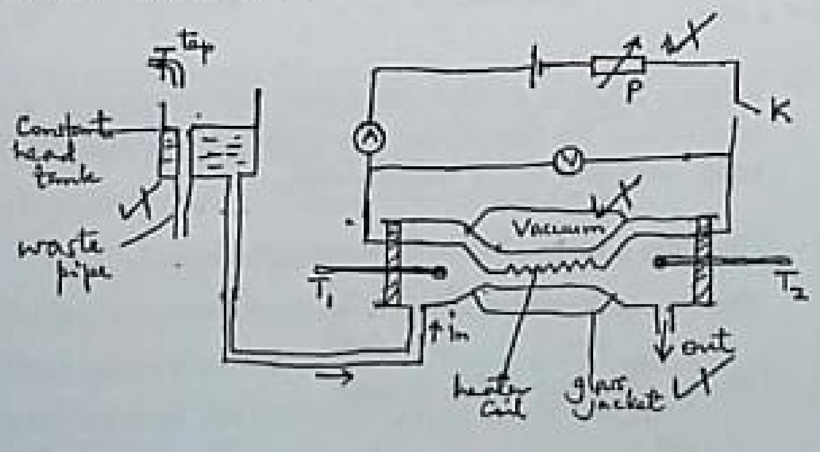
$$\eta = = \frac{2\times(4\times10^{-3})^2\times(7800-900)\times9.81}{9\times0.357}$$

$= 0.674Nsm^{-2}$ (03)

Total Marks = 20

5. (a) (i) S.H.C. is the heat required to raise the temp. of a unit (or 1kg) mass of a substance by 1^0c or 1k. (01)

(ii)



–Diagram ✓✓
–Description ✓✓✓
Total (06)

- The liq. whose s.h.c is required is made to flow through the constant flow calorimeter at a constant rate.

- Switch k is closed and the liq is heated until the temps indicated by thermometers T_1 and T_2 are constant
- Temps θ_1 and θ_2 read from $T_1$and T_2 are respectively recorded.
- The ammeter and voltmeter readings $I_1$and V_1 are also noted
- The liq that flows through the calorimeter is collected in a given time and the mass persecond, M_1, is determined
- The experiment is repeated by adjusting the rheostat to a new value m_2 and the current and P,u to I_2 and V_2 respectively by adjusting Rheostat p by adjusting the rheosted P, so that the temp. of the outflowing liq. Is θ_2.(i.e temp. difference is made the same as in the first part of the expt)
- The s.h.c of the liq. Is then obtained from:

$$C = \frac{I_1V_1 - I_2V_2}{(m_1 - m_2)(\theta_2 - \theta_1)}$$ (06)

(iii) Advantages:

- The thermal (heat) capacity of the apparatus is not required
- Heat loss to the surroundings are accounted for
- Cooling correction is not required
- Temps are recorded at leisure. Vacuum minimizes heat losses to the surroundings.

(02)

(b) Assuming heat losses to the surroundings are negligible:

$P_1 = \frac{v_1^2}{R} = m_1 c\theta$ ________________________ (i)

$P_2 = \frac{v_2^2}{R} = m_2 c\theta$ ________________________ (ii)

Dividing (ii) by (i) gives:

$$\frac{v_2^2}{v_1^2} = \frac{m_2}{m_1} \Rightarrow \frac{v^2}{12.0^2} = \frac{\frac{1}{2}m_1}{m_1} = 0.5$$ (03)

$\Rightarrow v^2 = 0.5 \times 144 = 72$

$\therefore v = 8.49V$

(c) (i) Newton's law of cooling states that under conditions of forced convention, the rate of heat of a body is directly proportional to its excess temp. over that of the surroundings. (01)

(ii) Consider a body of mass m whose s.h.c is C.

The rate of heat loss, $\frac{dq}{dt} = mc\frac{d\theta}{dt}$

Where $\frac{dq}{dt}$ = rate of fall of temp.

But $\frac{dQ}{dt} = kA(\theta - \theta_R) - accordingtonewton'slawofcooling$

$\Rightarrow \frac{mcd\theta}{dt} = kA(\theta - \theta_R)$

$\therefore \frac{d\theta}{dt} = \frac{KA(\theta - \theta_R)}{mc} \Rightarrow \frac{d\theta}{dt} \sigma \frac{1}{m}$ (02)

(d) s.h.t of vap.is the quantity of heat required to convert a liq. of mass 1kg into vapour at constant temp. (01)

(e) (i) When the water in the wet cloth absorbs heat from the hot water in the cup, the water in the wet cloth evaporates with latent heat of vap. This continues as heat from the hot water cool. (02)

(ii) A hot drink accelerates the rate of sweating; and when the sweat evaporates with latent heat, it leaves the body cold. (02)

Total Marks = 20

6. (a) (i) Isothermal change is the change in pressure and volume of a gas that takes place at constant temp. (01)

(ii) A diabatic change is the change in pressure, volume and temp of a gas that takes at constant heat (or in such a way that no heat enters or leaves the system of the gas). (01)

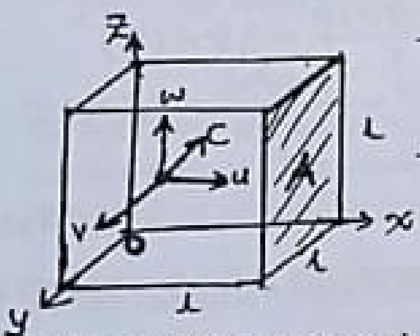
(b) (i)
- When a gas under goes an expansion, it cools
- For its temp. to remain constant, heat must be supplied from the constant temp, bath to maintain its temp. (02)

(ii) work done $\delta W = P\delta V$; but $PV = K$ or $P = \frac{K}{V}$

$\therefore \delta W = \frac{K}{V}\delta V \Rightarrow W = \int_{v_1}^{v_2} \frac{K}{V} dv = k \ln \frac{v_2}{v_1}$ (03)

But $P_1V_1 = K \Rightarrow W = P_1V_1 for \frac{v_2}{v_1}$

(c) (i)



- consider a gas enclosed in a cube of side l, containing N molecules each of mass M.
- suppose a given molecule moves with vel C; which can be resolved in the ox, oy,and oz directions into components u, v and w respectively.

In the ox direction; the molecule will have momentum = mu and a striking wall A, it bounces back with the same vel. u

- Its mom= ˉmu = change in mom = 2mu.

The rate of change of mom= $\frac{2mu}{t}$ where $t = \frac{2l}{u}$

$\therefore$ rate of change of mom = $\frac{2mu}{2l/u} = \frac{mu^2}{l}$ =force on A

Taking into consideration all the N molecules;

Total force on wall A = $\frac{mu_1^2}{l} + \frac{mu_2^2}{l} + \cdots + \frac{mu_n^2}{l}$ where $u_1, u_2 \ldots u_n$ are the component of the different vels in the ox-direction.

$\Rightarrow F = \frac{m}{l}(u_1^2 + u_2^2 + \cdots + u_n^2)$

$\therefore$ the pressure on A $P = \frac{F}{A} = \frac{m}{l^3}(u_1^2 + u_2^2 + \cdots + u_N^2)$

If $\overline{u^2} = \frac{u_1^2 + u_2^2 + \cdots + u_n^2}{N} \Rightarrow U_1^2 + U_2^2 + \cdots + U_N^2 = N\overline{u^2}$

$\therefore P = \frac{mN\overline{u^2}}{l^3}$

For each molecule, $c^2 = U^2 + V^2 + W^2 \Rightarrow \overline{C^2} = \overline{U^2} + \overline{V^2} + \overline{W^2}$

Also; $\overline{U^2} = \overline{V^2} = \overline{W^2} \Rightarrow \overline{C^2} = \overline{U^2} + \overline{U^2} + \overline{U^2} = 3\overline{U^2}$

$\therefore \overline{U^2} = \frac{1}{3}\overline{C^2}$ and $l^3 = V$

$\therefore P = \frac{mN\overline{C^2}}{3V}$, but $n = \frac{N}{V}$

$\therefore P = \frac{1}{3}nm\overline{c^2}$ (06)

(ii) Assumptions:

- Intermolecular forces are negligible.
- The volume of the molecules themselves is negligible compared to the volume occupied by gas.
- The molecules are like perfectly elastic spheres and make perfectly elastic collisions with each other and wall of container.
- The duration of a collision is negligible compared to the time between collisions.

(02)

(d) $P = 2.0\times10^5 Nm^{-2}$, $M = 5.0kg$, $V = 10m^3$

(i) From $P = {}^1/_3 \frac{M\overline{C^2}}{V} = {}^1/_2 M\overline{C^2} \times \frac{2}{3V}$

$\Rightarrow {}^1/_2 M\overline{C^2} = \frac{3PV}{2} = \frac{3\times2.0\times10^5\times10}{2} = 3.0\times10^6 J$ (02)

(ii) ${}^1/_2 M\overline{C^2} = 3.0 * 10^6 \Rightarrow \overline{C^2} = \frac{3.0\times10^6\times2}{5.0} = 1.2\times10^6$

$\therefore \sqrt{\overline{c^2}} = 1.095\times10^3 ms^{-1}$

(02)

Total Marks = 20

7. (a) (i) Coefficient of thermal conductivity is the rate of heat flow normal to a surface per unit.
cross sectional area per unit temp. Gradient.

(ii)
- when one end of the solid is heated, the amplitude of vibration of the atoms these increase.
- This will result into increase in amplitude of the atoms that have taken up some of this energy. These will then collide with their neighbouring atom and possess on some of their vibrations energy.
- In this way, heat propagates along the solid towards the colder end.

(03)

(b) (i) $d = 1.0cm \Rightarrow A = \frac{3.14\times(1.0\times10^{-2})^2}{4} = 7.85\times10^{-5}m^2$

Rate of heat flow; $\frac{Q}{t} = \frac{KA(100-0)}{l} = \frac{390\times7.85\times10^{-5}\times(100-0)}{0.12}$

$= 25.5 Js^{-1}$ (04)

But $\frac{Q}{t} = ml$ where m=mass of ice melted per sec.

$\Rightarrow m \times 3.34 \times 10^5 = 25.5$

$\Rightarrow m = 7.64 \times 10^{-5}$kg

$\therefore$Mass melted in 15s = $7.64 \times 10^{-5} \times 15 = 1.15 \times 10^{-3}$kg.

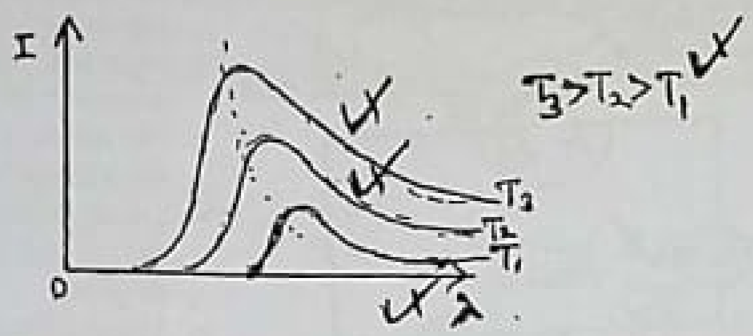
Assumption: No heat is lost on the side of the copper rod; or the copper rod is perfectly logged. (05)

(ii) heat coming in from surroundings con melt the ice beside the one from the boiling water. (01)

(c) (i) Black body is body that absorbs all radiations that fall on it transmits & reflects none

(01)

(ii)



- As temp rises, the energy emitted in each band of wave length increases.
- The intensity of short wave length increases more rapidly.
- At each temp there is maximum intensity which occurs at a particular wave length, which decreases with rising temp.

(04)

(d) (i) Stefan's law- the total energy radiated per second (power) per unit surface area of a blackbody is directly proportional to the fourth power of its absolute temp.

(ii) Power radiated by the cube, $Pc = 0.6\sigma AcT_c^4$

$= 0.6 \times (6 \times 0.02 \times 0.02) \times (833)^4$

Power radiated by the sphere, $Ps = 0.2Pc = \sigma As.T_s^4$

$= 0.2[0.6\sigma \times 6 \times 0.02 \times 0.02 \times (833)^4]$

$\theta \times 4\pi r_s^2 \times (530)^4$

From which $r_s = 1.18 \times 10^2$m

Total Marks = 20

SECTION C

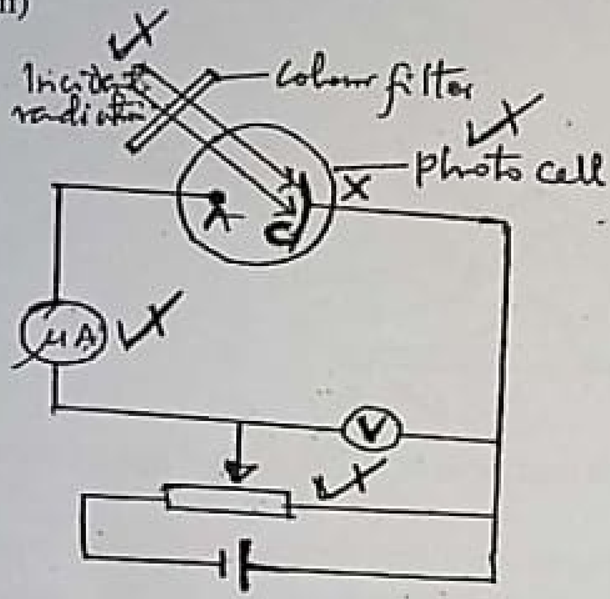
8. (a) (i) Photoelectric emission is the ejection of electrons from a clean metal surface when irradiated which an electromagnetic radiation of high enough frequency, whereas thermionic emission is the ejection of electrons from metal surface when heated. (02)

(ii) When a metal surface is irradiated by an electromagnetic radiation; the electrons on the surface absorbs energy from the radiation ;and if the energy is high enough, it will enable an electron to overcome the inward attractive force and is set free and leaves the metal surface.

(02)

(b) (i) Stopping potential- Is the minimum potential of the a node that reduces the photo current to zero-or it is the minimum potential of the anode that stops the most energetic electron from reaching it.

(ii)



- An evaluated photocell x that has inside it an emissive metal cathode C of a large surface area is connected as shown. 9
- The anode A is made negative in the potential relative to C.
- Light of suitable freq. is directed onto c. (All these shown on the diagram)
- The p.d btn A and C is varied using the potential divider until the reading of the micro ammeter becomes zero.
- The reading of the voltmeter v is the stopping potential.

(c) $\lambda = 546$ nm $= 546\times10^{-9}$m, p $= 0.080$ w.

(i) Energy of each proton, $E = \frac{hc}{\lambda}$

$$= \frac{6.6\times10^{-34}\times3.0\times10^{8}}{546\times10^{-9}}$$

$$= 3.36\times10^{-19}$$

no. of protons per second $= \frac{power}{E}$

$$= \frac{0.080}{3.36\times10^{-19}}$$

$$= 2.2\times10^{17}$$

no. of protons per minute $= 2.2\times10^{17}\times60$

$$= 1.32\times10^{19}$$

(04)

(ii) No. of electrons liberated per second

$$n = \frac{1.5}{100}\times 2.2\times10^{17}$$

$$= 3.3\times10^{15}$$

From I = ne

$= 3.3 \times 10^{15} \times 1.6 \times 10^{-19}$

$= 5.28 \times 10^{-4}$ A (03)

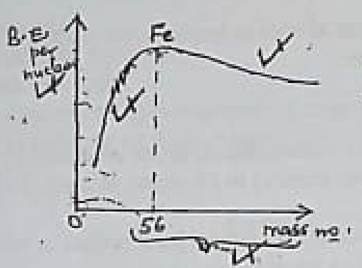
(d) When U.V is directed onto the zinc plate connected to the cap of a negatively charged G.L.E, its **leaf gradually** falls or the **leaf collapses.**

- This is because electrons, which are negatively charged will be lost through photoelectric emission by the zinc plate: and the amount of negative charge on the leaf will reduce. this force of repulsion on the leaf and the metal plate reduces, thus leaf falls. (03)

Total Marks = 20

9 (a) Binding energy per nucleon is the ratio of the energy needed to split the nucleus of an atom into its consistent components(or protons and neutrons)to the number of nucleons in the nucleus.
Unified atomic mass unit is one –twelfth of the mass of one atom of carbon – 12 (02)

(b) (i)



– General shape ✓
– Labelled axes ✓
(✓ @ axis) & 56

(ii)
- Elements with mass number less than 56 fuse or combine to form nuclides of higher binding energy per nucleon. The mass of the resulting nucleus is less than the total of the highest nuclei which consituete it. The mass difference is the energy released.
- During fission; elements with the mass number greater 56 break up into two highest nuclei of higher binding per nucleon. The total mass of the lighter nuclei is less than the mass of the heavy nucleus. The mass difference accounts for the energy released.

(03)

(iii) Similarity btn nuclear fusion and nuclear fission is that in both, **energy is released** or resulting binding energy per nucleon is higher.
Condition: for nuclear fusion; **high temp** is required; and for nuclear fission; an energetic particle like a **neutron** is needed.

(c) (i) Mass on the L.H.S $= 235.1175\,U + 1.0099U$
$= 236.1274\,U$

Mass on the R.H.S $= 143.9577U + 88.9264\,U + (3 \times 1.0099U)$
$= 235.9138\,U$

$\therefore$ Energy released $= 236.1274\,U - 235.9138\,U$
$= 0.2136\,U$
$= 0.2136 \times 931 \times 10^{6}$ eV

= energy released by 1 atom

$\therefore$ Energy released by 1 mole which has 6.02×10^{23} atoms

$= 0.2136 \times 931 \times 10^{6} \times 6.02 \times 10^{23}$

$= 1.197 \times 10^{32}$ eV

(05)

(ii) - Production of electricity at nuclear power station.
- Manufacture of atomic bombs or nucleus bombs.

(02)

(d) (i) ion – pairs are formed when ionizing particles collide with argon atoms; and at low pressure, gas molecules are further apart and so allow ions formed to move with minimum interference to the electrodes.

(ii) The halogen gas is a quenching agent and so prevents secondary ionization.

(iii) Anode is in the form of wire to increase the strength of electric field intensity in the tube.

(03)

Total Marks = 20

10. (a) (i) A lime spectrum are discontinuous times produced by electronic transitions with in an atom(s) as electrons in them fall back to the lower energy levels.

(01)

(ii)
- The atoms of a particular element emit radiation with definite frequencies or wave lengths.
- When atom is in an excited state, an electron may fall into a vacancy in the lower energy level(s)
- This is accompanied by an emission of an electro-magnetic radiation whose freq.is given by E = hf,where E is the difference in the energy of the levels involved and h is Plamcks constant.
- So since the freqs. are definite for a particular element then it implies that energy levels are discrete.

(04)

(b) (i)
- Ionization energy is the energy required to remove electron from an atom in its ground state to infinity where it has no influence of the nucleus.
- Excited state is the state of an atom that has a higher energy than the ground state -or it is the state of an atom in which not all electrons are in their lowest possible energy levels.

(02)

(ii) $E_1 = 3.4eV; E_o = 13.6eV$

Energy released, $DE = E_o - E_1 = \frac{hc}{\lambda}$

$\Rightarrow (13.6 - 3.4) \times 1.6 \times 10^{-19} = \frac{6.6 \times 10^{-34} \times 3.0 \times 10^{8}}{\lambda}$

From which $\lambda = 1.213 \times 10^{-7} m$

(03)

(c) (i) Radioactive decay is the spontaneous disintegration of an unstable nucleus of an atom to acquire a more stable nucleus by emitting particles and x-rays.

(ii) Decay constant is the fractional number of radioactive atoms that disintegrate per second. (02)

(d) Activity $A = \lambda N; where\ \lambda = \frac{0.693}{t^1/_2}$

99g of $^{99}_{43}Y$ has $6.02 \times 10^{23} atoms$

$\therefore$ 10mg of $^{99}_{43}Y$ has $\frac{6.02\times10^{23}}{99} \times 10 \times 10^{-3} atoms$

$\Rightarrow N = 6.08 \times 10^{19} atoms$

$\therefore A = \frac{0.6932}{6\times60\times60} \times 6.08 \times 10^{19}$

$= 1.9512\times10^{15} s^{-1}$ (05)

(e) **Industrial uses of radioactivity:**

- estimation of rate of wear of piston rings in an engine
- controlling thickness of paper, plastics or metal sheets during manufacture
- sterilization of food in food processing.
- detection of leaks in underground pipes.

(02)

Health hazards;

- causes genetic mutation.
- damages eye sight.
- causes cancer(malignant growth or tumours)
- causes skin burns or deep –seated wounds.

Total Marks = 20

END