ANSWERS

SERIES #01

FORM FOUR PHYSICS EXAMINATION - SERIES 01

MARKING SCHEME

QUESTION NO. 01.

QUESTION	i	ii	iii	iv	v	vi	vii	viii	ix	x
ANSWER	B	D	B	B	D	C	D	B	C	D

01 mark each (Total 10 marks)

Question no. 02

QUESTION	i	ii	iii	iv	v
ANSWER	C	A	E	B	F

01 mark each (total 05 marks)

3.a)(i) Gas molecules in a container are in a continuously random motion, as they collides with the walls of the container they exert force on the wall, hence the average force of these particles per surface area of the container determines the gas. (**02 marks)**

i) Rubbing inside of the canvas of the tent in a wet weather will cause water to drip on you because of the temperature difference between the inside and outside of the tent. (**02 marks)**

b) i) When a needle is carefully place on water it does not sink. (**1.5 marks)**

ii) Certain insect can walk on water due to the surface tension of water. (**1.5 marks)**

c) When a body is immersed in liquid, it experiences an upthrust force which reduces the weight of the body**. (03 marks)**

4. a) Resistivity is the ability of the material to oppose the flow of the electric current. Its SI unit is Ohm-metre (Ωm). (**01 mark)**

b) i)Temperature

-The resistance increases as the temperature increase. (**01 mark)**

ii) Cross-sectional area

-The resistance increases as the cross-sectional area decrease. (**01 mark)**

Iii) Length of the conductor

-The longer the conductor the higher the resistance**. (01 mark)**

c) Data: R_1=10Ω, R_2= required, L_1= L_2= L, r_1=2r_2

Solution;

$R_1A_1/L=R_2A_2/L$ (**01 mark)**

$10\times 3.14\times r_1/L=4\times 3.14\times r_1\times R_2/L$ (**02 marks)**

$10=4R_2$, $R_2=10/4$, R2=2.5Ω (**03 marks)**

5 a) i) Mutual induction is the production of an electromotive force in one conductor as a result of changing current in another conductor. (**1.5 marks)**

ii) Self induction is the production of an electromotive force in a conductor as a result of changing current in the same conductor. (**1.5 marks)**

b) i) As a heat in the transformer coil

ii) As eddy current (**0.5 mark to each of the two points)**

iii) Hysteresis losses

iv) Sound generated as a result of the vibrations in the transformer.

c) Data: N_S= 10000 turns, N_P= 100 turns, I_P= 5A, V_P= 12, I_S= required, V_S= required

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i) $V_P/V_S=N_P/N_S$, $VS= V_P \times N_S/N_P$ (**0.5 mark)**

$V_S=12\times10000/100=1200$. (**0.5 mark)**

V_S= 1200V (**01 mark)**

ii) Power in the primary, $P= I_PV_P= 5\times12= 60W$. (**01 mark)**

Efficiency= power in primary/ power in secondary×100% (**01 mark)**

$0.9=P_S/60$

$P_S= 60\times0.9=54W$ (**01 mark)**

$P_S=54W$

$54=1200I_S$

$I_S=54/1200$

$I_S=0.045A$ (**01 mark)**

6. a)

Evaporation	Boiling
i)Happens throughout the liquid	i) Happens on the surface of the liquid
ii)Occurs at the particular temperature	ii)Occurs at all temperature
iii)Has no cooling effect	iii)Has a cooling effect
iv)It is rapid	iv) It is slow

(**01 mark to each of the three points)**

b) Clouds helps to retain the heat emitted by earth and so insulate the earth surface, this temperature reduces the possibility of water to freeze and cause frost. (**02 marks)**

c) i) Coefficient of linear expansion is fraction increase in original length per increase raise in temperature. Its SI unit is per degree centigrade. (**01 marks)**

ii) Data: original length, L_0=1m, original temperature =313K, Final temperature=373K, change in length= 0.003m. (**01 mark)**

Solution:

Coefficient of expansion= increase in length/original length× change in temperature (**01 mark)**

$=\frac{0.003}{1}\times 60$ (**01 mark)**

=0.00005/k. (**01 mark)**

7. a) No, parallel connected cells each of the same voltage will have a total voltage equal to the voltage of one cell and so the pair will give the same potential difference and current as one cell when connected to a resistor. (**02 marks)**

b) 60w, 240v means that when the bulb is connected to 240v supply it will use energy at a rate of 60J in one second. (**02 marks)**

c) Power consumed for 5 lamps of 60w= 5×60w=300W and Power consumed for 4 lamps of 100w= 4×100w=400W. (**01 mark)**

Total power consumed= 300W+400W= 700W. (**01 mark)**

Energy consumed= 700W×8hrs=5600WHrs=5.6kwhr (**02 marks**)

Cost= Number of units×cost of a units= 5.6×27= 151.2shs. (**02 marks)**

8. a) i) Greenhouse effect is the ability of earth's atmosphere to retain heat of the surface of the earth even when the sun is not above the area. (**1.5 marks)**

ii) Earthquake is a sudden violet shaking of the earth crust caused the sudden movement of rocks in the earth crust. (**1.5 marks)**

b) - Increase in earth's surface temperature.

-Rise in the level of water in the sea

-Extinction of some of animal and plant species

-Melting of polar caps (**01 mark to each of the three points)**

-Increase in the range of disease vectors.

c) i) Constellation is a group of stars in space which forms patterns on the earth. (**1.5 marks)**

ii) Tides are caused by pull of the gravitational pull of the moon on the oceans of the earth. (**2.5 marks)**

9. a) i) -Newton's law of Electromagnetic induction state that "electromotive force is produced whenever there is a change in the magnetic flux linked with the coil" (**02 marks)**

-Lenz's law of electromagnetic induction state that "the direction of induced current is in such away as to oppose the change producing it" (**02 marks)**

ii) –The voltage produced can easily be stepped up

-Their voltage can easily be stepped up or down

- They can produce electricity without change in composition of its parts (**01 mark to each of the two points)**

-Easy to change the amount of electromotive force created by simply changing the rate of cutting flux.

b) i) Heating and doping (**02 marks)**

ii) Charge carrier in p-type doped semiconductors is holes (**01 marks)**

c) i)Potential difference will be develop between the heated and the cooled ends of the semiconductor **(02 marks**)

ii) The colder end will be negative **(01 mark)**

10. a) i) Binding energy is the energy used to separate protons and neutrons in the nucleus of an atom **(02 marks)**

ii) Thermonuclear fusion is the process of using extremely high temperature to bring about the fusion of an atom. **(02 marks)**

b) As the temperature of the metal increases the rate at which electrons leave the metal surface increases since electron vibrations increase with temperature. **(04 marks)**

c) Hydrometer is dipped vertically into the liquid whose density can be determine, the density of liquid is then read from the graduated mark on the stem, that is in the line with the liquid surface **(04 marks)**

11. a) i) Resonance is the vibration of an object when it set into an oscillation as its own natural frequency as a result of the impulse receive from some other object which is vibrating at the same frequency. **(01 mark)**

ii) Overtones are all frequencies present in a tone beside the fundamental frequency. **(01 mark)**

b) i) During the day the temperature change which results to the change in velocity of sound, hence the fundamental frequency may alter. **(02 marks)**

ii) This is because each fundamental note is accompanied by overtones, so an overtone from violin is different from flute. **(02 marks)**

c) Data: f_1=400Hz, T_1=2N, T_2=8N

i) Solution:

$F1/T1/2=f_2/T^{1/2}$ **(01 mark)**

$f_2=f_1T^{1/2}/T^{1/2}$

f_2=400×2=800Hz **(01 mark)**

f_2= 800Hz **(01 mark)**

ii) Let f_2= 600Hz, T_1= 2N, f_1= 400Hz.

Solution:

$T_2= (f_2/f_1)^2 \times T_1$ **(01 mark)**

$T_2= \left(\frac{600}{400}\right)^2 \times 2$ **(01 mark)**

$= \frac{9}{4} \times 2$

T_2 =4.5N **(01 mark)**

ANSWERS

SERIES #02

FORM FOUR PHYSICS EXAMINATION - SERIES 02

MARKING SCHEME

1.

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
C	E	B	C	E	B	D	C	A	A

(Each 01 marks)

2.

(i)	(ii)	(iii)	(iv)	(v)
D	H	B	E	G

(Each 01 mark)

3. (a) (i) The volume of liquid displaced

(ii) The density of the fluid

(iii) The volume of immersed body **(Each 01½ marks)**

(b) (i) From principle of conservation of momentum

$$mu + 0 = (m+m)v$$ **(01 mark)**

$$v = \frac{mu}{m+m}$$ **(00½ mark)**

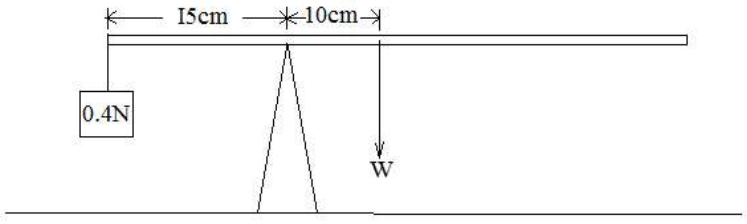
$$= \frac{m \times 20ms^{-1}}{2m}$$ **(01 mark)**

$$= 10ms^{-1}$$ **(01 mark)**

(ii) Because some of the kinetic energy is lost as heat and sound during collision.

(02 marks)

4. (a) Sketched diagram



(02 marks)

From the diagram;-

The sum of clockwise moment = the sum of anticlockwise moment **(01 mark)**

$$0.4 \times 15 = W \times 10$$

$$W = \frac{0.4 \times 15}{10}$$ **(01 mark)**

$$= 0.6N$$ **(01 mark)**

(b) A screw jack has a screw pitch of 5mm and the effort arm of 16cm .

(i) - Kinetic energy (due to the motion of the effort arm) **(01 mark)**

- Potential energy (due to the position of the Load) **(01 mark)**

(ii) From $$MA = \frac{L}{E} = \frac{750N}{30} = 25$$ **(01 mark)**

$$V.R = \frac{2\pi R}{p} = \frac{2 \times 3.14 \times 16}{0.5} = 201$$ **(01 mark)**

$$efficiency = \frac{MA}{VR} \times 100\% = \frac{25}{201} \times 100\% = 12.4\%$$ **(01 mark)**

5. (a) It is used as a driving mirror **(02 marks)**
It is preferred to a plane mirror because it forms a smaller image (diminished image) or it has a wide range of view **(02 marks)**

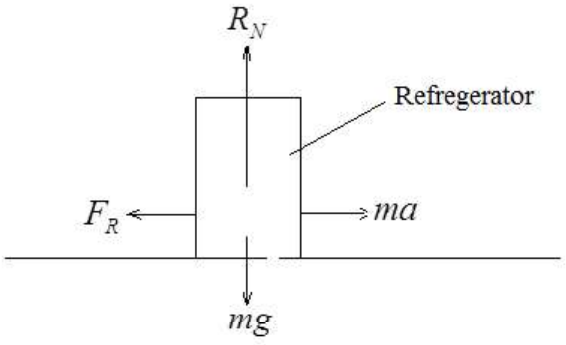
(b) The type of the lens is a convex lens (since the image formed is real) **(03 marks)**
To the image at large distance the object must be placed at principal focus. So the value of focal length is 20cm **(03 marks)**

6. (a) (i) Both consists convex lens which focus an inverted image. In camera focused onto film while human eye focused on retina. **(02 marks)**

(ii) Both adjust the quantity of light entering. In camera it's done with aperture while in human eyes it's done with iris. **(02 marks)**

(iii) Both capture the image through an important element, retina for human eyes and film in a camera. **(02 marks)**

(b) From the diagram



$$F_R = ma$$ **(01 mark)**

But $F_R = \mu R_N = \mu mg$

$$\mu mg = ma$$ **(01 mark)**

$$a = \mu g = 0.44 \times 10 ms^{-2}$$ **(01 mark)**

$$= 4.4 ms^{-2}$$ **(01 mark)**

7. (a) A is the heater because brass expand more than iron. At high temperature, bend towards B to cool the room by cooler and at low temperature the bimetallic bends toward A to heat the room by the heater A. **(05 marks)**

(b) (i) The one which painted matt black will cool mostly quickly because black body is a good radiant compared to white body. **(03 marks)**

(ii) A process is called evaporation. **(02 marks)**

8. (a) In pressure cooker there is high pressure compared to the open saucepan hence the boiling point in pressure cooker is higher so it cook the beans quickly. **(05 marks)**

(b) From principle of heat exchange in the mixture;

Heat loss = Heat gained **(01 mark)**

$$m_1 c(\theta_{100} - \theta_f) = m_2 c(\theta_f - 0)$$

$$m_1(\theta_{100} - \theta_f) = m_2\theta_f \quad \textbf{(01 mark)}$$

$$0.2kg(100 - \theta_f) = 0.3kg \times \theta_f$$

$$20 - 0.2\theta_f = 0.3\theta_f \quad \textbf{(01 mark)}$$

$$0.5\theta_f = 20^o C$$

$$\theta_f = 40^o C \quad \textbf{(02 marks)}$$

9. (a) Current for a single bulb

$$I = \frac{P}{V} = \frac{60W}{240V} \quad \textbf{(01 mark)}$$

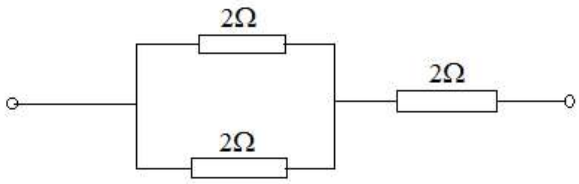
$$= 0.25A \quad \textbf{(01 mark)}$$

For N bulbs total currents $I_T = 5A = NI$ **(01 mark)**

$$N = \frac{I_T}{I} = \frac{5A}{0.25A} = 20$$

He can connect 20 bulbs to a 240V and 5A fuse **(01 mark)**

(b) By connecting two 2Ω resistors in parallel, then in series with another 2Ω resistor. As shown below;-



(04½ marks)

NOTE;

The above is minimum number, but there other alternatives which can be allowed using more resistors

(c) (i) Step down transformer **(01 mark)**

(ii) From $\frac{N_S}{N_P} = \frac{V_S}{V_P}$

$N_S = \left(\frac{V_S}{V_P}\right) N_S$ **(01 mark)**

$= \left(\frac{15{,}000}{1000}\right) \times 80$ **(01 mark)**

$= 1200$ **(01 mark)**

10. (a) (i) By changing the length of the wire **(01 mark)**

(ii) By changing the size of the wire. **(01 mark)**

(iii) By changing the tension on the wire. **(01 mark)**

(b) From the graph period = 0.004s **(01 mark)**

$Frequency = \frac{1}{T} = \frac{1}{0.004s} = 250Hz$ **(01 mark)**

Since, $f = \frac{v}{\lambda}$ **(01 mark)**

$\lambda = \frac{v}{f} = \frac{12}{250}$ **(01 mark)**

$Wavelength = 0.048m$ **(01 mark)**

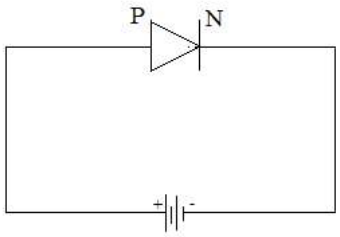
(c) From $v = \frac{2d}{t}$ **(01 mark)**

$d = \frac{vt}{2} = \frac{1500 \times 3}{2}$ **(01 mark)**

$= 2250m$ **(01 1/2 marks)**

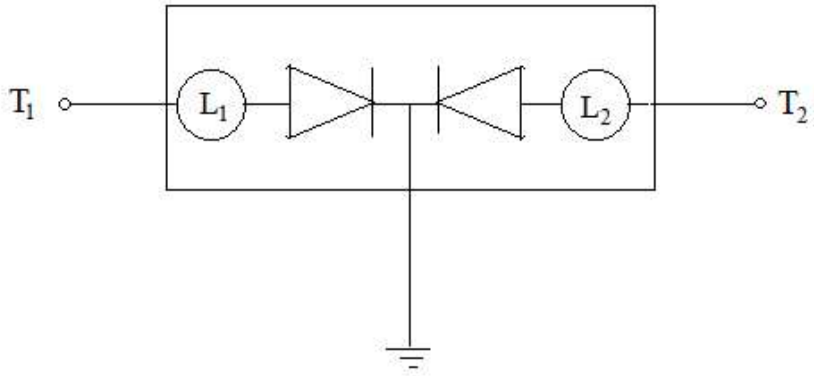
11. (a) In P-type semiconductors the majority charge carrier are holes which are **p**ositive WHILE in N-type semiconductors the majority charge carriers are electrons which are **n**egative Why are some semiconductors called 'P' type and other 'N' type?**(03 marks)**

(b) A semiconductor diode is connected as forward bias when the anode(positive terminal) is connected to P side and cathode(negative terminal) in N-side of the PN junction of the diode as shown below;- (They can use block diagram) **(04 marks)**



(c) A puzzle box consists of two lamps and two diodes. **(02 marks)**

Connections



(03 1/2 marks)

ANSWERS

SERIES #03

FORM FOUR PHYSICS EXAMINATION - SERIES 03

MARKING SCHEME

SECTION A (TOTAL MARKS 15%)

1. Each item caries 1% mark

Item number	I	ii	iii	Iv	v	vi	Vii	viii	ix	x
Corresponding letter	C	A	C	B	D	A	D	A	C	B

2. Each item caries 1% mark

LIST A	I	ii	iii	Iv	V
LIST B	G	I	J	C	F

SECTION B (TOTAL MARKS 60%)

3. (a) The following are applications of measurements

(i) in architecture

Scientists working in architecture they use the knowledge of measurements to identify densities

of various building materials. Therefor helps them to select best materials for constructing different standard structures like bridges, flyover etc **(2.5 marks)** (ii) in hospitals

Doctors uses correct dosage by using appropriate apparatus and at a right time which is the knowledge of measurement. For example a patient could be injected 5 cm^3 at 5:00 clock. In this case measurement of volume and time has been considered. **(2.5 marks)**

(b) Solution

Data given

Mass of Crown (total mass of gold + silver), $m_t = 1.05kg = 1050g$

Volume of Crown (total volume of gold + silver), $v_t = 60cm^3$

Density of gold, $\rho_g = 19.3g/cm^3$

Density of silver, $\rho s = 10.5g/cm^3$

Required; to find mass of gold (m_g) **(1 Mark)**

Since the crown is a mixture

$Vt = vg + vs$ - - - - - - - - - -(1)

$mt = mg + ms$ - - - - - - - - - -(2) **(1 Mark)**

But:

$vg = mg/\rho g$

$Vs = ms/\rho s = (vt - vg)$ $Vt = mt/\rho t$ $ms = (vt - vg) \times \rho s$- - - - - - - - - (3) **(Total = 5marks)**

$mg = vg \times \rho g$ - - - - - - - - - - (4) Substitute eq (3) and (4) into eq (2) $mt = vg \times \rho g + (vt - vg)\rho s$

$mt = vg\rho g + vt\rho s - vg\rho s$ – make vg subject

$vg = (mt - vt\rho s)/(\rho s - \rho s)$

$vg = (1050 - 60 \times 10.5)/(19.3 - 10.5)$

$vg = 47.73\ cm^3$ **(1 Mark)**

Since: $vg = mg/\rho g$ - make mg subject $mg = vg \times \rho g =$

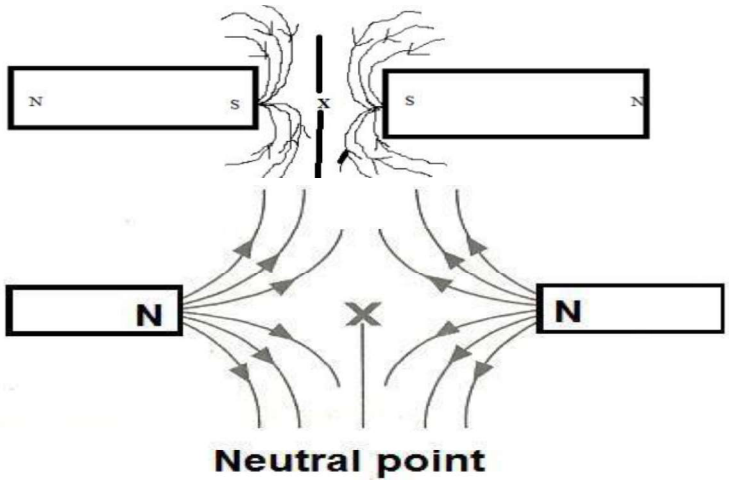
$47.73 \times 19.3 = 921.14g$ $mg = 921.14g$

Therefore mass of gold = 921.14g **(2marks)**

4. (a) ~~D~~ifference between x-rays and cathode rays
   (i) X-rays they havent charge while cathode ray they carry negative charge (2marks)
   (ii) X-ray do not affected by electric or magnetic fields while cathode ray they affected by electrical and magnetic fields. (2marks)
   (iii) X-rays they ionise gases causing the gases to conduct electricity while cathode rays they ionise gas atom if they potential difference is larger and the gas pressure is not high.(2marks)
   (b) X-ray are produced when electron from the filament experience the potential difference and are accelerated to wards the anode, when they hit the anode they are stopped and transfer energy

   to the electrons of the anode materials. This gives to rise to x-rays.(4marks)
5. (a) A neutral point occurs when like poles of two bars of magnet are placed close to each other. It can be either north (N) to north(N) south(S) to south(S). At this point the net magnetic fields is zero. **(3marks)**

   Diagrams **(Total = 5marks)**



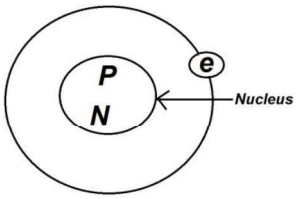
(1mark)

(1mark)

(b) The magnetic property to the magnet caused by the motion of electrons which are in two ways. **(1mark)**

(i) Motion of an electron around the nucleus of an atom **(2marks)**

(ii) Motion in electrons spin around their own axis**(2marks)**

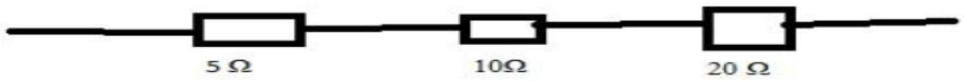


(Total = 5marks)

These two motions are independently hence induces magnetic effect on each electron causing each to behave like a tiny magnet.

6. (a) Ohm's law describe the relationship of V and I with constant R under the condition that all physical factors (length, cros-sectional area, type of material) of a conductor to be kept constant **(1mark)**
   - If length is not kept constant, cause the variation of R (i.e R α L), therefore the system will not obey Ohm's law **(2mark)**
   - If cross-sectional area is not kept constant, it cause the variation of R (i.e R α $\frac{882352D}{3\times10^8} = 10s$). Therefore the system will not obey Ohm's law. **(2mark)**

   (b) The maximum value obtained from the series connection of resistors



(1mark)

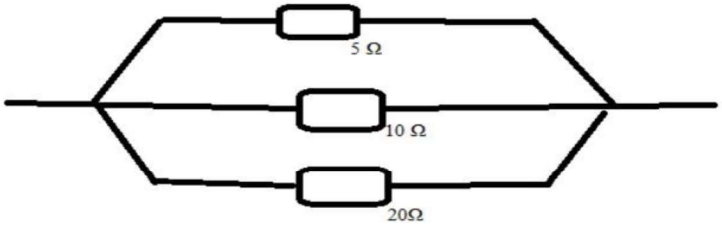
$R_{max} = R_T = R_1 + R_2 + R_3$ **(0.5 mark)**

$R_{max} = 5 + 10 + 20$

$R_{max} = 45\ \Omega$

Therefore the maximum value of resistance after connection = 45 Ω **(1mark)**

The minimum value of resistance is obtained from parallel connection of resistors



(1mark)

$1/R_T = 1/R_1 + 1/R_2 + 1/R_3$ **(0.5mark)**

$= 1/5 + 1/10 + 1/20$

$1/R_T = D = \frac{3\times10^9}{882352}$ **(Total = 5marks)**

$1/R_T = \frac{7}{20}$

$R_T = \frac{20}{7} = 2.9\ \Omega$

Therefore the minimum value of resistance after connection = 2.9 Ω **(1mark)**

7. (a) **Beat are formed when** two sources of sound of nearly equarly frequency are both sounded together (2marks) (b) soln Δt=10s vl=3

Vs=340m/s d=?

tth-tl=10s (1mark)

$\frac{D}{Vth} - \frac{D}{Vl} = 10s$

$D\frac{1}{Vth} - \frac{1}{Vl} = 10s$ (1mark)

D $\frac{1}{340} - \frac{1}{3\times10^8} = 10s$

D $\frac{882352-1}{3\times10^8} = 10s$

D $\frac{882352D}{3\times10^8} = 10s$

$$D = \frac{3 \times 10^8 \times 10}{882352}$$

$D = \frac{3\times10^9}{882352}$ (1marks)

D = 3400m (1mark)

Far away is the thunderstorm is 340m (1mark)

(c) The changes occur when a light wave is refracted into an optically less medium

(i) In fequency unchanged it remain constant (1mark)

(ii) In the speed increase (1mark)

(iii) In the wave length increase (1mark)

8 (a) solution

Data given

Initial temperature, θ1 = 40°C

Final temperature, θ2 = 100°C

Temperature rise, Δθ = (100–25)°C = 60°C

Original length, L1 = 1 m

New length, L2 = L1 + (L1x 0.03%) = 1 + 1x0.3 = 1.003 m

Increase in length, (1.003 - 1) = 0.003 m

Coefficient of Linear Expansion, α =? **(1mark)**

$$\text{From: } \alpha = \frac{\Delta l}{l1\ x\ \Delta\theta}$$

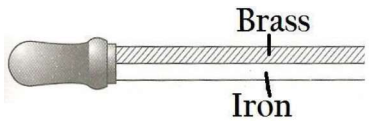
$$\alpha = \frac{0.003}{1\ x\ 66} = \frac{0.003}{60} = 5 \times \underline{10^{-5}}$$

(2 marks) **(Total = 5 marks)**

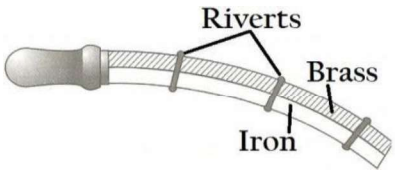
α = 5 x $\mathbf{10{-}5}$ ℃ = 5 x $\mathbf{10{-}5}$ K **(2 marks)**

(b) The bimetallic strip consists of two different metals that expand at different rates when heated through the same temperature change. The metal that expands faster forms the outside part of the curve while the one that expands more slowly is on the inside of the curve. Also when is cooled the metal that expand faster also cooled faster and make the curve inward while the other metal cooled slowly and makes a curve outward. **(3 marks)**

The diagram before heating

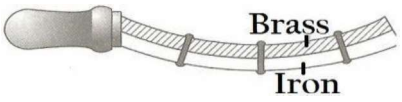


The diagram hwen heated **(Total = 5marks)**



(1mark)

The diagram when cooled



(1mark)

SECTION C (TOTAL MARKS 25%)

9. (a) It is easy to cut a meat with a sharp knife because of small area in the contact part that cause large pressure to exert from the knife to the meat where as a blunt knife has large area at the contact that cause small pressure to exert from the knife to the meat. **(2.5marks)**

(b) Uses of hydraulic press **(2marks @)**

i. It used to lift heavy loads, a heavy load to be lifted is placed in one side and the force is applied to the other side, therefore a load will raise up. **(1,1 mark)** ii. It used to make hydraulic brakes, when a piston of one side is pressed, it will **(Total = 4marks)**

force the second piston to stop the motion of a moving part. **(1,1 mark)**

(c) Solution

Data given

Force of small Piston, f =120N

Area of small piston, a = $0.0003m^2$

Area of large piston, A = $0.02m^2$

Force of large Piston, F = ? **(1mark)**

From:

F/A = f/a **(2 mark)**

make F subject F = (f x A)/a

F = (120 x 0.02)/0.0003 **(1mark)**

= 2.4/0.0003 **(Total marks 6%)**

= 8000 **(1mark)**

F = 8000N

Therefore area of the large piston = 8000N **(1 marks)**

10. (a) The statement means that; the time taken for material X to decay into its half way from its original amount is 50hours. **(2.5 marks)**

(b) Nuclear fission is the process whereby unstable nucleus of an atom split into two or more smaller nuclei. **(1mark)**

Example $^{236}_{92}U \xrightarrow{\text{yields}} {}^{94}_{36}Kr + {}^{140}_{56}Ba + 2\,{}^{1}_{0}n$ **(1mark)**

While **(Total = 4marks)**

Nuclear fusion is the process whereby lighter nuclei joining together to form heaver nucleus (**1mark)**

Example $^{2}_{1}H + {}^{3}_{1}H \xrightarrow{\text{yields}} + {}^{4}_{2}H + {}^{1}_{0}n + H$ **(1mark)**

(c). Solution

Data given

Half- life $t_{1/2}$ = 2hrs

Initial count rate C_0 = 2400/s

Final count rate C = 300/s **(0.5 mark)**

From the concept of radioactive decay

Count rate (C) directly proportional to undecayed atoms in the sample (N)

$C \propto N$

$C_0 \propto N_0$

$\frac{C}{C_0} = \frac{N}{No}$ **(1mark)**

But $N = N_0\, 2^{-n}$

$\frac{C}{C_0} = 2^{-n}$ **(1mark)**

$\frac{300}{2400} = 2^{-n}$

n = 3 **(0.5mark)** from $n = \frac{t}{t_{1/2}}$ **(1mark)**

(Total =

6marks)

t = 3 x 2 = 6hrs **(1mark)**

The time will be 11:00a.m + 6hrs = 5:00p.m

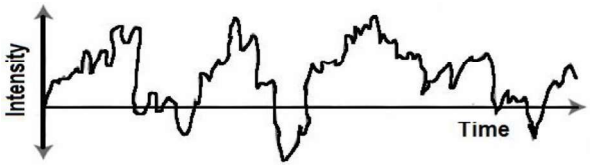
Therefore the count will be dropped at 5:00p.m **(1marks)**

11. (a).Since a diode is a device that allow electricity to flow in one direction only, therefore is a suitable device for converting sinusoidal waveform into unidirectional waveform of electricity? **(2.5 marks)**

(b). transistor applied in all virtually electronic devices such as calculators, televisions, radios, computers etc, as follows;

- Used in switching in electronic circuits **(1mark)**
- Used for amplification of signals **(1mark)**
- Used as oscillators **(1mark)** **(Total = 4marks)**
- Used to control circuit **(1mark)**

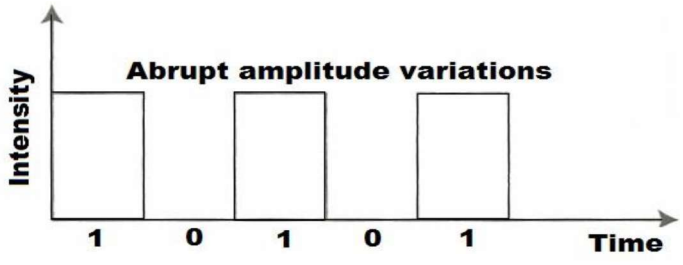
(c) Analogue signals are electrical signals that convey or store information by means of variation in a *continuous* wave form **(2marks) Diagram**:



(1mark)

While **(Total = 6marks)**

Digital signals are electrical signals that convey or store information by means of variation in a noncontinuous wave form **(2marks) Diagram**:



(1mark)

ANSWERS

SERIES #04

FORM FOUR PHYSICS EXAMINATION - SERIES 04

MARKING SCHEME

SECTION A

1. @ 1mark = 10 marks

Item no.	i	ii	iii	iv	v	vi	vii	viii	ix	x
Answer	E	C	D	A	B	D	B	A	A	A

2. @ 1mark = 10 marks

Item no.	i	ii	iii	iv	v	vi	vii	viii	ix	x
Answer	J	E	D	F	G	I	H	B	C	A

SECTION B

3. (a) (i) Wave is a mechanical disturbance which transfers energy from one region to another **(0.5 mark)**

(ii) Types of waves are; Mechanical waves and Electromagnetic waves **@ 0.5 mark= 1 mark**

(iii) water waves, waves in strings **@ 0.5 mark = 1 mark**

(b) Given **(01 mark)**

Wavelength, $\lambda = 150m$

$Velocity$, $V = 3x10^8 m/s$

From; $f = \frac{V}{\lambda} = \frac{3x10^8 m/s}{150m} = 2x10^6 Hz$

(c) Given

Velocity, V = 2m/s

(i) Amplitude, A = Maximum vertical displacement reached = 0.2m **(1.5 marks)**

(ii) Frequency, $f = \frac{n}{t} = \frac{1.5}{0.15} = 10\ Hz$ **(02 marks)**

Alternatively

$Frequency, f = \frac{1}{T} = \frac{1}{0.10} = 10\ Hz$

(iii) Wavelength, $\lambda = \frac{V}{f} = \frac{2m/s}{10} = 0.2m$ **(02 marks)**

4. (a) **@ 0.5 mark = 2.5 marks**

(i) Comet is a solid body orbiting the sun typically composed of rock dust or ice (ii) Galaxy is a giant collection of stars, gas and dust.

(iii)Constellation is a group of stars that form a definite shape or pattern when viewed from the earth

(iv) Zodiac light

(v) Asteroids are small solar system in orbit around the sun especially in the inner solar system.

(b) **@ 02 marks = 06 marks**

(i) Star is a large celestial body made up of hot gases known as plasma while Planet is a large object which is in orbit around a star.

(ii) Terrestrial planets

5. (a) (i) Inertia is the ability of a body to resist changes in its state of motion or rest **(0.5 marks)** (ii) Law of inertia states that " Everybody continues in its state of rest or uniform motion in a straight line provided no external force is acting on it" **(01 marks)** (iii) Speed is the rate of change of distance covered by a body **(0.5 marks)** (b) **(02 marks)**

Velocity		Speed	
(i)	The rate of change of displacement	(i)	The rate of change of distance
(ii)	It is a vector quantity	(ii)	It is a scalar quantity

(c) Given

Case A

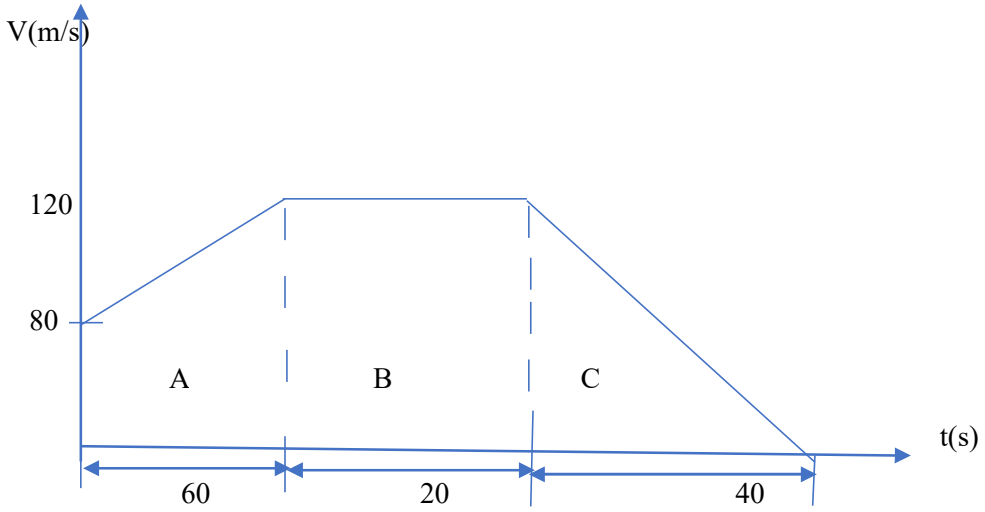
$U_A = 80m/s$, $V_A = 120m/s$ and $t_A = 60s$

Case B

$U_B = 120m/s$, $V_B = 120m/s$ and $t_B = 20s$

$U_C = 120m/s$, $V_C = 0m/s$ and $t_C = 40s$

(i) **(02 marks)**



Case C

(ii) **(02 marks)**

Total distance = Area under the graph = A + B + C

$= \frac{1}{2}(80 + 120)x60 + (20x120) + \frac{1}{2}x40x120 = 6000 + 2400 + 2400 = 10{,}800m$

$\therefore \boldsymbol{Total\ distance = 10,800m = 10.8km}$

6. (a) (i) **(01.5 marks)**

Conductors	Insulators	Semi-conductors
(i) They conduct electricity at any temperature (ii) Increasing temperature lowers conductivity of conductors	(i) Do not conduct electricity at all (ii) Increasing temperature has no effect to insulators	(i) Their conductivity lies between that of insulators and conductors (ii) Increasing temperature increases the conductivity of semi-conductors

(ii) Intrinsic and extrinsic semi-conductors **(01 marks)**

intrinsic semi-conductors	extrinsic semi-conductors
Their conductivity is increased by increasing temperature	Their conductivity is increased by a process called doping

Donors and acceptors **(01 marks)**

Donors	Acceptors
Donate electrons to semi-conductor Are obtained when pure semi-conductor is doped by pentavalent elements	Accepts electrons from semi-conductors Are obtained when pure semi-conductor is doped by trivalent elements

(iii)

(iv) P-type and N-type semi-conductors **(01 marks)**

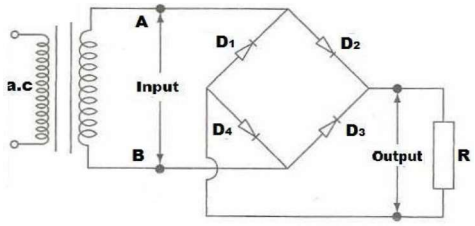
N-type	P-type
Are semi-conductors which are formed when pure semi-conductor is doped by pentavalent elements Majority charge carriers are electrons	Are semi-conductors which are formed when pure semi-conductor is doped by trivalent elements Majority charge carriers are holes

(b) Silicon and Germanium **(02 marks)**

(c) (i) Doping is the process of adding impurity atoms into a pure semi-conductor to improve its conductivity **(0.5 marks)**

(ii) Rectification is the process of converting an alternating current into direct current **(0.5 marks)**

(d) (i) Bridge circuit full wave rectification **(01.5 marks)**

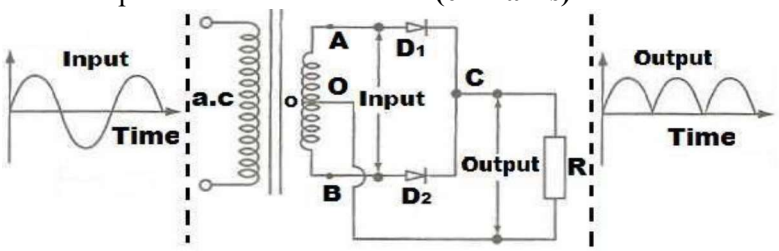


Mechanism

(i)In the first half-cycle, point A is positive so that diode D_2 and D_4 are forward-biased and D_1 and D_3 are reverse-biased. Diode D_2 conducts and the current flows from A via D_2, R, D_4 and back to the source at B.

(ii)In the second half-cycle, B is positive and so diodes D_1 and D_3 are forward-biased while diodes D_4 and D_2 are reverse- biased. Diode D_3 and D_1 conduct and current flows from B via D_3, R, D_1, and back to the source at A.

(ii) Centre- tape full wave rectification **(02 marks)**



Mechanism

(i) In the first positive half-cycle, point A is positive with respect to O. Diode D_1 conducts but diode D_2 is reverse-biased. The current passes through D_1, C, R and back to O.

(ii) In the second positive half-cycle, point B is positive with respect to O. Diode D_2 conducts but diode D_1 is reverse- biased. The current passes through D_2, C, R and back to O.

7. (a) (i) Galvanometer is an electrical device which deflects when current flows through it. **(01 marks)**

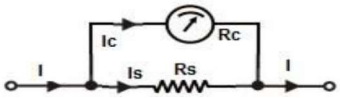
(ii) Sensitivity of a moving coil galvanometer is the deflection of a pointer of a galvanometer when the current flows through it. **(01 marks)**

(b) Factors for sensitivity of a moving coil galvanometer **@ 1 marks = 3 marks**

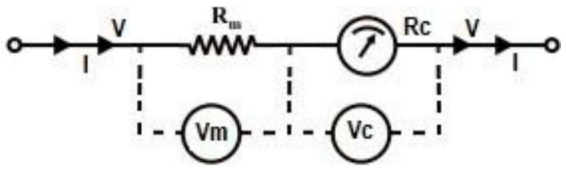
i. Magnetic flux density (B) must be large (Strength of magnetic field) ii. Number of turn (N) must be large iii. Area of coil (A) must be large

iv. Tensional constant (C) must be small or power of hair spring

(c) (i) A moving coil galvanometer is converted into an ammeter by connecting a low resistance resistor called **shunt** in parallel with the coil of galvanometer. Refer to the diagram below; **(02.5 marks)**



(ii) A moving coil galvanometer is converted into a voltmeter by connecting a high resistance resistor called **multiplier** in series with the coil of galvanometer. Refer to the diagram below; **(02.5 marks)**



8. (a) (i)Electromotive force of a cell is a potential difference across the cell terminals when there is no current flowing through it. **(01 marks)**

(ii) Given **(03 marks)**

Number of lamps, n = 5

Power, P = 60W

Time, t = 10 hrs

Cost per unit = Tsh 300/=

From;

Cost $= Energy(kWhr)\ x\ Cost\ per\ unit$

But Electrical energy, $E = P(kW)xt(hrs)$,

Again, Total power, $P = Nunmber\ of\ bulbsxPower\ consumed\ by\ one\ bulb = nP$

$$P_t = nP = 5x0.06kW = 0.3kW$$

Now $E \quad 0\ 3kWx10h \quad 3kWh$

; = . $rs = \quad r$

Then, total cost $= Energy(kWhr)\ x\ Cost\ per\ unit = 3kWhr\ x\ 300/= 900/=$

$\therefore$ **total cost** $= \mathbf{900/=}$

(b)(i) Kilowatt-hour is the electrical energy consumed when an electrical power of 1 kW flows through an electrical appliance in 1 hour. **(01.5 marks)**

(ii) This means for the bulb to function efficiently, it requires power source of not less and greater than 60W and 250V. **(01.5 marks)**

(c) Given **(03 marks)**

Power, P = 480W

Voltage, V = 240V

To choose for the best fuse, we determine the required current;

$I = \frac{P}{V} = \frac{480W}{240V} = 2A$

The best fuse is not available as it requires to be fitted with the fuse rated 2A. Although the fuse rated 3A can be used but not recommended to be fitted for the safety of an appliance.

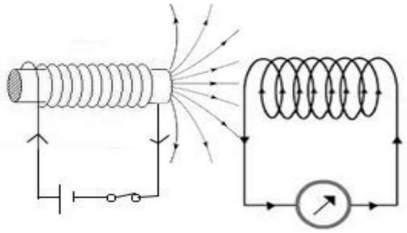
SECTION C

9. (a) (i) Electromagnetic induction is the production of electromotive force whenever there is change in the magnetic flux (lines) linking a conductor (ii) **Laws Of Electromagnetic Induction**

- ✓ **Lenz's Law** states that *"The direction of induced e.m.f is such that the resulting induced current flows in such a direction that oppose the change that cause it*"
- ✓ **Faraday's Law of electromagnetic induction** states that "*The induced e.m.f in a conductor in a magnetic field is directly proportional to the rate of change of the magnetic flux linking the conductor*"

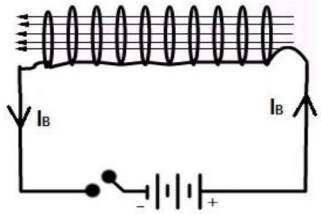
(iii) **@ 1 mark = 2 marks**

Mutual induction is the production of e.m.f in one conductor or solenoid as a result of changing current in another conductor or solenoid



while

Self-induction is the phenomenon in which a change in electric current in a coil produces an induced e.m.f in the coil itself.



(b) Given

Number of turns in primary coil, $N_p = 200$

Number of turns in secondary coil, $N_s = 100$

Voltage in primary coil, $E_p = 240V$

(i) The transformer is step-down as it has number of turns in primary coil greater than secondary coil **(01 marks)**

(ii) **(03 marks)**

Output voltage $=$ Voltage in secondary coil, $E_s = ?$

From; $Power\ input = Power\ output$, this is possible only for ideal transformer

$$\frac{E_p}{N_p} = \frac{E_s}{N_s}$$

$$E_s = \left(\frac{E_p}{N_p}\right) N_s = 100\left(\frac{240}{200}\right) = 120V$$

$$\therefore \boldsymbol{Output\ voltage, = 120\ V}$$

10. (a) **@ 01 mark = 03 marks**

(i) Earthquake is a sudden motion or shaking of the earth caused by a sudden release of energy that has accumulated within or along the edges of the earth's tectonic plates. (ii) Global warming is the increase of the average temperatures near or on the surface of the earth as a result of what is known the greenhouse effect.

(iii) Greenhouse effect is the process in which the emission of radiation by the atmosphere warms the earth's surface

(b) (i)Major cause of global warming is greenhouse effect **(01 marks)**

(ii) Measures to be taken to control global warming **(03 marks)**

- Use of cleaner alternative sources of energy, such as solar and wind
- Check deforestation and replant trees(afforestation) that would absorb carbon dioxide
- Putting in place energy-conservation measures to reduce the use of fossil fuels
- Minimizing the emission of greenhouse gases into the atmosphere

ANSWERS

SERIES #05

FORM FOUR PHYSICS EXAMINATION - SERIES 05

MARKING SCHEME

SECTION A, 2 QUESTIONS

1.

1.	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
	D	A	A	E	C	D	B	B	D	A

@ 1 marks

2.

(i)	(ii)	(iii)	(iv)	(v)
B	C	D	A	C

SECTION B, 6 QUESTIONS

3.

1. (a) (i) Is the change in direction of light as it passes from one medium to another medium ofdifferent density. **mark**

(ii) -A ray parallel to the principle axis converges to the principle focus.

- A ray through the principle focus is reflected parallel to the principle axis

01 mark

- A ray through the centre of culvature is reflected back through the same path

01 mark (b) (i) The pool like structure on roads in hot days is caused by total internal reflection of light as it passes through the layer of air of different densities. A ray of light from the sky is thus totally reflected internally as it is travelling from a dense to less dense medium. The observer can then see the sky as a poolof water**.** **04 marks** (ii) Data given: Read depth = 16cm Refractive index=4/3 **001/2** Apparent depth (h)= ?

Recall

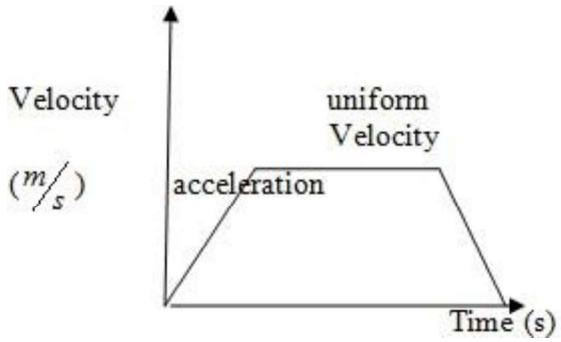
4. a) i) - landing with a parachute -Kicking a ball (2mark @1 mark) b) (i) Elastic collision : is a collision in which both kinetic energy and momenton are conserved while inelastic collision only momentum is obsened (1mark) acceleration =

= 500N (1N = 10kg) = = $4m5^{-2}$

(1 mark) c) (i) similarities

- Speed and velocity have the same limit which is m/s - They are all physical quanties Difference: -Speed is a scalar quantity while velocity is velocity quantity -Speed is a rate of change of distance while velocity is a rate of change of displacement. 1 mark @ ½ mark

- Velocitytimegraph



(3 marks)

5. (a) The extra images are formed by reflection from the front surface of the glass and also by multiple total internal reflection inside the glass (02)

I 1

Glass

O

Main image

Silvered back

I

I

1

I

2

(b) Give Refractiveindex = 1.65 Critical angle (c) = (01

(01 Critical angle is (02

a) .

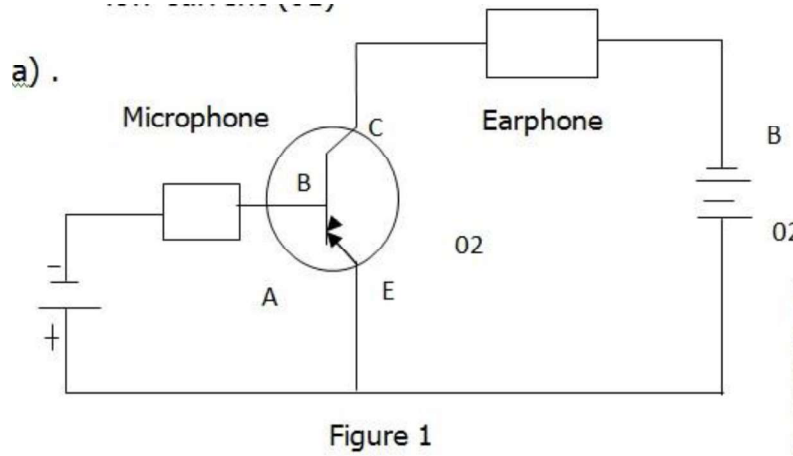


Figure 1

6 (a)

Where
A – transistor
E – emitter (01)
B – base
C – collector
B – output power source

E – emitter (01) B – base C – collector B – output power source (b) (i) A low voltage is used for heating the cathode which emits fast-moving electrons into a vacuum. (2.5) (ii) A high voltage is used to provide a high p.d. between the electrodes for accelerating the electrons. (2.5)

7. (a) This is because water waves are transversal; therefore a duck experiences only the vertical displacement and not horizontal displacement. (b) Given Frequency loaded (F1) = 250HZ Other frequency (F2) =? Beat frequency (B.F1) = 6HZ Beat frequency (B.F2) =4HZ Case 1. Consider beat frequency before loading Either BF1 = F1 - F2 or B.F1=F2 - F1 (01) Either 6HZ = 250HZ – F2 or 6HZ = F2 - 250HZ Either F2 = 244HZ or F2 =256HZ (01) Difference in beat frequency = 6HZ – 4HZ = 2HZ (01) Case 2 Consider beat frequency after loading with wax Either (F2 – 2HZ) – F1 = 4HZ or F1 – (F2 – 2HZ) = 4HZ (F2 – 2HZ) – 250HZ = 4HZ or 250 – (F2 – 2HZ) = 4HZ (01) F2 – 2HZ – 250HZ = 4HZ or 250HZ – F2 +2HZ = 4HZ Either F2 – 252HZ = 4HZ or 252HZ – F2 =
4HZ F2 = 256HZ or F2 = 248HZ Since F2=256HZ occurs in both two cases therefore the frequency of the other note is 256HZ
(01)

8. (i) cathode rays: Are stream of fast moving electron from the heated metal surface while X rays are electromagnetic radia twin similar to light with much higher frequency and short wavelength (1 mark) (ii) X-rays are produced when fast

moving electrons are stopped and their energy is covertod into unknown rays (x-rays) and heat energy. (1

mark) = n = (1 mark)

3 = = 2 T= 6

minutes (½ mark) It takes 6 minutes !

1. = will the fruction remain undecayeo!

n n = (½ mark) 3

= The 1/8 of the particle

will left undeayed. (½ mark)

SECTION C, 3 QUESTIONS

9.

1. (a) (i) Radioactive element, this is an element whose isotopes are unstable hence they decay or disintegrate spontaneously, emitting radiation. **01mark**

(ii) Instruments used to detect radiation

- Gieger – muller tube
- Spark counter
- Gold lead electro scope **02mark @ 001/2**
- Cloud chamber

(b) (i) Q – Betta particle **01mark** P – Gamma rays **01mark** S – Alpha particles **01 mark** Reasons: particle

Q is beta because it has negative charge thus it is deflected towards the positive field. Particle P is Gamma ray because it is neutral thus it remainundeflected and particle S is alpha particle because it is deflected towards the negative field implying that it is a proton. (positively charged particle). **01mark** (ii) properties of the particles

P - Particle	∝ - particle	S - particle
-It has high penetrating power	-moderate penetrating power	-least penetrating power
-It has low ionising power (very weak)	-weak moderate ionising power	-strong – high ionising power
-Pass undeflected on magnetic field	-they are deflected toward North pole of the magnet	-Deflected toward South pole of the magnet

03mark

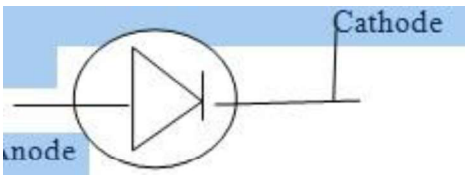
(c) Data given Initial sample (Mi) = 800g Final sample (Mf) = ? Time (t) = 40days Half life (T½)= 8days From: t = n T½ **001/2**

10. a) i)A conductor - valence ban overlap with conduction band - the forbidden gap does exist

(1 mark) @ ½ A semiconductor -Valence band and clonclution band are very lose to each other they gain sufficient energy. (1 mark) Insulator -A valence band and conduction band are far apart -Forbidden gap is so wide that electrons cannot cross it . (1 mark) ii) Doping the adding of small amount of impurities in a semiconductor in order to modity its electrical conductintydroping produces two types of semi conductors (i) n-type semiconductor which result from addition of group V element in group IV elements (semiconductor like silicon) here by atom with four covalent bonds will be form with on unbounded ectron.

iii)Transistor is a semi conductor device in amplificationorswitching or electronic signals

Diode is an electrical device that allows current to flow through it in one direction only. (½ mark)



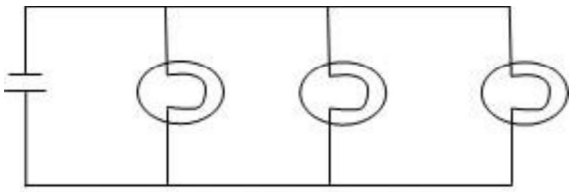
11.

1. (a) Reasons for connecting bulb in parallelarrangement

i) The full potential difference of source is applied across each bulb irrespective of the number of bulbs

ii) Switching one bulb on and off does not affecttheothers (5 marks)

Parallel



Parallel arrangement of bulbs

, I2=0.08A when another R2=

arrangement of bulbs (b) Given dry cell which can deliver I1=0.15A R1= is connected in series

E

0.15A

8

r

Figure (i)

Then from current = Electromotive force (E) Internal resistance + Load resistor

1 mark E1=0.15a (8 +r) (figure 1) E1 = 1.2 + 0.15r 1 mark Also E2 = I (R2+r) E2 = 0.08A (8+ 8 +r) E2 = 0.08 (8+8+r)

0.08A

8

8

Figure (ii)

But when the resistor R1=8 and R2=8 are connected in series given R=8 +8 =16 (1 mark) E r E2 = 0.08 (16+r) figure E2 =1.28 + 0.08r

Equating equation (1) and (ii)

E1=E2 1 mark 1.2 + 0.15r = 1.28 + 0.08r 0.15r – 0.08r = 1.28 – 1.2 0.07r = 0.08 (0.5mark) 0.07r = 0.08

(1mark) But E = 1.2 + 0.15r E = 1.2 + 0.15 (1.143) (1 mark) E = 1.37V Therefore the e.m.fand

internal resistance of the cell are 1.37V and 1.143 respectively (1mark)

ANSWERS

SERIES #06

FORM FOUR PHYSICS EXAMINATION - SERIES 06

MARKING SCHEME

SECTION A (15 MARKS)

1.

i	ii	Iii	iv	V	vi	Vii	viii	ix	x
D	E	B	D	B	E	B	E	C	A

(01 each =10marks)

2

i	Ii	iii	iv	V
G	C	A	J	E

(01 each = 05marks)

SECTION B (60 MARKS)

3.a) The air in the refrigerator cabinet in contact with the freezer at the top is colder than the air below. It is therefore denser and sinks to the bottom. The less cold air rises to the top and becomes colder hence sinks. Therefore the air in the refrigerator cabinet is thus kept cold with help of the freezer **(05 marks)**

(b) Given:

Mass of the sphere (m) = 5kg

Tension in the rope (T) = 60N

Required: Volume of the sphere (V) = ?

Weight of the sphere (W) = mg **(00 ½ marks)**

$= 5kg \times 10N/kg = 50N$ **(00 ½ marks)**

NOTE: tension in rope act downward, weight of sphere act downward, and upthrust on the sphere act upward

Total downward force on sphere = tension + weight **(00 ½ marks)**

= 60N + 50N= 110N **(00 ½ marks)**

From: Archimedes' principle

Upthrust = weight of fluid displaced = 110N

Mass of liquid displaced = $\frac{w}{g}$ **(00 ½ marks)**

$= \frac{110N}{10N/kg} = 11kg$ **(00 ½ marks)**

Volume of liquid displaced = $\frac{mass}{density}$ **(00 ½ marks)**

$= \frac{11kg}{1300kg/m^3} = 0.008m^3$ **(01marks)**

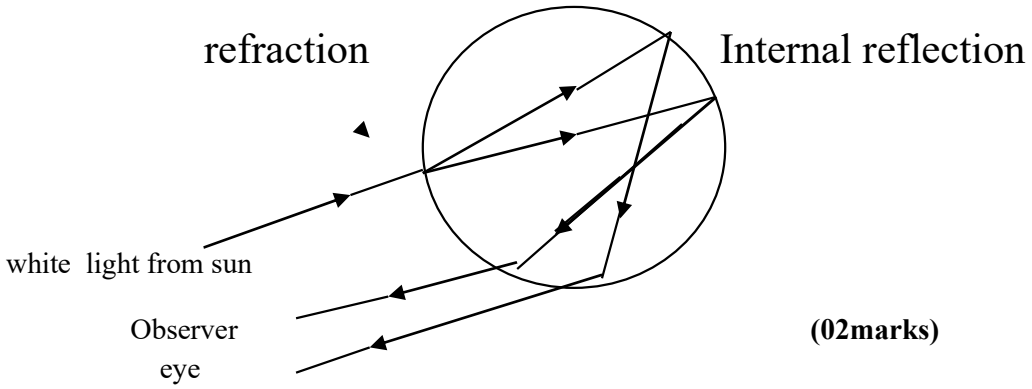
From: the law of flotation

Volume of liquid displaced = volume of the sphere

The volume ot the hollow metal sphere is $0.008m^3$ **(00 ½ marks)**

4. a)Formation of rainbow

Rain bow are formed when sunlight is scattered from the rain drops into the eye of the observer. This is caused by dispersion of sunlight as it refracted and reflected by rain drops. The rain drop must be infront of the viewer **(03marks)**



(02marks)

b) length of the wire ,l =2m

cross section area of the wire, A=0.5mm^2 =0.5 x10^{-6}m^2

Resistance , R =2.2Ω

Resistivity,(ƒ) = ?

i)

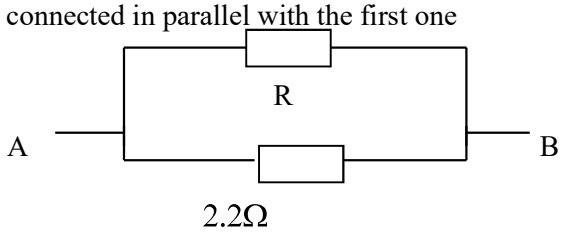
$$\text{Resistance} = \frac{resistivity \times length}{area} \quad \textbf{(00 ½ marks)}$$

$$resistivity = \frac{RA}{l} \textbf{ (00 ½ marks)}$$

$$= \frac{2.2\Omega \times 0.5 \times 10^{-6} m^2}{2m} = 5.5 \times 10^{-7} \Omega m \textbf{ (00 ½ marks)}$$

The resistivity of the wire is $5.5 \times 10^{-7} \Omega m$ **(00 ½ marks)**

ii) Consider a wire connected in parallel with the first one



(00 ½ marks)

Effective resistance between point A and B is given by;

$$R_T = \frac{R_1 R_2}{R_1 + R_2} = \frac{2.2\Omega \times R}{2.2\Omega + R}$$ but: $R_T = 1\Omega$ **(00 ½ marks)**

$$1.0\Omega = \frac{2.2R}{2.2+R}$$

$1\Omega\ (\ 2.2\Omega + R) = 2.2R$

$2.2\Omega + 1R = 2.2R$

$2.2\Omega + 1R - 1R = 2.2R - 1R$

$$\frac{2.2}{1.2} = \frac{1.2R}{1.2}$$

R = 1.83Ω **(00 ½ marks)**

The length will be given by;

$$length = \frac{resistance \times area}{resistivity} = \frac{1.83\Omega \times 0.5 \times 10^{-6} m}{5.5 \times 10^{-7}\ \Omega m} = 1.66m$$ **(01mark)**

The length of the wire is 1.66 meters **(00 ½ marks)**

5.a) The level of the liquid being heated in a vessel first falls before starting to rise because the vessel expands first before the liquid. **(05marks)**

b) Data given

Pitch, (p) =1.0mm

Arm length, (l) =70mm

Efficiency (e) = 40%

Effort (E) =10N

Required: Load , (L) = ?

Velocity ratio, (VR) = distance moved by effort / distance moved by load

= Circumferance of the circle / Pitch (p) **(00 ½ marks)**

$$= \frac{2\pi l}{p}$$ **(00 ½ marks)**

$$= \frac{2 \times 22/7 \times 70mm}{0.1mm}$$

= 4400

Velocity ratio of the simple machine is 4400 **(00 ½ marks)**

From,

Efficiency = mechanical advantage (MA) X100% / Velocity ratio (VR) **(00 ½ marks)**

$$M.A = \frac{Efficiency \times V.R}{100\%}$$ **(00 ½ marks)**

$$= \frac{40\% \times 4400}{100\%}$$

= 1760

Mechanical advantage is 1760 **(00 ½ marks)**

Mechanical advantage , $M.A = \frac{Load(L)}{Effort(E)}$ **(00 ½ marks)**

Load = M.A $\times$ Effort **(00 ½ marks)**

$= 1760 \times 10N$

= 17600 N **(00 ½ marks)**

The load is 17600N **(00 ½ marks)**

6 .a) Ways of increasing the frequency of note produced by a guitar

- increasing the tension in the string **(01 ½ marks)**
- decreasing the length of the string **(01 ½ marks)**
- using a string with small cross-section area **(02 marks)**

b) Given

Mass of the pendulum(m) =100g = 0.1kg

Height raised ,(h) = 20cm = 0.2m

Maximum potential energy(PE_{max}) = ?

(PE_{max}) = mass (m) $\times$ height (h) $\times$ acceleration (g) **(00 ½ marks)**

= mgh

= 0.1kg $\times$ 10N/Kg $\times$ 0.2m **(00 ½ marks)**

= 0.2 Nm **(00 ½ marks)**

Potential energy is 0.2 Joules **(01mark)**

ii)The maximum speed of the bob is observed at the lowest part C of the bob.

From: principle of conservation of energy

Kinetic energy = Potential energy **(00 ½ marks)**

$$\frac{1}{2}mv_{max}^2 = mgh$$

$$v_{max}^2 = \frac{2mgh}{m}$$

$$v_{max} = \sqrt{2gh} \quad \textbf{(00 ½ marks)}$$

$$= \sqrt{2 \times 10 m/s^2 \times 0.2m}$$

= 2 m/s **(00 ½ marks)**

The maximum speed of the bob is 2m/s **(01mark)**

7.a) Object appear coloured when light falls onto it because coloured objects tend to reflect light of its colour falling onto it and absorb the rest **(05marks)**

b) **Given:**

height of the girl (h_0) = 1.2m

object distance (u) = 6m

image distance (v) = 15cm

REQUIRED: height of the girl image (h_i) = ?

From: magnification formula

$$m = \frac{v}{u} = \frac{h_i}{h_0}$$ **(01Marks)**

$$\frac{15\times10^{-2}m}{6m}=\frac{h_i}{1.2m}$$ **(01Marks)**

$$h_i=\frac{15\times10^{-2}m\times1.2m}{6m}$$ **(01Marks)**

$=3\times10^{-2}m$ **(01mark)**

= 3cm

The height of the girl image is 3cm **(01mark)**

8. (a) i. Because air pressure in space is nearly zero such that body temperature is enough to boil the blood **(** $02\frac{1}{2}marks$)

ii. Because gravitational force is almost zero in outer space ($02\frac{1}{2}marks$)

(b) Total force stretching spring (F) = load + pan weight **(00 ½ marks)**

= 2N + 0.4N

= 2.4N **(00 ½ marks)**

From: Hookes' law $k=\frac{F}{e}$ (**where:** k is force constant) **(00 ½ marks)**

$k=\frac{2.4N}{24mm}$ **(00 ½ marks)**

= 0.1 N/mm **(00 ½ marks)**

Given: e =16mm to find F

From: $k=\frac{F}{e}$

$F=ke=0.1N/mm\times16mm$ **(00 ½ marks)**

= 1.6N **(00 ½ marks)**

Load = F- pan weight **(00 ½ marks)**

= 1.6N – 0.4N

= 1.2N **(00 ½ marks)**

The load on the scale pan is 1.2N **(00 ½ marks)**

SECTION C (25 MARKS)

9. a) The strength of the magnet cannot increased beyond limit because when all domains have been oriented in the same direction, no further magnetization is possible and material is said to be saturated **(04 marks)**

b) The coin cuts magnetic field lines and hence e.m.f is induced. From Lenz's' law the induced e.m.f act in a way to oppose the change causing it hence create a force opposing its weight downwards. **(04 marks)**

(c) Data given;

Primary current (I_P) = 0.6 A
Secondary current (I_S) = 0.1A
Primary turns (N_P) =200 turns
REQUIRED: Secondary turns (N_S) =?

From: $\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$ (Transformer equation) **(00 ½ marks)**

$$N_S = \frac{N_P \times I_P}{I_S} \quad \textbf{(00 ½ marks)}$$

$$= \frac{200 \times 0.6A}{0.1A}$$

=1200 turns **(00 ½ marks)**

Number of turns in secondary coil is 1200 turns **(01 marks)**

Primary voltage = 240 V (Given)

$$\frac{V_P}{V_S} = \frac{N_P}{N_S} \textbf{(00 ½ marks)}$$

$$V_S = \frac{V_P \times N_S}{N_P}$$

$$= \frac{240V \times 1200}{200} \textbf{(00 ½ marks)}$$

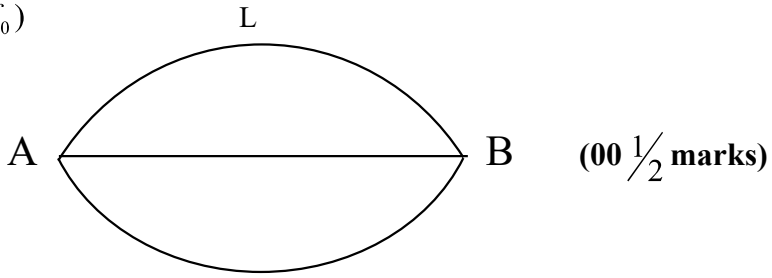
= 1440 V

Voltage in secondary coil is 1440 Volts **(01 marks)**

10. (a) When hall has many people, sound is absorbed by clothes and skin of audience ,thus echoes do not occur **but** when the hall has few people the sound is less absorbed and multiple echoes arises which hinders clear audibility of sound. **(03 ½ marks)**

b) Consider a string fixed at point A and B

Fundamental frequency (f_0)



(00 ½ marks)

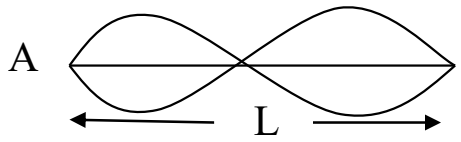
$$\text{Length (L)} = \frac{wavelength(\lambda)}{2} \quad \textbf{(00 ½ marks)}$$

Velocity = wavelength × frequency (f)

$$f_0 = \frac{V}{\lambda} \quad \textbf{but: } \lambda = 2L$$

$$f_0 = \frac{V}{2L} \quad \textbf{(00 ½ marks)}$$

First overtones



(00 ½ marks)

$$L = \lambda$$

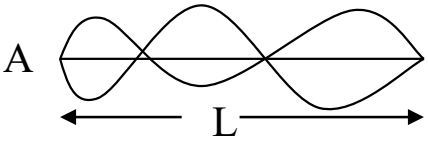
From: $V = f\lambda$

$$f = \frac{V}{\lambda} = \left(\frac{2}{2}\right)\frac{V}{L} \quad \textbf{(00 ½ marks)}$$

$$= 2\left(\frac{V}{2L}\right) \quad \text{where: } f_0 = \frac{V}{2L}$$

$$f = 2f_0 \ \textbf{(00 ½ marks)}$$

Second overtones



(00 ½ marks)

$$L = \frac{3}{2}\lambda \quad \text{where: } \lambda = \frac{2L}{3}$$

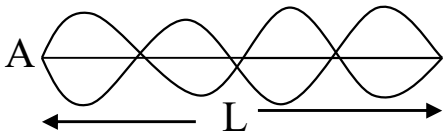
From: $V = f\lambda$

$$f = \frac{V}{\lambda} = \frac{V}{\frac{2L}{3}} \ \textbf{(00 ½ marks)}$$

$$= 3\left(\frac{V}{2L}\right) \text{ where: } f_0 = \frac{V}{2L}$$

$$f = 3f_0 \textbf{(00 ½ marks)}$$

Third overtones



(00 ½ marks)

$$L = 2\lambda \text{ where: } \lambda = \frac{L}{2}$$

From: $V = f\lambda$

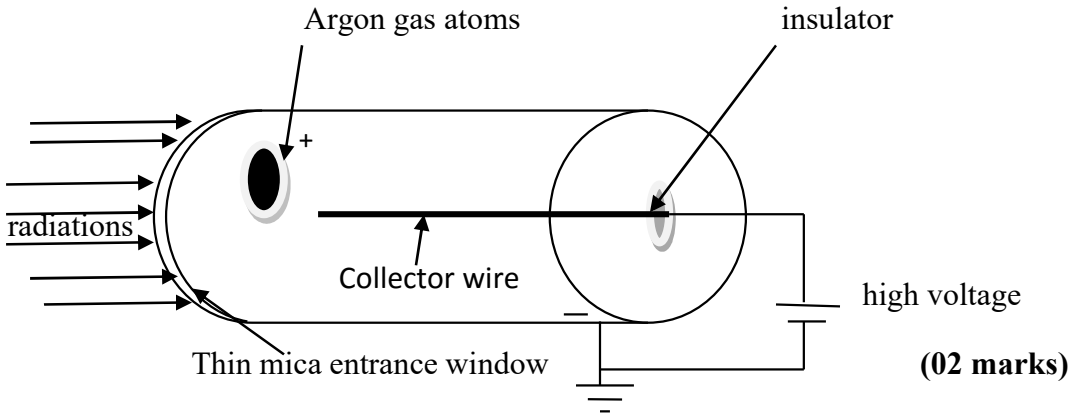
$$f = \frac{V}{\lambda} = \frac{V}{\frac{L}{2}} \ \textbf{(00 ½ marks)}$$

$$= \frac{2V}{L} = 4\left(\frac{V}{2L}\right) \quad \text{where: } f_0 = \frac{V}{2L}$$

$f = 4f_0$ **(00 ½ marks)**

(c) As they are cathode ray tubes, the screen are charged during operation by thermionic emission. These charges attract dust particles on the screen. **(03 marks)**

11.a)



(02 marks)

-When radiations enters the tube, argon gas is ionized into argon ions and electrons **(01 ½ marks)**

- These are accelerated towards the cathode and the anode ionizing more argon atoms by collision **(01 ½ marks)**
- On cathodes the ions produce a current pulse which is amplified and input in a rate meter which gives counts per second hence the radiation is detected **(01 ½ marks)**

b) (i) The plane is charged after a long flight due to friction with air and clouds **(02 marks)**

ii)Passengers in the plane are not charged because there is an insulation in between the passengers cabin and the metal body of the plane which get charged due to friction with air ;but an attendant who will open the door from outside is at risk because if he/she touches the body of the plane the one will be electrified **(04 marks)**

ANSWERS

SERIES #07

FORM FOUR PHYSICS EXAMINATION - SERIES 07

1.

MARKING SCHEME

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
C	D	A	C	C	B	A	C	E	B

(@01mark, total 10 marks)

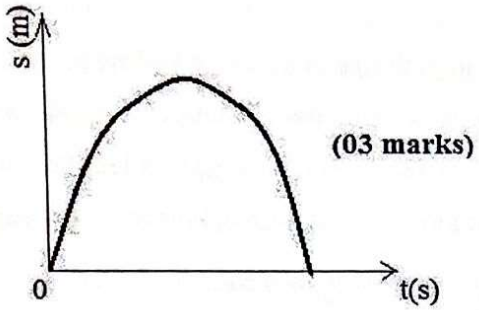
2. Matching items.

(i)	(ii)	(iii)	(iv)	(v)
G	E	C	A	I

(@01 mark, Total 05 marks)

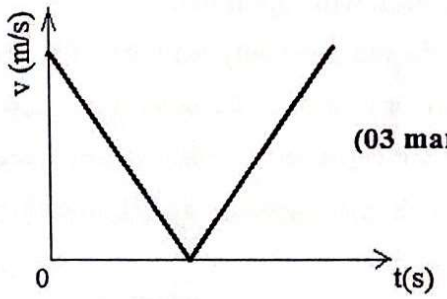
3.

(a) Distance- time graph



(03 marks)

Velocity-time graph



(03 marks)

(b) From $v^2 = u^2 - 2gs$

$$s = \frac{v^2}{2g} = \frac{40^2}{2\times 10}$$ **(01 mark)**

$$= 80m$$ **(01 mark)**

From $v = u + gt$

$$t = \frac{v-u}{g} = \frac{0-40}{-10} = 4s$$ **(01 mark)**

Total time $2t = 2\times 4s = 8s$ **(01 mark)**

4. (a) Increase from 15°C to 4°C **(02 marks)**

Decreases from 4°C to 0° **(02 marks)**

(b) From; $\Delta l = l_o \alpha \theta$ **(02 marks)**

$$= 20\times 0.000011\times(30-20)$$ **(02 marks)**

$$= 0.0022m$$ **(02 marks)**

5. (a) When two identical cells are connected in series **increases the electromotive cell (e.m.f)** hence drive more current through the resistor than one does. **(02 marks)**

The current is not double since **the equivalent resistance is also increases.** **(02 marks)**

(b) From $\text{Power} = IV$ **(02 marks)**

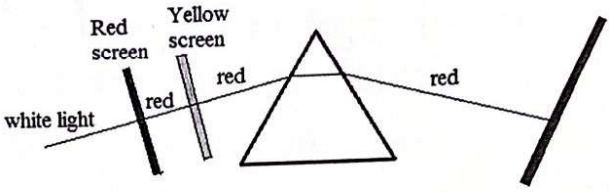
$$I = \frac{P}{V}$$

$$I = \frac{1000}{240}$$ **(02 marks)**

$$= 4.2A$$

The heater should be connected to fuse labeled 4.2A. **(02 marks)**

6. (a) Diagram

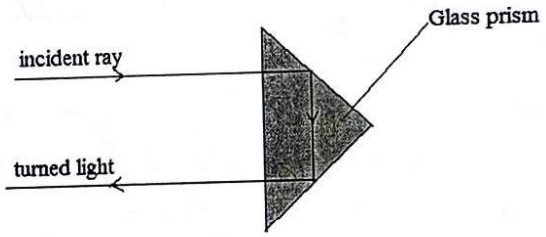


(02 marks)

The red screen will appear red.

Since on the red scree only red light will path through, the same as in the yellow screen, red colour will pass through the prism forming red on the screen after reflection **(03 marks)**

(b) By using **45° right-angled glass prism** Since the critical angle of the glass is less than 45o, the light ray will undergo total internal reflection inside the glass as shown below;- **(02 marks)**



(03 marks)

7. (a) Balanced equation

$${}^{14}_{7}N + {}^{1}_{0}n \rightarrow {}^{14}_{6} + {}^{1}_{1}X$$ **(02 marks)**

Element X is hydrogen nucleus with 1 proton (Atomic mass 1 and atomic number1) **(02 marks)**

(b) Since $t_{\frac{1}{2}} = 5700\,years$

$$t = n \times t_{\frac{1}{2}}$$ **(01 mark)**

$$\left(\frac{1}{2}\right)^{n} = \frac{1}{16} = \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right) = \left(\frac{1}{2}\right)^{4}$$ **(01 mark)**

$$n = 4$$ **(01 mark)**

$$t = 4 \times 5700 years$$ **(01 mark)**

$$= 22{,}800 years$$ **(02 marks)**

(a) (i) **By using magnetic field**

- Alpha particle deflecting towards the direction where positively charged can be deflected WHILE Beta-particle deflected towards the direction where negative charged can be deflected.

(ii) **By using electric field**

- Alpha particle deflecting towards cathode WHILE Beta-particle deflected towards the anode.

(iii) **Using a sheet of paper**

- Alpha particle can be stopped by a sheet of paper WHILE Beta-particle penetrates a sheet of paper. **(Any two @ 02 marks)**

(b) Differences between hard and soft X – rays

- Hard X rays are rays of short wavelength with very high penetrating power and are produced from high voltages WHILE Soft X- rays are rays of long wavelength with low penetrating power and are produced from low voltages

(02 marks)

Uses of X rays

(i) Trace the broken bones.

(ii) Trace swallowed objects.

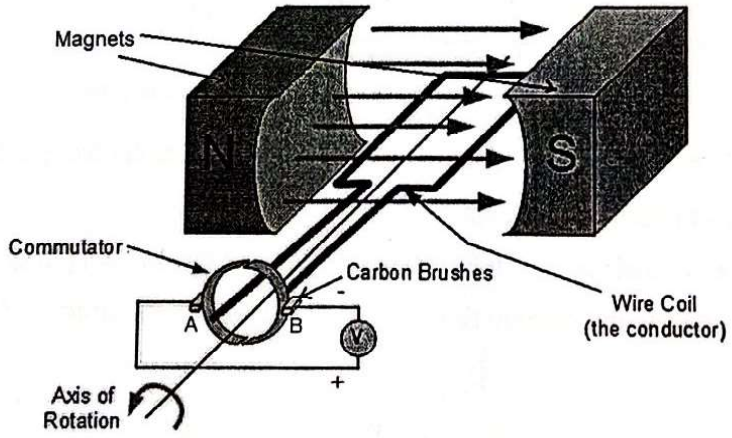
(iii) Detect crakes and flaws in metal casting

(iv) Investigate the structure of the crystal

(v) When strike many minerals such as zinc sulphide, they make them fluoresce.

(vi) X-rays can be used in security. **(Any two @ 02 marks)**

9. (a) Diagram of a DC generator **(02 marks)**



When the coil is rotating anti-clockwise, the current at A is positive and at B is negative (From Fleming's left hand rule), the same direction of flow of current will remain the same when the coil is turned to 180o. the direct current is produced **(02 marks)**

(b) - By increasing the number of turns.

- By increasing the magnetic fields strength

- By increasing the rate of rotation of the armature **(@ 01½ marks)**

(c) From $\frac{V_s}{N_s} = \frac{V_p}{N_p}$

$N_s = \frac{V_S N_p}{V_p}$ **(01 mark)**

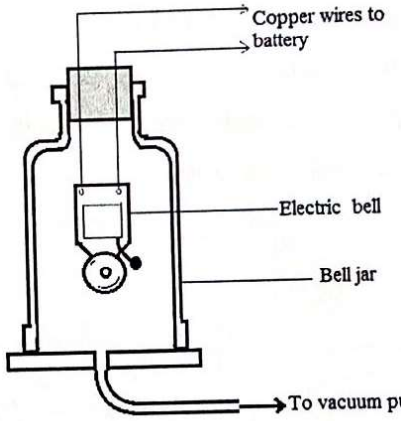
$= \frac{8 \times 4800}{240}$ **(01 mark)**

$= 160 turns$ **(02 marks)**

10. (a) - By changing the length of the wire.
- By changing the tension of the wire.
- By changing the size of the wire. **(Any two points @ 02 marks)**

(b) Experiment

Electric bell and a bell jar is set as shown bellow



(02 marks)

The electric bell is a vibrating source. When there is air in the ball jar the sound of an electric bell is heard to the surroundings **(02 marks)**

When there is no air inside the bell jar after pumped by vacuum pump no sound is heard from the electric bell to the surroundings so sound will not travel through the vacuum. Air is the medium. **(02 marks)**

(c) From $f = \frac{v}{\lambda}$ **(01 mark)**

$= \frac{330 m/s}{0.5m}$ **(01 mark)**

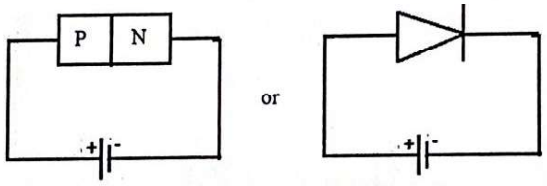
$= 660 Hz$ **(01½ marks)**

(a)

INSULATORS	SEMICONDUCTORS	CONDUCTORS
Have large forbidden gap	Have smaller forbidden gap than insulators	Have no forbidden gap ,the electrons are free to move from valence band to conduction band all the time
Needs very high temperature to conduct since its resistivity is extremely very high	Needs normal (optimum) temperature to conduct since its resistivity lies between that of insulators and conductors	At very low temperature it can conduct since its resistivity is very low

@02 marks) = 04marks

(b) This can be connected as P-type terminal to the anode and N-type terminal to the cathode as shown in the diagram; - **(01½ mark)**



Block diagram Circuit diagram **(01½ marks)**

(c) -The potential difference V across the terminals of the a capacitor is directly proportional to the charge accumulating on its plates. **(01½ mark)**

i.e $Q \propto V$

$Q = CV$ **(01 mark)**

Where by C = the proportionality constant called capacitance of a capacitor
Q = charge
V = potential difference **(00½ marks)**

ANSWERS

SERIES #08

FORM FOUR PHYSICS EXAMINATION - SERIES 08

MARKING SCHEME

SECTION A (15 MARKS)

1. ……(@01 Mark)

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
C	B	E	D	D	C	B	E	C	A

2. ……(@ 01 Mark)

(i)	(ii)	(iii)	(iv)	(v)
A	D	F	H	I

SECTION B (60 MARKS)

3. (a)

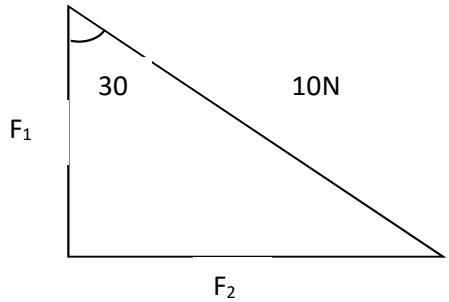
(ii) Red colour, the red light has long wavelength than all other light components of white light **(02 Marks)**

(iii) The blue light is highly deviated and highly spread than all light components of white light. **(02 Marks)**

(b) Colour filter is a material that allows a certain only type of colour to pass. **(@0.5 Mark)**

Colour filter	Colour of object
Red filter	Red
Blue filter	Blue

c) Diagram ……(01 Mark)



F_1=force tend to bend the nail

$$\cos 30^\circ = \frac{F_1}{10N}$$

$F_1 = 10\cos 30^\circ$ ……(0.5 Marks)

$F_1 = 10 \times 0.8660$

$F_1 = 8.66N$ …… (0.5 Mark)

F_2 = Force tend to pull the nail out

$$\sin 30^\circ = \frac{F_2}{10N}$$

$F_2 = 10\sin 30^0 \text{N}$ ..... (0.5 Mark)

$F_2 = 10 \times 0.5000 \text{N}$

$F_2 = 5N$ ..... (0.5 Mark)

4. (a)

(i) Indicates the presence of radioactive radiations. (01 Mark)

(ii) Indicates the materials that are inside the container can easily break. (01 Mark)

(b)

(i) Inner planet and outer planet. (@0.5 Mark)

– Characteristics

- *Inner planet* (@0.5 Mark)
  - they are high denser
  - They contains of core is of molten metal
  - Have natural satellites
  - Near to the sun.
  - Have large atmosphere.
- *Outer planet* (@0.5 Mark)
  - Have less denser
  - Have a ring system
  - They are away from the sun
  - Have large number of natural satellites
  - Have thin atmosphere
  - Are much large
  - Are massive than inner planet.
  - They are made up of light gases.
- Seasonal constellation and circumpolar constellation (@0.5 Mark)
  - Circumpolar constellations are the type of constellation which is observed all the time in the sky either in northern or southern pole of the earth. (0.5 Mark)
  - Seasonal constellation these are the constellation which appears some periods of the year and then disappears. (0.5 Mark)

c)(i)Spring tides these are the ocean tides which occurs when there is a new moon or full moon. (01 Mark)

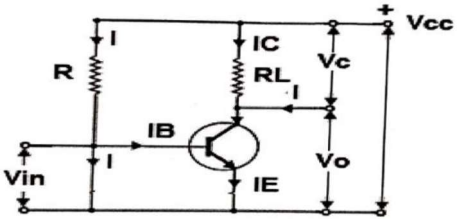
(ii) Diagram of spring ocean tides. (03 Mark)

5. (a)(i) Zener diode is a type of semiconductor diode that works in reverse breaking down voltage. (01 Mark)

(ii) Field effect transistor is a type of transistor in which require a biasing input only a voltage and no practical current. (01 Mark)

(iii) Rectifier is a device that converts alternating current direct current (01 Mark)

b) (i)A diagram of simple circuit transistor (03 Mark)



(ii) Any two among of these (@01 Mark)

- common base amplifier
- common collector amplifier
- common emitter amplifier

c) (i)Fire outbreak may be caused by temperature rise which might cause the ignition of substance to be reached and fire break (01 Mark)

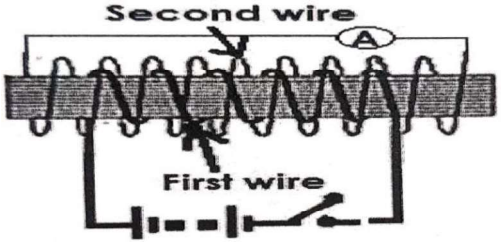
(ii) Titling of the ground may cause river to change the course.

(iii) There are only two methods (@0.5 Mark)

- Optical method
- Electronic method

6. (a)(i) Non inductive coil is a doubly wounded turns of wire device that used to minimize self induction (01 Mark)

(ii) Diagram of non induction coil. (03 Marks)

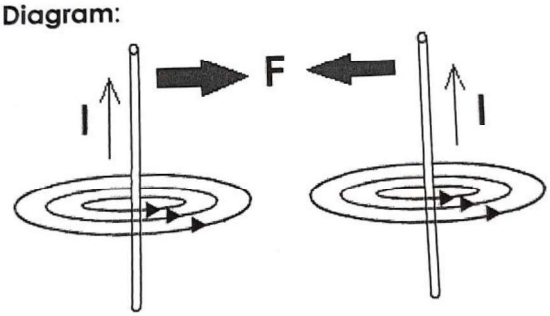


(iii) How non induction coil device used to minimize self induction

- If the electric is flowing through the first coil wire, the second coil will cancels out by induce in the opposite direction. The electric current which deflected by ammeter or galvanometer, Thus self induction is minimized. (02 Marks)

b) (i)Diagram of parallel conductor for the same direction (02 Marks)

Diagram:



(ii) Applications of eddy current (Any four of these) (@ 0.5 Mark)

- Used in heating metal.
- Used in electrical damping.
- Used in crack detection of materials.

- Used to measure material thickness.
- Used to measure the coating thickness of the material.
- Used to measure thermal conductivity of the material

(iii) Eddy current is induced current loops circulating within a conductor.

(01 Mark)

7. (a)(i) Data

- Velocity of brick is 6 m/sec
- Final velocity of brick is 0 m/sec
- Acceleration due to gravity is 10 m/sec^2
- Weight of the brick=w=mg=friction force (F)
- Coefficient of kinetic friction= 0.4
- Distance traveled by brick=?

Solution

$F = ma$ ……. (i) …… (0.5 Mark)

$R = mg$ …….. (ii) …… (0.5 Mark)

Divide equation (i) by (ii)

$\frac{F}{R} = \frac{ma}{mg}$ …… (0.5 Mark)

$\frac{F}{R} = \frac{a}{g}$ but $\frac{F}{R} = 0.4$ and g=10

$0.4 = \frac{a}{10}$ …… (0.5 Mark)

$a = 4m/\sec^2$

From Newton's third law of motion

$V^2 = U^2 + 2aS$ …… (0.5 Mark)

$S = \frac{V^2 - U^2}{2a}$ …… (0.5 Mark)

$S = \frac{6^2 - 0^2}{2 \times 4}$ …… (0.5 Mark)

$S = \frac{36}{8}$ …… (0.5 Mark)

$S = 4.5m$ …… (01 Mark)

(ii) Mention methods that can be used to increase friction (Any two)

(@0.5 Marks)

- Using material with high coefficient.

- Increasing weight of a body.
- Increasing normal reaction
- Changing roughness surface of the material.

b) (i) Archimedes principle

- "When a body is either totally or partially immersed in a fluid it experiences an upthrust which equals to weight of fluid displaced" **(01 Mark)**

(ii) Data

- Total mass, $mt = ml + mb$
- Volume capacity, $v = 20m^3$
- Volume of cold air, $v_1 = 20m^3$
- Mass of balloon, $mb = 2.5kg$
- Density of balloon, $\rho_1 = 0.089kg/m^3$
- Density of air, $\rho_2 = 1.29kg/m^3$
- Mass of instrument, mi =?

Solution

- $mi = v\rho - mb$ ..... **(01 Mark)**
- $mi = 20 \times 1.201 - 2.5$ ..... **(01 Mark)**
- $mi = 21.52kg$ ..... **(01 Mark)**
- ∴Mass of instrument is 21.52 kg

8. (a)

(i) Fundamental frequency this is a lowest frequency of the vibrating object **while** Fundamental note this is a note that respond to fundamental frequency. **(02 Marks)**

(ii) Data

- Frequency, $f = 512Htz$
- First column length, $l_1 = 18cm = 0.18m$
- Second column length, $l_2 = 51cm = 0.51m$
- Velocity of sound in air, $V_a = ?$

Solution

From $l_1 = \frac{\lambda}{4}$ .....(i) ..... **(0.5 Mark)**

$l_2 = \frac{3\lambda}{4}$ .....(ii) ..... **(0.5 Mark)**

Subtracting equation (ii) from (i) gives:

$$l_2 - l_1 = \frac{3\lambda}{4} - \frac{\lambda}{4}$$

$$0.51-0.18=\frac{\lambda}{2}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ (0.5 Mark)

$$0.33=\frac{\lambda}{2}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ (0.5 Mark)

$$\lambda=0.66m$$

But $V=\lambda f\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$ (0.5 Mark)

$$V=0.66\times512m/\sec$$

$$V=338m/\sec\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ (0.5 Mark)

b)

(i) Electromagnetic waves this is a type of waves which do not require material medium for energy transfer and its vibrations are caused by electric and magnetic field. (01 Mark)

(ii) Mechanical waves this is a type of waves that which require medium for transfer energy from one point to another. (01 Mark)

c)

(i) Diffraction of waves occurs when waves are travelling and meet an obstacle with the small like of air ventilation. (1.5 Mark)

(ii) Reflection of waves occurs when waves are travelling and meet with an obstacle. Hence bounce back from the former direction of the waves. (1.5 Mark)

9. (a)(i) Data

- Current temperature =25^0 C
- Absolute humidity, $AH=23.05g/m^3$
- Relative humidity, $RH=53.6\%$
- Actual vapor pressure, $AP=?$

Solution

$$RH=\frac{AP}{AH}\times100\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ (01 Mark)

$$AP=\frac{RH\times AH}{100}$$

$$AP=\frac{53.6\times23.05}{100}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ (01 Mark)

$$AP=\frac{1235.48}{100}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ (01 Mark)

$$AP=12.35g/m^3\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$ (01 Mark)

(ii) Applications of humidity and vapor are (any four) (@ 0.5 Mark)

- used in operation rooms
- used to locate suitable area for cotton cultivation
- used in transport and storage of electronic equipments
- used in weather forecasting

b)

(i) Aluminium foil has a shining surface that reflects back the radiation the radiation from the hot food and makes the food to absorb heat radiation reflected from aluminium foil which makes food to be hot for a long time. (02 Marks)

(ii) Car tires are made of black color since black are good absorber and good emitter of radiation which makes it to lose easily thermal energy occurring due to friction between tires and the ground which might cause it to burst due to overheating. (02 Marks)

c) (i) Physician is a person who deals with Physics applications . (01 Mark)

(ii) Importance of studying Physics (any three) (@0.5 Mark)

- Helps to get professional people
- Helps to understand environment and the structure of the earth.
- Helps to design different structures of buildings.
- Helps I transport and communication.
- Helps in entertainment.
- Helps to understand the universe.
- Helps to manufacture different items.
- Helps in running machines in industries and mining.

10. (a)

(i) Activity is a rate of disintegration of radioactive material with a time. (01 Mark)

(ii) Carbon 14 is a scientific method of which is used to determine age of dead living organism and non living (01 Mark)

b) (i) data

- Half life $\left(\frac{1}{2}t\right)=10\,\text{min}$
- Initial sample $\left(N_0\right)=100\%$
- Element decayed $\left(N_d\right)=90\%$
- Sample decayed un-decayed $N=10\%$
- Time taken (t)=?

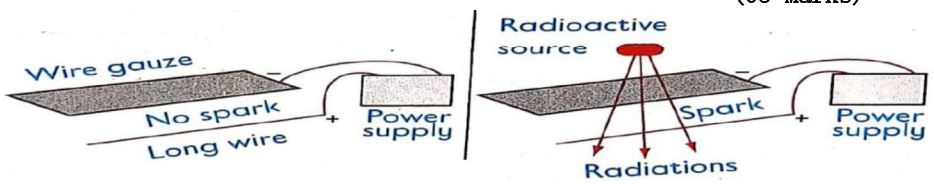
Formula

- $\frac{N_0}{N}=2^{\left(\frac{t/t_2}{2}\right)}$
- $10=2^{\left(\frac{t/t_2}{2}\right)}$ apply log both sides……(01 Mark)

- $\log 10 = \log 2^{\left(\frac{t/_{2}}{2}\right)}$ .....(0.5 Mark)
- $\log 10 = \log 2^{\left(t/_{10}\right)}$
- $\log 10 = \frac{t}{10}\log 2$ ..... (0.5 Mark)
- $\frac{t}{10} = 3.32 \times 10$ ..... (0.5 Mark)
- $t = 33.2\,\text{min}$ ..... (01 Mark)

(ii) Spark counter is a device used to detect the presence of radiations based on their ability of ionizing dry air molecules by producing sparks

(03 Marks)



c) (i) Nuclear fusion is the process whereby a week light nuclear combine to form stable nuclear. (01 Mark)

(ii) Application of nuclear fusion (@0.5 Mark)

- It is used in power plant production.
- It is used in making atomic weapons/bombs.

11. (a)

(i) All matters are made up of tiny particles which are always in constant motion. (02 Marks)

(ii) Volume is amount of space that is occupied by a substance. (01 Mark)

(iii) According to kinetic theory of matter (@ 01 Mark)

- Solid particles are highly packed together application of temperature leads particles to vibrate about their mean position.
- Liquid particles are slightly far apart from each other and are in random motion temperature when applied leads to the particles to move fast than before.
- Gas particles are far apart from each other than that of solid and liquid when temperature is applied leads to an increase of collision of particles than when was no temperature applied.

b)

(i) Electric and telephone cables are left sagging in order to allow expansion during hot day and contraction during cold day. (02 Marks)

(ii) Train tyres can be constructed by taking a small ring placing it in a hot place of about $3{,}000^{\circ}C$ and then fitting the larger ring. inside the small ring and then allowing the system to cool up to room temperature where the small ring will tight the larger ring and the train will be constructed. (03 Marks)

(iii) Applications of anomalous expansion of water is (any three) @ 0.5 Mark.

- The concept is used in filling liquids in the bottle.

- The concept is used in cold water pipe.
- The concept is used in iceberg for passing a danger ship.
- It supports aquatic life.
- Used in liquid thermometer constructions.

ANSWERS

SERIES #09

FORM FOUR PHYSICS EXAMINATION - SERIES 09

MARKING SCHEME

1.

I	II	III	IV	V	VI	VII	VIII	IX	X
E	C	C	E	A	A	A	D	B	E

(10 marks @ 01 mark)

2.

LIST A	I	II	II	IV	V
LIST B	B	F	J	A	E

(05 marks @ 01 mark)

SECTION B (60 Marks)

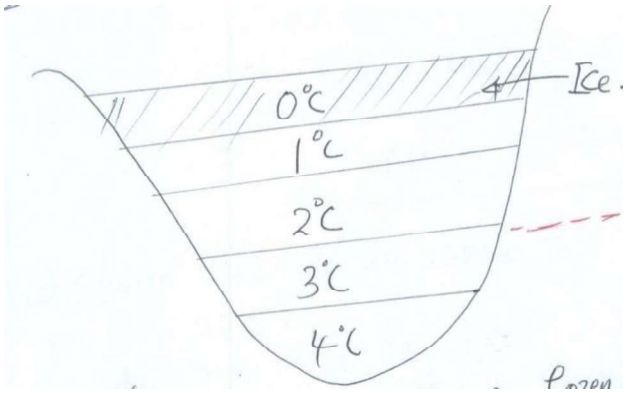
3. (a) (i) Surface area of a liquid

When the surface area exposed is large; the rate of evaporation is increased because there are many molecules near the surface of the liquid. **[02 ½ marks]**

(ii) Higher humidity

When there is higher humidity of the atmosphere, the rate of evaporation is decreased because, there is higher concentration of water in the atmosphere. **[02 ½ marks]**

(b) Water in takes and ponds usually freezes in winter. Ice, being less denser than water, floats on the water. This insulates the water below against heat loss to the cold air above. Water at 4°C being most dense remains at the bottom of the lakes, while ice being less dense than floats on the layers of water at different temperature as shown in figure below:



(03)

(Variation of temperature in a frozen lake)

- This enables fish and other aquatic life to survive in the water below the ice. **[02 mark]**

4. (a) - The tension T in the rope is equal to effort E applied.

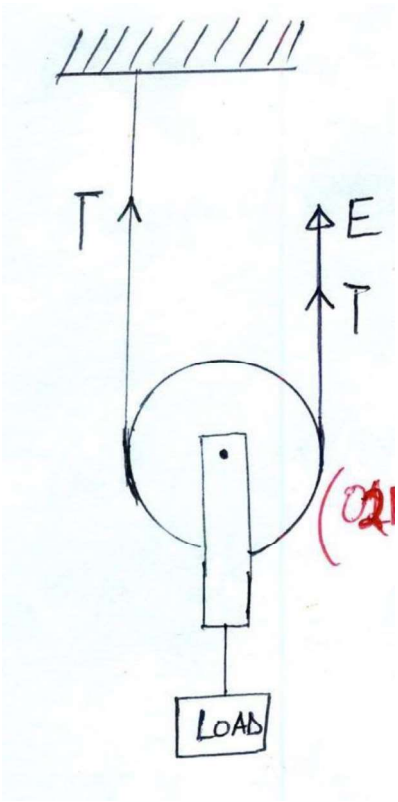
- The load is supported with two tensions; **[01mark]**

L=2T

- L = 2E

But M.A $\frac{L}{E} = \frac{2E}{E} = 2$ **01mark**

 M.A = 2 shown **01 mark**



(b) Characteristics of the image of Sukhaila;

(i) It is virtual

(ii) It is same size as object

(iii) It is laterally inverted

(iv) It is the same distance behind the mirror as the object infront

(v) It is erect (up-right) **[@01mark]**

5. (a) Given;

Rated iron = 240V, 2000N

time, t = 10hours/month

Cost, 1 unit = 100/=

Solution

Electrical energy = Power x time

= 2Kw x 10h/month

= 20Kwh/month [**01mark]**

Cost per month

1Kwh = 100/=

20Kwh = x

$$\frac{x + 1Kwh}{1Kwh} = \frac{20Kwh \times 100}{1Kwh}$$

x = 2000/= per month **[01mark]**

Cost of 3 months

- Cost = 3 x 2000/= = 6000/= **[01mark]**
- The cost will be 6000/= **[01 mark]**

5. (b) (i) OHM'S LAW

"At constant temperature and other physical factors, a current in conductor is directly proportional to the potential different across its ends". **[01mark]**

LIMITATIONS

- Temperature must remain constant **[½ mark]**
- The law is not applied in no ohmic materials such as liquids, gases and some solid. – Electrolyte
- - Semiconductor **[½ mark]**

(ii) E.m.f = 1.5V - Grasses Potential difference, $V_1 = 1.0V$

Resistance, $R_2 = R$

Potential difference, $V_2 = 0.5V$, But,

$V_1 = I_1R_1$ ……. (i)

$E = V_1 + I_1r$ ……. (ii) And

$E = V_2 + I_2r$ …….. (iii)

$V_2 = I_2R_2$ …….. (iv)…… **[01 Mark]**

E and r remain unchanged since the same cell is used take

Take equation ……. (i)

$V_1 = I_1R_1$

$1.0 = 10I_1$

$I_1 = 0.1A$

Thus form equation …… (ii)

$E = V_1 + I_1r$ = But $I_1 = 0.1A$

$1.5 = 0.5 + 5I_2$

$1.0 = 5I_2$ **[01 Mark]**

$I_2 = 0.2A$ **[0 ½ mark]**

Substitute the value of I2 into eqn(iv)

$V_2 = I_2R_2$

$0.5 = 0.2R_2$ R_2

$= 2.5\Omega$

$\therefore R_2 = R = 2.5\Omega$ **[½ mark]**

Resistance = 2.5Ω and internal resistor = 5Ω **[1mark]**

6. (a) (i) Half-life is defined as the time taken for one-half of the atoms of a radioactive to disintegrate. **[01 mark]**

(ii) Binding energy – Is the energy needed to separate nucleus into individual protons and neutron

OR

Binding energy – Is the energy hold protons and neutrons present in the nucleus oppose and overcome repulsion between protons. **[1mark]**

(iii) Radioactive Decay - Is the process in which an unstable atomic nucleus loses energy by emitting radiation in the form of particles or electromagnetic wave.

(b) (i) Four danger's (hazards) occur when handling radioactive materials.

- Eye cataracts
- Cancer
- Skin burns
- Leukemia and other blood disorders

@ ½ mark = 02 marks

(ii) $^{238}_{92}U \xrightarrow{2\Omega} {}^{238}_{94}X + 2{}^{0}_{-1}e$, A = 238, Z=94 **½ mark**

$^{238}X \xrightarrow{2\Omega} {}^{230}_{90}T + 2(^{4}_{2}He)$, A=230, Z=90. **½ mark** 94

$^{230}_{90}T \xrightarrow{\alpha}$ $^{230}_{90}G$, A=230, Z=90 **½ mark**

Where A = Mass number
B = Atomic number **[02 marks]**

(c) (i) Data given

Initial count rate (N_o) = 1200 counts/min

Final count rate (N) = 150 counts/min Time taken (T) = 15 hours

Required Half-life ($t_{\frac{1}{2}}$) = ?

From $N = N_o\left(\frac{1}{2}\right)^{\frac{T}{t}}$ ½ **[½ mark]**

$150 = 1200\left(\frac{1}{2}\right)^{\left(\frac{T}{t}\right)}$ ½

$= 150/1200 = \left(\frac{1}{2}\right)^{T/t}$ ½ **[½ mark]**

$\frac{1}{8} = \left(\frac{1}{2}\right)_{15/t}$ ½

$\left(\frac{1}{2}\right)^3 = \left(\frac{1}{2}\right)$

$3 = \frac{15}{\frac{t1}{2}}$ 15/t ½

$\frac{t1}{2} = \frac{15}{3} = 5$ hours.

Half-life = 5 hours **[½ mark]**

6. (c) (ii) Data given

Initial number of atoms (No)= $3x10^{20}$ atoms.

Final number of atoms (N) = ?

Time taken (T) = 25hrs.

Half-life (t1/2) = 5hrs.

From $N=N_o\left(\frac{1}{2}\right)^{T/t_{1/2}}$ **[½ mark]**

$N = 3x10^{20}\left(\frac{1}{2}\right)^{\frac{25}{5}}$

$N = 3 \times 10^{20}\left(\frac{1}{2}\right)^5$

$N= 9.375 \times 10^{18}$ **[½ mark]**

But

Number of decay = $3 \times 10^{20} - 9.375 \times 10^{18} = 2.9062 \times 10^{20}$

The atom that will decay 2.9062×10^{20} C.P.S. **[½ mark]**

7. (a) Both P-type and N-type semiconductors are formed by doping process. **01mark**

P-type is formed by adding a trivalent atoms such as Boron to an extrinsic semiconductor and results in availability of holes in valence band.

02marks

N-type semiconductors is formed by adding a pentavalent atom (donor) such as phosphorus to an extrinsic semiconductor (Germanium or Silicon) and causes the presence of free electrons in a conduction band.

02marks

(b) Five hazards of earthquakes

(i) Landslides

The shaking caused by an earthquake can cause mountain slopes and cliffs to move downwards causing landslides. **01mark**

(ii) Collapsing buildings

A strong earthquakes can flatten a whole city by collapsing all buildings. **01mark**

(iii) Opening deep valleys

An earthquake can displace parts of the earth's crust causing a deep valley. **01mark**

(iv) Tsunamis

An earthquake that occurs under the see can cause tsunamis.**01mark**

(v) Fire outbreak

It can happen when the earthquake cause oil or gas to break or collapse of electrical lines. **01mark**

8. (a) (i) A couple is a pair of forces, equal in magnitude but oppositely directed and displaced by perpendicular distance. **01mark**

(ii) Center of gravity is the point in which all particles weight act on it.

01mark

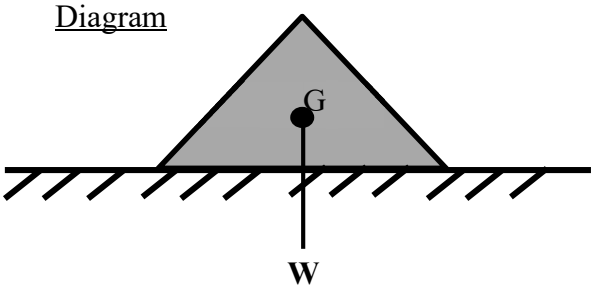
(iii) Centre of mass

Is the point in which mass of the body or particle appears to be concentrated. **01mark**

(b) **Stable equilibrium**

Stable equilibrium occurs when a body slight displaced the body returns to its original position after displacement.

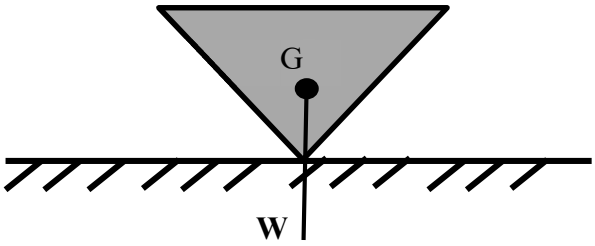
Diagram



[01mark

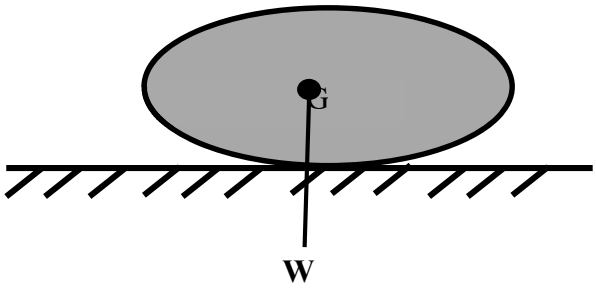
Unstable Equilibrium

Unstable equilibrium occurs when a body slight displaced the body it does not returns to its original position after displacement. **EXAMPLE** human body



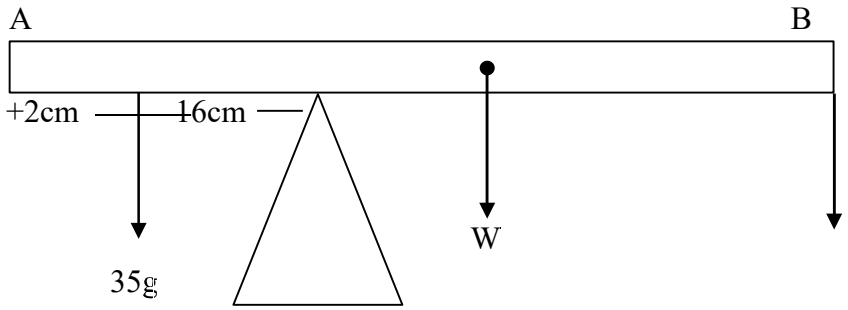
Neutral Equilibrium

Neutral equilibrium occurs when a body slight displaced the body it does not alter the position of the center of gravity. **EXAMPLE,** A ball.



[01 mark]

8. (c)



01mark

From principle of moment

Sum of Anticlockwise moment's = sum of anticlockwise moments **½ mark**

(i) 35g x 16cm = 7cm x w **½ mark**

$W = \frac{35g \times 16cm}{7cm} g$

W = 80g **½ mark**

(ii) Force = weight = mass x gravity **½ mark**

Force = 80 x 10^{-3} x 10N

Force = 0.80N **02 marks**

SECTION C (25 Marks)

9. (a) A swimmer coming out of water on windy day usually feels cold because evaporation of water from the surface of his/her body. **01mark**

As water evaporates, it absorbs latent heat of vaporization from the body which results in cooling effect. **1 ½ mark**

(b) Evidence on properties of cathode rays:

(i) When cathode rays are allowed to pass through an obstacle (in maltese cross tube), they cast a sharp shadow on a screen. This shows that cathode rays travel in straight cene. **02marks**

(ii) When cathode rays are allowed to pass through magnetic field, they deflected towards the north pole. This shows that cathode rays are charged particles with negative charge.

(iii) If a beam of cathode rays is allowed to strike a movable frictionless paddle wheel in a discharge tube, the wheel moves and rotates. This shows that cathode rays have momentum and energy. **02marks**

(c) (i) Data

L =

8cm

fo = ? fi

= ?

v = 340Hz

fo $\frac{}{4(L+C)} = {}^{V}$ .....

01 Mark fo = $\frac{340}{4(0.08+0.02)}$

Hz.....**½ mark**

fo = 850Hz **½ mark**

(c) (ii) For first overtone – f1.

f1 = 3fo **1mark**

f1 = 3 x 850Hz **½ mark**

f1 = 2550Hz **½ mark**

10. (a) LENZ'S LAW

(i) States that "The direction of induced e.m.f is such that the resulting induced current flows in such a way that the direction oppose the change that causing it". **01mark**

FARADAY'S LAW

States that "The induced e.m.f in a conductor in a magnetic field is proportional to the rate of change of magnetic linking the conductor.

01mark

(ii) (i) AC generator can be used with transformer for step up and step down. **01mark**

(ii) AC generator are much simpler and cheaper since it has slip rings which are simple and cheap compared to a commutator which are complex and costful. **01mark**

(b) Data

Np = 100turns

Ns = 10,000 turns
Vp = 12V Ip
= 5A
e = 90%
Vs = ?
Is = ?

(i) $\frac{Np}{Ns} = \frac{Vp}{Vs}$ **01 ½ marks**

Vs = $\frac{Ns}{Np} \times Vp = 12 \times \frac{10000}{100} = 1200V$ **01mark**

$\epsilon = \frac{IsVs}{IpVp}$ x 100% **01mark**

Is = $\frac{\epsilon \times Ip \times Vp}{Vs}$ x 100%

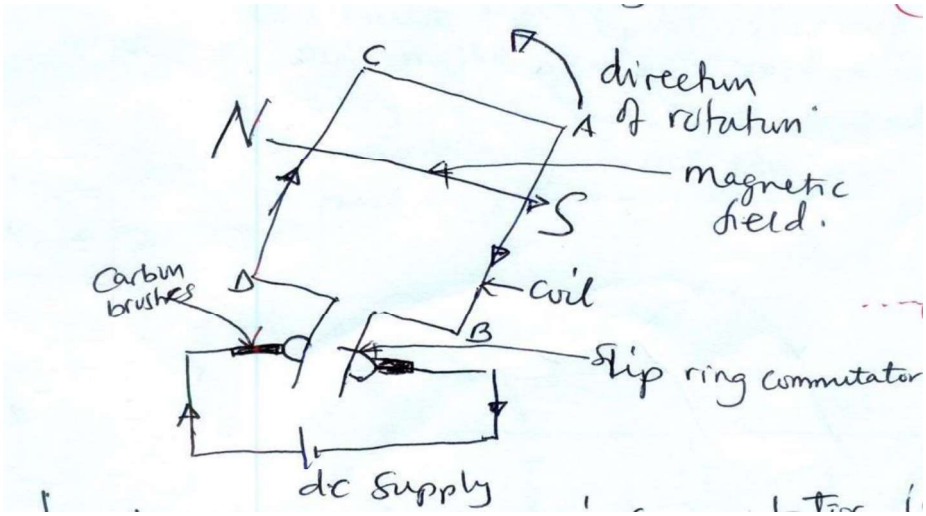
Is = $\frac{90 \times 5 \times 12}{1200}$ x 100%

Is = 0.045A **01 ½ marks**

(c) (i) The structure and mode of action of simple d.c generator.

DC Generator

Is an electrical device which converts mechanical energy into electrical energy. It mainly consists of three main parts magnetic field system, Armature and commutator and Brush gear. **½ mark**

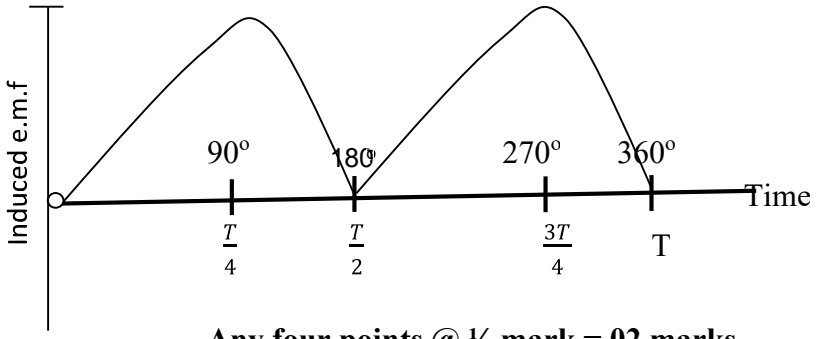


In d.c generator there is commutator instead lf slip rings as in d.c generator this prevents reverse direction of current flow. It half commutator is called commutator segment which insulated from other half commutator.

Mode of action of D.C Generator.

- When the coil is vertical no e.m.f produced due to no cutting of magnetic field on the coil. **½ mark**
- When the armature is rotate at 90° (parallel to magnetic field) the motion or force of coil is perpendicular to the magnetic field hence maximum e.m.f is induced (maximum positive). **½ mark**

- When the coil vertical (at 180º) no e.m.f produced due to cutting of the magnetic field on the coil. **½ mark**
- When the armature is rotate after 180º starting from vertical position and the side of commutator segment interchange the loop which cause the loop of current remain in the same direction. **½ mark**
- This cycle of events is repeated automatically hence electricity is produced.



Any four points @ ½ mark = 02 marks

10. (c) (ii) By increasing the flux
- the speed of motor can be increased.
- the flux can be changed by changing the current with shunt field rheostat. **½ mark**

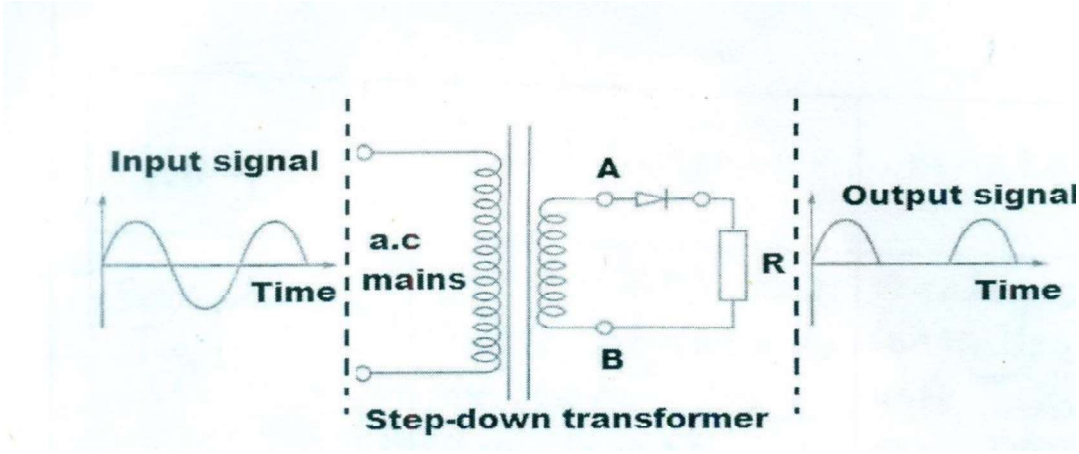
By decreasing the resistance
- In which there is increase in armature current which lead to increase in the rotation of a motor. **½ mark**

By increasing the supply voltage
- It is known that when the supply voltage is high it increase the speed of rotation of motor. **½ mark** 11. (a)

Intrinsic semiconductor	**Extrinsic semiconductor**
(i) It is pure form of semiconductor **(½ mark)**	It is an impure form of semiconductor **(½ mark)**
(ii) It exhibits conductivity **(½ mark)**	It possesses comparatively better conductivity than intrinsic semiconductor due to presence of impurities. **(½ mark)**

(iii) The conductivity depends on temperature **(½ mark)**	The conductivity depends on both concentration of dipped impurity and temperature **(½ mark)**
(iv) Equal number of charge carries i.e. equal number of electrons and holes are present in conduction and valence band **(½ mark)**	Charge carriers differ depending on types of extrinsic semiconductor **(½ mark)**

(b) (i) Half-wave rectifier



Mechanism

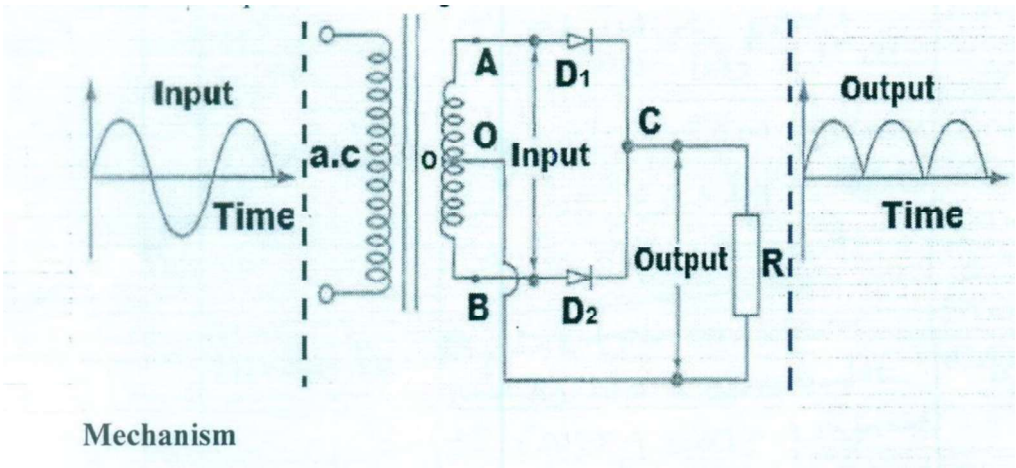
- During the first half-cycle of the sinusoidal wave form, A is positive and B is negative. The diode is forward-biased and current flows around the circuit formed by the diode
- During the second half-cycle, A is negative and, B is positive. The diode is reverse-biased therefore no current flows in the circuit

NB:

(i) The diode conducts only in every half0cycle
(ii) The rectified voltage is d.c and is always positive in value
(iii) If the diode is reversed, then the output voltage is negative

FULL-WAVE RECTIFIERS

In the circuit both halves of the a.c. cycle are transmitted but in the same direction. One way of achieving this is to have a transformer whose output has a Centre tap, that is, its output can be taken at two points one being half the other



Mechanism

- In the positive half-cycle, point A is positive with respect to O. Diode D1 conducts but diode D2 is reverse-biased. The current passes through D1, C, R and back to O
- In the negative half-cycle, point B is positive with respect to O. Diode D2 conducts but diode D1 is reverse-biased. The current passes through D2, C, R and back to O.
- The direction of the current through R is the same as in the first half-cycle

11. (b)

Key	Digital system	Analog system
Signal type	Digital system uses discrete signals as on/off representing binary format off is 0 on is 1.	Analog system uses continuous signal with varying magnitude
Wave type	Digital system uses square wave	Analog system uses sine waves
Technology	Digital system first transform the analog waves to limited set of numbers and then record them as digital square waves	Analog system records the physical waveforms as they are originally generated
Transmission	Digital transmission is easy and can be made noise proof with no loss at all	Analog systems are affected badly by noise during transmission
Flexibility	Digital system hard wave can be easily modulated as per requirements	Analog systems hard waves are not flexible
Bandwidth	Digital transmission needs more bandwidth to carry same information	Analogy transmission requires less bandwidth
Memory	Digital data is stored is form of bits	Analog data is stored inform of waveform signal
Power requirement	Digital systems needs low power as compare to its analog counterpart	Analog systems consume more power than digital system

Best suited for	Digital system are good for computing and digital electronics	Analog systems are good for audio or video recordings
Cost	Digital system are costly	Analog system are cheap
Example	Digital system are computer, CD, DVD	Analogy systems are: Analog electronics, voice radio using AM frequency

Any four difference @ 1 mark

(i) Common emitter amplifier **01mark**

(ii) Since emitter is sandwiched between base and collector. **01mark**

(iii) C_1 and C_2 used for DC isolation. **02marks**

ANSWERS

SERIES #10

FORM FOUR PHYSICS EXAMINATION - SERIES 10

MARKING SCHEME

1. (10 marks)

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
C	D	A	B	E	E	E	C	C	B

2. (5marks)

LIST A	(i)	(ii)	(iii)	(iv)	(v)
LIST B	C	A	B	E	D

3. (a) (i) By letting off some air from the tyres, each tyre flattens there by increasing the surface area in contact hence the pressure exerted by each tyre on the soft sand is reduced. In so doing prevents ~~they~~ tyres from sinking. (4MKs)

(ii) Atmospheric pressure is exerted on both sides of a window so no net force is exerted on the window and hence uniform pressure does not break glass windows. (4marks)

3(b) Data:

Mass of a trolley = 0.5kg

Speed of a trolley, V = 2m/s

From; The principle of Conservation of energy:

Maximum P.E = Maximum K.E

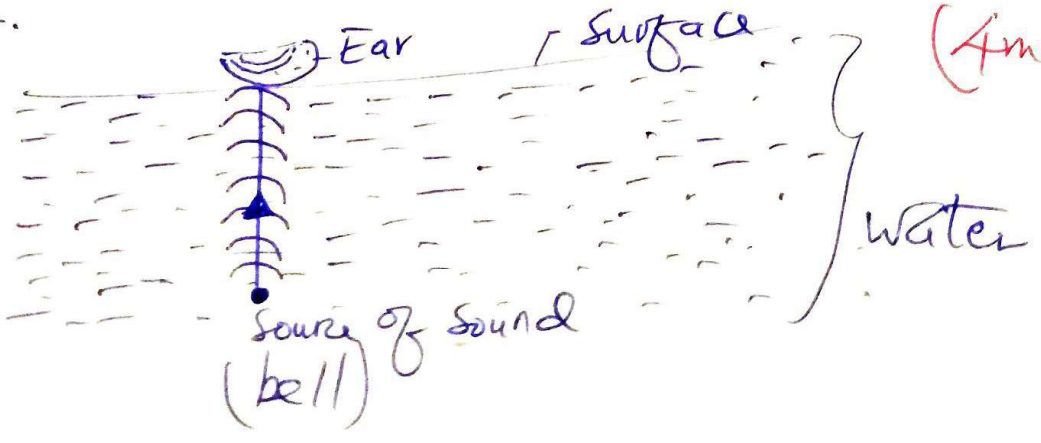
$= \frac{1}{2}mV^2$

$= \frac{1}{2} \times 0.5 \times 2^2$

= 1 Joule.

So: potential energy of a compressed spring is 1 Joule. (2marks)

4(a) Keep one of your ears gently on the surface of water without letting water into the ear. Now ring the bell inside the water. You will be able to hear the sound clearly. This shows that sound can travel through water.



(4marks)

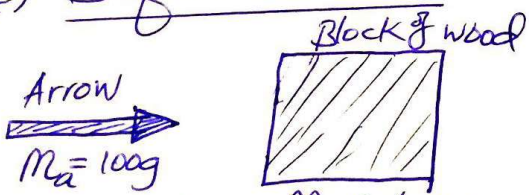
5. (a)(i) - Oscillation of a simple pendulum.
- A ball/an object thrown up ~~air~~ in air.
- Falling of a fruit from a tree
- Slidding down a hill/mountain.

(2marks) any two.

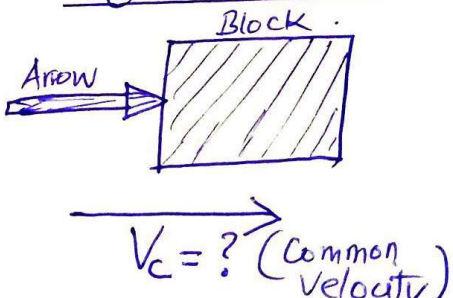
(ii) Elastic collision	Inelastic collision
- Both K.E and momentum are conserved	- Only momentum is Conserved
- Mechanical energy is not dissipated	- Mechanical energy is dissipated into heat, light, sound etc
- Forces involved are Conservative forces	- Forces involved are non-conservative forces

(4marks)

(b) Before collision



After collision



From The principle of Conservation of Linear momentum:

Total momentum before = Total momentum after impact:

$$m_a u_a + m_b u_b = (m_a + m_b) V_c$$

($u_b = 0$)

$$V_c = \frac{m_a u_a}{m_a + m_b} = \frac{100g \times 15m/s}{100g + 400g}$$

$$V_c = \frac{100g \times 15m/s}{500g} = 3m/s$$

(4marks)

∴ The common velocity after impact is 3m/s.

6. (a) It is dangerous to connect the switch in the neutral wire in case of excessive current. The fuse blows off due to excessive current and the current stops flowing in the circuit. But the appliance still remains connected to the high potential point of the supply through the live wire. Now if a person touches the body of the appliance he/she gets an electric shock. Thus, it is highly unsafe to connect a fuse (switch) in the neutral wire. (2marks)

(b)(i) 1 - Earth (E)
2 - Neutral (N) (3marks)
3 - Live (L)

(ii) Terminal 1 is connected to the outer metallic case of the appliance. (3marks)

(iii) The fuse is connected to live wire joined to 3 because in case of excessive flow of current fuse melts first and breaks down the circuit to protect appliances. (2marks)

7. (a)(i) When the bulb is lighted, the levels of oil in limb X falls while in limb Y rises. (2marks)

(ii) On lighting the bulb, The bulb which is painted black absorbs radiant energy (heat), as a result the gas inside the bulb expands pushing ~~the oil~~ down the oil in limb X in turn causes a rise of oil in limb Y. (6marks)

(b) Atmospheric pressure is low at high altitudes. Hence, boiling point of water decreases and so it does not provide the required heat energy to its contents for cooking. Due to this reason it becomes difficult to cook vegetables on hills and mountains. (2marks)

8. (a) (i) To attain the room temperature, ice cream absorbs heat energy as well as latent heat while water absorbs only heat energy. Thus ice cream absorbs more amount of heat energy from the mouth as compared to water. for this reason, ice cream appears colder than water at 0°c. (2marks)

(ii) Water has ~~high~~ large value of specific heat capacity, Therefore it absorbs more heat energy from the body at a small temperature change as a body cools. For this reason, water is a preferable liquid for quenching thirst (cooling). (4marks)

8(c) Data:

Mass of water (M_1) = 45g

Temperature of water (T_1) = 50°C

Mass of copper (M_2) = 50g

Temperature of copper (T_2) = 18°C

final temperature (T) = ?

The specific heat capacity of the copper

$C_2 = 0.39 J/g/K$

Specific heat capacity of water $C_1 = 4.2 J/g/K$

$$M_1 C_1 (T_1 - T) = M_2 C_2 (T - T_2).$$

$$T = \frac{M_1 C_1 T_1 + M_2 C_2 T_2}{M_2 C_2 + M_1 C_1}$$

$$T = \frac{(45 \times 4.2 \times 50) + (50 \times 0.39 \times 18)}{(45 \times 4.2) + (50 \times 0.39)}$$

$$T = \frac{(9450 + 351)}{(189 + 19.5)} = \frac{9801}{208.5}$$

$T = 47°C$. (3marks)

∴ The final temperature is 47°C.

Assumptions:- We assume no loss of heat energy to the surrounding air. (1mark)

9. (a) This means that a substance is 0.65 times less denser than water. (2.5marks)

(b) Mass of hydrometer = mass of water displaced
= 28g (from the law of flotation)

Volume of Water displaced = $\frac{\text{Mass of water displaced}}{\text{density of water}}$

$= \frac{28g}{1g/cm^3} = 28cm^3$

Volume of water displaced = Volume of portion of hydrometer in water.

Volume of hydrometer immersed = $28cm^3$.

Volume of hydrometer above water = Ah
$= 0.75cm^2 \times 3cm$
$= 2.25cm^3$.

(i) Total volume of hydrometer = $28cm^3 + 2.25cm^3$ (03)
$= 30.25cm^3$.

(ii) When it floats in a liquid of R.D = 1.4.

Volume of liquid displaced = $\frac{\text{Mass of liquid displaced}}{\text{Density of liquid}}$

$= \frac{28g}{1.4g/cm^3} = 20cm^3$.

Volume of hydrometer immersed = $20cm^3$.

Volume of stem above the liquid = $(30.25 - 20)cm^3$
$= 10.25cm^3$

Length of stem above, from V = Ah

$10.25cm^3 = 0.75cm^2 \times h$

$$h = \frac{10.25\,cm^3}{0.75\,cm^2} = 13.67\,cm.$$ (3marks)

∴ The length of stem above the surface when it floats in a liquid of R.D 1.4 is 13.67cm.

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9. (c) Volume of cork = $100cm^3$

Density of cork = $0.25g/cm^3$

Mass of cork = Density of cork × Volume of cork

$= 0.25g/cm^3 \times 100\,cm^3$

$= 25\,g$.

From, the Law of flotation

Mass of cork = Mass of water displaced (25g).

Mass of water displaced = 25g.

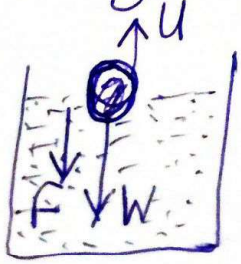
$$\text{Volume of water displaced} = \frac{\text{Mass of water displaced}}{\text{Density of water}}$$

$$= \frac{25g}{1g/cm^3}$$

i) Volume of water displaced = $25cm^3$.

∴ Volume of cork immersed = $25cm^3$. (1mark)

ii)



Upthrust = Weight of water displaced

$= mg$ ~~$0.25g \times 10N/g$~~

$= 0.025kg \times 10$

$= 0.25\,N$ (Weight of cork)

If it is totally immersed volume of water displaced = $100cm^3$, mass = $\rho V = 1g/cm^3 \times 100cm^3$

mass of water displaced = 100g

Weight of water displaced when totally immersed

$= mg = 0.1kg \times 10N/kg$

$= \underline{1N}$.

Total upthrust $= W + F_{down}$

$1N = 0.25N + F_{down}$.

$F_{down} = 0.75N$.

The force required to immerse the cork completely is 0.75N. (3marks)

10. (a) Recording studios and Concert auditoriums sometimes have their ceilings and walls covered with soft perforated boards so as to absorb sound waves from the source there by preventing from being reflected as echoes from the walls. This enables sound to be heard clearly. (2.5marks)

(b) Data:

Third overtone (4th harmonic) = 840Hz

Velocity of sound, $V = 330m/s$

For open pipe, $f_n = (n+1) f_0$ for overtones.

For 3rd overtone, $n = 3$

$f_3 = (3+1) f_0$, $840 = 4 f_0$.

$f_0 = 210Hz$.

i/ From $f_0 = \frac{V}{2l}$ for open pipe.

$210 = \frac{330}{2l}$, $l = \frac{330}{2 \times 210}$

$$l = \frac{330}{420} m = 0.79 m.$$

$l = 0.79 m$ or $79 cm$.

The length of the open pipe $= 0.79 m$ or $79 cm$. (3marks)

(ii) fundamental frequency, $f_0 = 210 Hz$. (3marks)

(c) Data:

$f_1 = 384 Hz$

$T_1 = T$

$f_2 = ?$

$T_2 = T + \frac{2}{100} T = 1.02T$.

From $\frac{f_1}{f_2} = \sqrt{\frac{T_1}{T_2}}$

$$\frac{384}{f_2} = \sqrt{\frac{T}{1.02T}}$$

$f_2 = \sqrt{1.02} \times 384 Hz$.

$= 388 Hz$.

Beat $= f_2 - f_1 = 388 Hz - 384 Hz$.

$= 4 Hz$. (4marks)

11. (a)

Human eye	lens Camera
Lens: - Biological - flexible	- Lens is artificial - a rigid glass or plastic
focal length: Variable	For camera is fixed.
Distance: The distance between the lens and retina is fixed.	The distance btn the film and the lens is variable.
focusing: By changing the shape of the lens	By moving the lens relative to the film.
Aperture: Controlled by the Iris.	Controlled by the diaphragm
Exposure: Is continuous	Controlled by the shutter
Light sensitive surface: ~~Film~~ Retina	film.

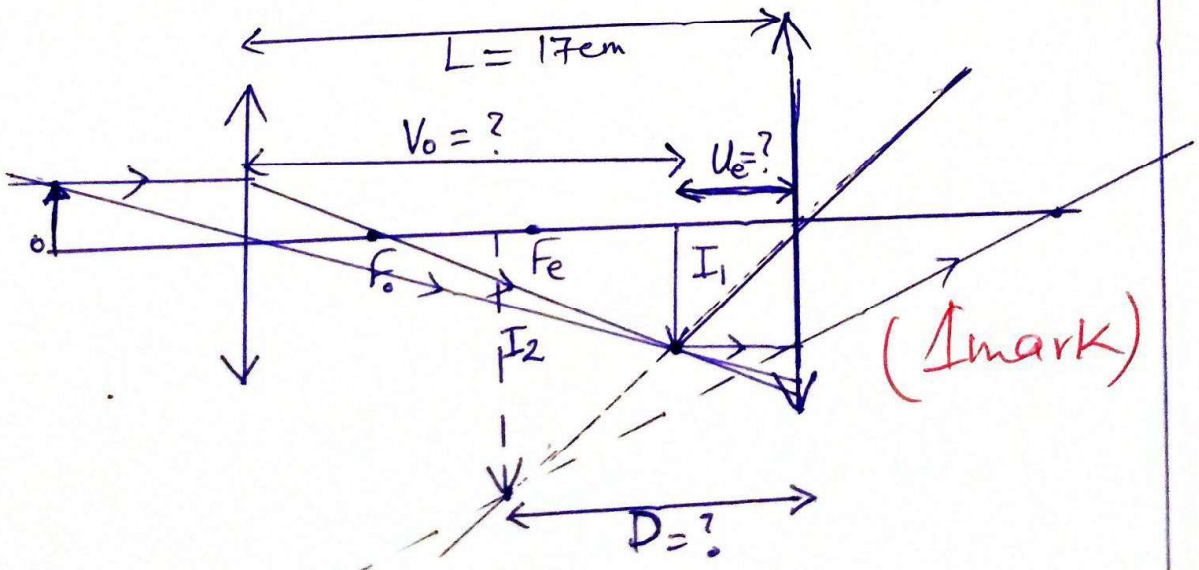
any five (5marks)

(b) Shutter controlls the amount of light entering the camera by the length of times the shutter is open. It act as a gate (2·5marks)

(c) Data:

$f_o = 2\,cm$, $f_e = 6\,cm$, $U_o = 2{\cdot}4\,cm$, $L = 17\,cm$

(i)



(1mark)

Refraction from objective lens:

from: $\frac{1}{f_o} = \frac{1}{u} + \frac{1}{v}$, $\frac{1}{2} = \frac{1}{2.4} + \frac{1}{v}$

$v = 12\,cm$.

$V_o = 12\,cm$ but $V_o + U_e = L$

$U_e = L - V_o = 17\,cm - 12\,cm = 5\,cm$.

$U_e = 5\,cm$.

Also consider the refraction from the eyepiece lens:

$\frac{1}{f_e} = \frac{1}{u} + \frac{1}{v}$ but $v = D$.

$\frac{1}{6} = \frac{1}{5} + \frac{1}{D}$, $D = -30\,cm$

$D = -30\,cm$ (According to R.P the final image is virtual).

The distance of the final image from the eyepiece lens is 30cm. (2marks)

(ii) Linear magnification (Total magnification):

$M = m_o m_e = \left(\frac{V_o}{f_o} - 1\right)\left(\frac{D}{f_e} - 1\right)$

$= \left(\frac{12}{2} - 1\right)\left(\frac{30}{6} - 1\right)$

$= (6-1)(5-1)$

$= 5 \times 4$ (2marks)

$= \underline{\underline{20}}$.