CHRISTIAN SOCIAL SERVICES COMMISSION
An Ecumenical Body of Tanzania Episcopal Conference and Christian Council of Tanzania
P.O. Box 9433, Dar es Salaam, Tanzania

CSSC-SOUTHERN ZONE FORM FOUR JOINT EXAMINATION

(MARKING GUIDE)

031/1 **PHYSICS 1 AUGUST 2024**

1.

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

2.

I	II	III	IV	V	VI
C	G	H	A	E	D

3. **From** the Diagram:

Data: y= 30cm, x =6cm, Area, a = 4cm^2, Area, A =120cm^2, Effort, E = 60N.

(a) Force F exerted on piston 'a'

Since E is applied at the distance y from the fixed point, then by considering the moment about the lever:

E x Y = X x F

60N x 30cm = F x 6cm

F = 60N x 30cm/6cm

F = 300N.

The force exerted on piston 'a' is 300N (03marks)

(b) The maximum load (W) that could be raised:

From Pascal's principle,

F/a =W/A

300N/4cm^2= W/120cm^2

W = 300 X 120/4

W = 9000N.

The maximum load that could be raised is 9000N (03marks)

(c) Given VR of the hydraulic press = 100 and VR of the lever = 2

Total Velocity ratio , VR =2×100

= 200

From efficiency =MA/VR X 100%

But MA = L/E

=9000N/60N

MA =150

e =150N/200N X100%

e = 75%

The efficiency of the hydraulic press system is 75% (03marks)

4. (a) From the law of floatation,

The weight of floating body = weight of liquid displaced

Mass of hydrometer x g = v x ρ x g

Mass = v x ρ

15 = A x l x ρ

15 = 2 x l x 1

L = 7.5cm.

The length immersed in water is 7.5cm (04.5marks)

(b) When floating in a liquid of density, ρ

Mass x g = A x l x ρ x g

15 = 2 x 10 x ρ

P = 0.75 g/cm^3 or 750 kg/m^3

The density of the liquid is 0.75 g/cm^3 or 750 kg/m^3 (04.5marks)

5. (a) The one with bright shining colour will be preferred during the hot sunny day because it is poor absorber of heat energy therefore it ensure inside the car cool, at the same time the car with the same bright shining surface is preferred during the cold night because it is poor emitter or radiator of heat energy therefore prevent heat loss inside the car. **(05marks)**

(b) Data given.

Change in length = 15m

Original temperature (Q1) = 10^o C

Final temperature (Q2) = 30^o C

Superficial expansivity (β) 0.04/^{o}C

Required: Initial length (L_1) =?

From β = 2α,

$\alpha = \frac{\beta}{2} = \frac{0.04}{2} = 0.02/^oC$ **(01 mark)**

From $\alpha = \frac{\Delta L}{L1\Delta Q}$ **(01mark)**

$L_1 = \frac{\Delta L}{\alpha \Delta Q} = \frac{15}{0.02(30-10)}$ **(01mark)**

$L_1 = 37.5m$

Therefore, the new length is 37.5m **(01mark)**

6. **(a) According to kinetic theory of gas, gas molecules or atoms are considered to move with constant random motion. In the enclosed vessel, gas molecules move in straight line colliding**

themselves and also colliding with the wall of the vessel. Now when temperature increases the K.E of the molecules increases and the rate of collision increases as well. If the initial momentum of the molecule = mv, then the final momentum = -mv

Therefore, change in momentum = mv –(-mv)

= 2mv

From the second newton's law, F = change in momentum/time

= 2mv/t.

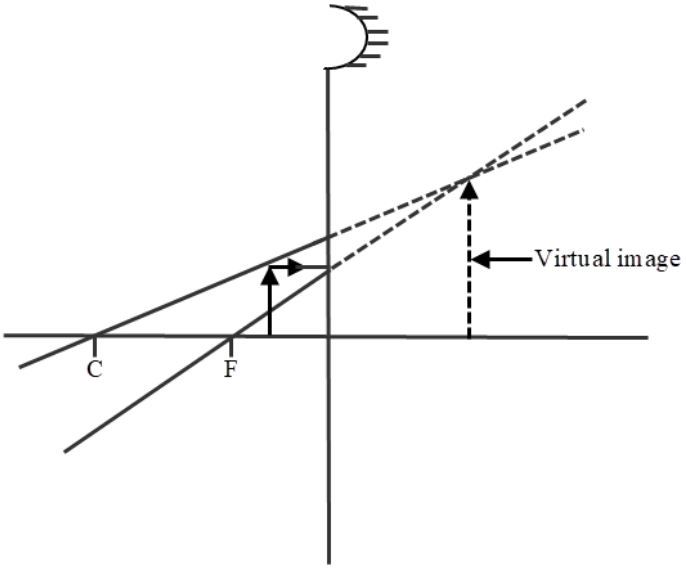
This force exerts on the wall of a container. Therefore,

P = F/A

= 2mv/At

This expression shows that as temperature increases with time, pressure also increase inside the container at constant volume. (04marks)

(b)



The image formed is:

- **Virtual image**
- **Upright**
- **Magnified**
- **Formed behind the mirror** **(03 for diagram, 02marks for properties)**
- Data given

7. (a) Current of fuse = 8A

Voltage mains = 240V

Total power of appliances = 1200+800+400 = 2400W **(01mark)**

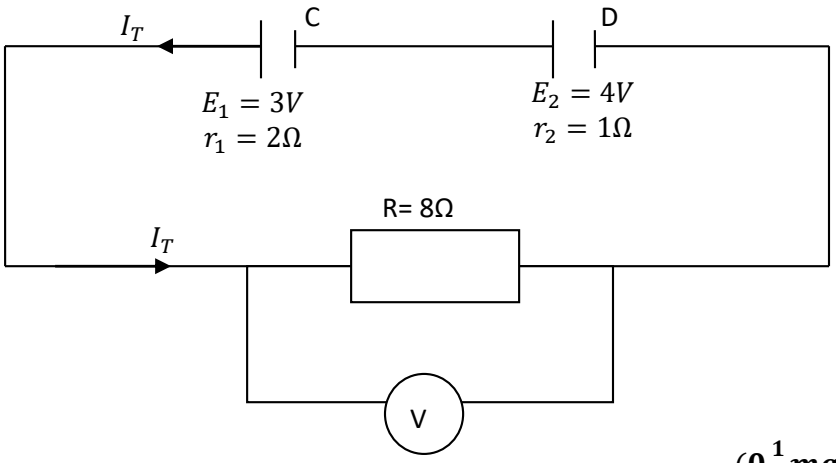
From Current (I) = $\frac{power}{voltage} = \frac{2400}{240}$ = 10A **(01mark)**

The total current produced by all appliances is 10A**. (01mark)**

Then the fuse will blow off since the current of appliance is greater than that of fuse i.e $10A > 8A$ **(02marks)**

(b) Solution

Consider a re – drawn circuit below



$(\mathbf{0\frac{1}{2}mark})$

According to Ohm's law,

$$V = I_T \times R$$

$$V = I_T \times 8\Omega \_\_\_\_ (i) (\mathbf{0\frac{1}{2}mark})$$

$$But\ I_T\ is\ given\ as\ follows$$

$$E_T = I_T(R + r_T)$$

$$I_T = \frac{E_T}{R + r_T} \qquad (\mathbf{01\ Mark})$$

$$I_T = \frac{E_1 + E_2}{R + r_1 + r_2}$$

$$I_T = \frac{3V + 4V}{8\Omega + 2\Omega + 1\Omega}$$

$$I_T = \frac{7V}{11\Omega} \qquad (\mathbf{01\ Mark})$$

$$I_T = 0.636A \approx 0.64A$$

$$From\ eqn(i)$$

$$V = 0.64A \times 8\Omega$$

$$V = 5.12V \qquad (01\ Mark)$$

$$\therefore The\ p.d\ across\ the\ 8\Omega\ resistor\ is\ 5.12V$$

$$(\mathbf{01\ Mark})$$

7 (a) Data given:

Let specific heat capacity of water (Cw)= y

Specific heat capacity of acid (Ca) = $\frac{y}{2}$

Mass of water Mw = x

Mass of acid Ma = x **(01mark)**

Initial temperature of water Qw = 20^o C

Initial temperature of acid Qa = 80°C

Required: Temperature of the mixture (Qf)

From heat lost by acid = heat gain by water **(01mark)**

Ma x Ca x ΔQa = Mw x Ca x ΔQa

X x $\frac{y}{2}$ x (80-Qf) = X x y (Qf-20) **(01mark)**

80-Qf = 2Qf-40

3Qf = 120 **(02mark)**

Qf = 40° C

Therefore, the final temperature of the mixture is 40°C **(01mark)**

(b) When the hand is moved closer (approaches) to the plate, it will influence the charge distribution in the electroscope through a process called electric induction. (1.5 marks)

When the hand is moved away from the electroscope's plate, the original charge distribution on the electroscope will tend to restore and the leaf will return to its original degree of divergence (1.5 marks)

9. (a) The phenomenon is called electromagnetic induction. This phenomenon explains that whenever there is a change in magnetic flux linking a conductor and a magnet, an emf that drives the current is induced across a conductor. This phenomenon is governed by two laws called faraday's law and lenz's law of electromagnetic induction.

(03 Marks)

(b) (i) I will prefer to use the aluminum cables because are lighter and form a protective layer (oxide layer) when exposed to air. This prevents further corrosion. This make the aluminium cables to be handled and installed very easily and can be used over a long period of time. **(03 Marks)**

(ii)I will use a step – up transformer to transfer the power at high voltage (low current). This is because when power is transmitted a high voltage, there will be minimal power loss in form of heat energy due to the resistance of the cables. Therefore, a lot of megawatts of power will reach the consumers.

(03 Marks)

(c) Solution

Given,

Vp = 220V

Is = 8A

Vs = 75V

Wasted (lost) energy percent = 20%

Required the current (Ip) in the primary winding.

From,

$$e = \frac{Is \times Vs}{Ip \times Vp} \times 100\% \qquad (\mathbf{01\ Mark})$$

$$e \times Ip \times Vp = Is \times Vs \times 100\%$$

by making Ip the subject

$$Ip = \frac{Is \times Vs \times 100\%}{e \times Vp} \quad (\mathbf{01\ Mark})$$

$$Ip = \frac{8A \times 75V \times 100\%}{e \times 220V} \quad \text{____(i)}$$

But $e = 100\% - 20\%$ (**02 Marks**)

$$e = 80\%$$

$$\text{Thus, } Ip = \left(\frac{6000}{80 \times 22}\right) A$$

$$Ip = 3.4A \qquad (\mathbf{01\ Marks})$$

∴ The current in the primary winding is 3.4A (**01 Marks**)

10. (a) effects of global warming

- Loss of biodiversity
- Rising of sea level due to thermal expansion of oceans, melting of ice sheets and glaciers
- Climatic change

Solutions to control

- Afforestation and reafforestation
- Encourage on the use of clean energy
- Emphasize on the use of public transport to reduce private vehicles which may reduce carbonic gases
- Government to adopt carbon emission policies (04marks)

(b) i. Dopping is the process of inducing impurities in a semiconductor material in order to increase conductivity of the material.

ii. Rectification is the process of changing ac to dc

iii. Coupling is the process of pairing or linking the input signals from one single stage amplifier to another as isolated d.c (06marks)

(c). Bulb 1 in circuit number 1 will light on because the diode is in forward biasing where current is allowed to flow, but bulb 2 in circuit number 2 will light off because the diode is in reverse biasing where there is no flow of current. (**05 marks)** Solution

11. (a) Required the fundamental frequency ($\mathbf{f_o}'$) when the tension (T_1) is four times the original ($T_1 = 4T_o$)

From,

$$f_o = \frac{1}{2L}\sqrt{\frac{T_O}{\mu}}$$

$$\text{if } fo' = \frac{1}{2L}\sqrt{\frac{T_1}{\mu}} \qquad (\mathbf{01\ Mark})$$

$$fo' = \frac{1}{2L}\sqrt{\frac{4T_O}{\mu}}$$

$$fo' = \frac{1}{2L} \times 2\sqrt{\frac{T_O}{\mu}}$$

$$fo' = \frac{2}{2L}\sqrt{\frac{T_O}{\mu}} \quad (\mathbf{02\ Mark})$$

$$fo' = \frac{1}{L}\sqrt{\frac{T_O}{\mu}} \quad \text{_____(i)}$$

$$\text{from, } f_o = \frac{1}{2L}\sqrt{\frac{T_O}{\mu}}$$

$$2f_o = \frac{1}{L}\sqrt{\frac{T_O}{\mu}} \quad \text{_____(ii)}$$

equate eqn(i)and (ii)

$$f' = 2f_o = \frac{1}{L}\sqrt{\frac{T_O}{\mu}} \quad (\mathbf{01Mark})$$

$$\therefore fo' = 2f_o$$

∴ The new fundamental frequency will be two times the original fundamental frequency (**02 Mark**)

(b) yes, a sound can break a wine glass. This is because when the external source of sound is sounded near the wine glass, it makes a glass into vibrations. when the frequency of sound from the source matches the natural frequency of a glass, resonance occurs. this makes a glass to vibrate at its maximum amplitude causing the glass to break into pieces.

(04 marks)

(c)when a string is heated, it expands and becomes loosen causing the change(decrease) in its fundamental frequency. also, when a string cooled, it contracts and becomes very tight causing the increasing in tension causing the change (increase) in the fundamental frequency. so, the musician must re – tune the instrument depending on the temperature change so as to restore the natural fundamental frequency of a stringed instrument. (05 marks)