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 TWO EXAMINATION

031 PHYSICS MARKING SCHEME YEAR 2025

1.

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

01 Mark@

2.

i	ii	iii	iv	v
E	D	F	A	B

01 Mark@

3. (a) (i). **Electrifying by contact** involves charging a neutral object by touching it with a charged object, allowing electrons to transfer directly and redistribute. *02 Marks*

While

Electrifying by friction involves rubbing two different materials together, causing electrons to transfer due to differences in attraction to the nucleus, leaving one object positively charged and the other negatively charged

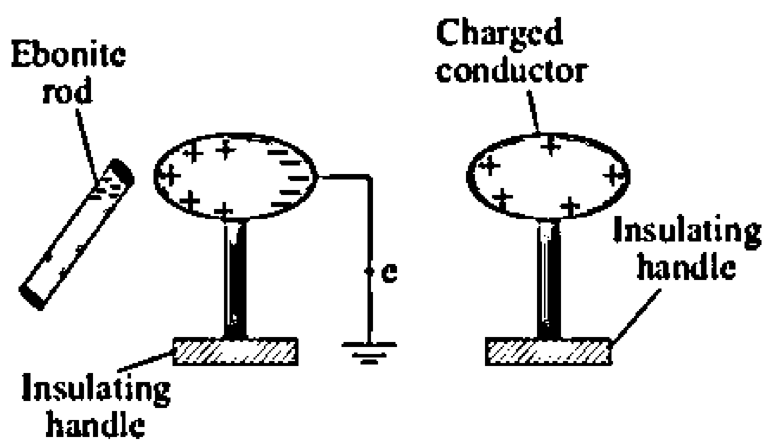
(ii). **Electrifying a body by induction**.

It is a method used to charge an object without actually touching the object with any other charged object.

The inducing charge must be of an opposite sign where by induction induces opposite charge to the uncharged body by bringing a charged body nearby an uncharged body.

In the figure below, earthing is removed first then charging rod. The body is left with a net positive charge. *02 Mark*

Consider the following diagram



02 Marks

Charging a body positively by induction

(b) **Solution**

Data

Capacitance of A (C_1) = 10μF

Capacitance of B (C_2) = 20μF

Capacitance of C (C3) = 30μF

Series connection of capacitor is given by

$$\frac{1}{C} = \left(\frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3}\right)$$ *01 Mark*

$$\frac{1}{C} = \frac{1}{10} + \frac{1}{20} + \frac{1}{30}$$

$$= \frac{6+3+2}{60}$$ *01Mark*

$$\frac{1}{C} = \frac{11}{60}$$ *01 Mark*

$$C = \frac{60}{11}$$

$$C = 5.45\ \mu F$$ *01Mark*

∴The value of a single capacitor is $5.45\ \mu F$

4. (a) (i) **Gravitational potential energy**- refers to the energy stored due to an object's height in a gravitational field. Example; ball held above the ground, a car on a hill, (P.E = mgh) *02Marks*

While

Elastic potential energy- refers to the energy stored in an object that is stretched and compressed. Example; the energy possessed in rubber bands, springs or a bow and arrow. *02Marks*

(ii) The work done will be equal to zero because there will be no force moved in the direction of the force. *02Marks*

(b) **Solution**

Data

The volume of the ballon (V) = $30m^3$

Density of hydrogen (ρ_h) = 0.089 kg/m^3

Density of air (ρ_{air}) = 1.29 kg/m^3

Mass of balloon (m) = 6kg

let extra weight be x

Total mass = mass ballon + hydrogen + x *01Mark*

$= 6kg + \rho_h V_h + x$

$= 6kg + 0.089 \times 30 + x$

$= 6kg + 2.67 + x$

$= 8.67 + x$ *01Mark*

Mass of air displaced by a balloon $= \rho_{air} \times V_{air}$ *01Mark*

$= 1.29 \times 30$

$= 38.7kg$

$8.67kg + x = 38.7kg$

$x = 38.7kg - 8.67 kg$

$x = 30.03kg$

01Mark

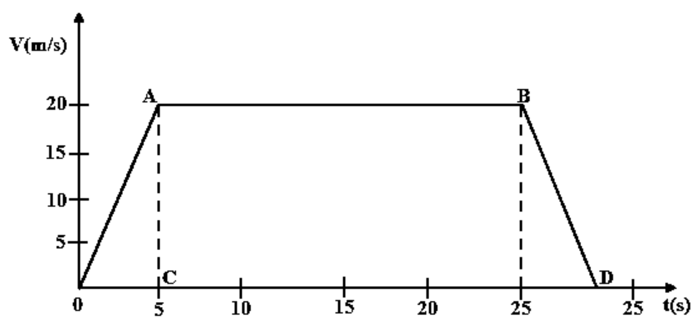
∴**The extra weight = 30.03kg**

5. (a) (i) Inertia is the tendency of an object to resist a change in its state of motion.
When you're in a moving vehicle, your body is also moving at the same speed as the vehicle. If the vehicle suddenly stops (e.g., during a crash), your body tends to keep moving forward due to inertia. *02 Marks*
Without a seatbelt, nothing restrains your motion, so you could be thrown forward into the dashboard, windshield, or out of the vehicle, causing serious injury or death

(ii) This phenomenon is explained by **Newton's Third Law of Motion**, which states:
"For every action, there is an equal and opposite reaction."
When **Kiragwa throws an object forward** out of the boat (the **action**), the object exerts an **equal and opposite force** back on Kiragwa and the boat (the **reaction**).
Since the boat is floating on water and has relatively little resistance, this opposite force causes it to **move backward**.
This is a clear demonstration of action–reaction pairs: *02 Marks*

- **Action:** Force on the object forward
- **Reaction:** Force on the boat backward

(b) (i) VELOCITY (m/s) TIME (s) GRAPH.



03 Marks

(ii) From the value of acceleration and its equation

$a = v/t$

$v = 4m/s^2 \times 5\ s$ *01 Mark*

$= 20m/s$

The maximum velocity attained is 20 m/s

Total distance covered

Area AOC + Area ABCE + Area BED *01 Mark*

$= (½ \times \frac{20m}{s} \times 5s) + (\frac{20m}{s} x\ 20 \frac{m}{s}) + (\frac{1}{2} x \frac{20m}{s} x\ 3\ s)$

$= 50m + 400m + 30m$

∴**Total distance covered is 480m** *01 Mark*

6. (a) (i) To effectively reduce the perceived steepness of the hill, making it easier to pedal up. By increasing the distance travelled, the angle of the incline is reduced requiring less effort to climb. *01 Mark*

(ii) **Solution**

Data

Effort =150N

Efficiency (ϵ) =80%

Velocity ratio (Number of pulleys) = 6

$$\epsilon = \frac{M.A}{V.R} \times 100\%$$ *01 Mark*

$$M.A = \frac{\epsilon \times V.R}{100}$$

$$M.A = \frac{80 \times 6}{100}$$ *01 Mark*

$$M.A = 4.8$$

$$M.A = \frac{Load}{Effort}$$

$$L = M.A \times E$$ *01 Mark*

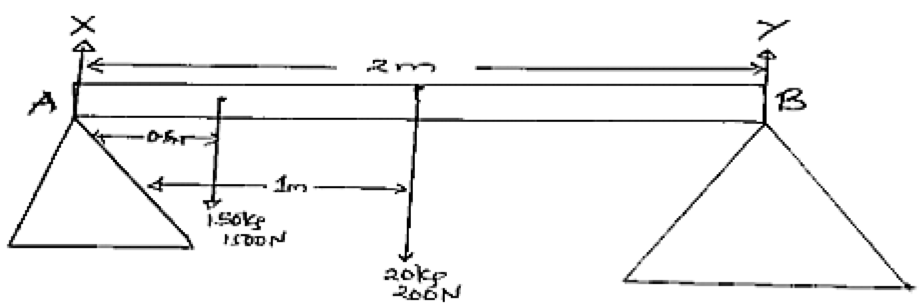
$$L = 4.8 \times 150$$

= 720 N

∴**Load maximum raised by effort applied is 720N** *01 Mark*

(b) (i). Because the center of gravity is further away from the support point, making it less stable. *01 Mark*

(ii).



01 Mark

Let the moment about A

Clockwise moment = Anticlockwise moment

1500 ×0.5 + 200 x 1 + x × 0 =2y

750 + 200 + 0 =2y *01 Mark*

950/2 =2y/2

y =475N

But total upward force = total downward force

x + y =1500N +200N

x + 475N =1700N

x =1700N-475N *01 Mark*

x =1225N.

∴**The thrusts at the supports are 475N and 1225N** *01 Mark*

- (Assumption made the beam is uniform).

7. (a) (i). Heating water would decrease the curve of the meniscus because the surface tension of water decreases as the temperature increases. Also, as water is heated, the kinetic energy of the molecules increases, causing them to move faster and break away from the surface more easily *02 Mark*

(ii). This is because of surface tension which strives for the minimum surface area and a spherical shape has the smallest surface area for a given volume. *02 Mark*

(b) (i). The law governing this is HOOKE'S LAW
States that "Within the elastic limit of the spring, the extension of the spring is directly proportional to the force applied provided that the elastic limit is not exceeded"

Mathematical expression for it

$F \alpha e$ *02 Mark*

$F = Ke$

$K = (\frac{F}{e})(\frac{N}{M})$

Where K = spring constant
F = force applied
e = extension

Solution

(ii). **Data**

Force one (F_1) = 9.6N
Force two (F_2) = 14.4N
Force three (F_3) = required
Extension one (e_1) = 6 cm = 0.06 m,
Extension two (e_2) = 9cm = 0.09m,
Extension three (e_3) =15cm =0.15m

From Hooke's law *01 Mark*

F α e

$F = ke$

$K = 9.6N/0.06m \ 160N/m$

Also verifying "K" using second data.

$K = F_2/e_2$

$= 14.4N/0.09m$ *01 Mark*

$= 160N/m$

Use a spring constant K to find the force required to stretch the spring by 15cm

$F_3 = Ke_3$ *01 Mark*

$= 160N/M \ X \ 0.15m$

Force required is 24N

∴**Force required to stretch the spring by 15cm is 24N.** *01 Mark*

8. (a) (i) It is used in industries to compress bulky items. Eg a large bale of cotton into a small size for more economical transport.
(ii) It is used in hydraulic brake system. *01 Mark@ = 4 marks*
(iii) It is used in industries in the forming of metals.
(iv) It is used in lifting heavy loads.

(b) (i) **Solution**

Data

Diameter of master cylinder (d) = 2cm
Diameter of slave cylinder (D) = 3.5 cm
Distance by master cylinder (h_1) =10cm
Distance by slave cylinder (h_2) = ?
Small force (f) = 50N
Large force (F) = ?

From $d^2h_1 = D^2h_2$ *01 Mark*

$$h_2 = \frac{d^2h_1}{D^2}$$

$$h_2 = \frac{2\times2\times10}{3.5\times3.5}$$ *01 Mark*

$$= 3.3\text{cm}$$

∴The brake shoe will move 3.3 cm *01 Mark*

(ii) Solution

From;

$$\frac{f}{a} = \frac{F}{A}$$ *01 Mark*

$$F = \frac{f\times A}{a}$$

$$F = \frac{f\times\pi D^2}{\pi d^2}$$

$$F = \frac{50\times3.5^2}{2^2}$$ *01 Mark*

$$= 153.125\text{N}$$

∴The force against the brake drum is 153.125N *01 Mark*

9. (a) (i). This is because mercury has the following

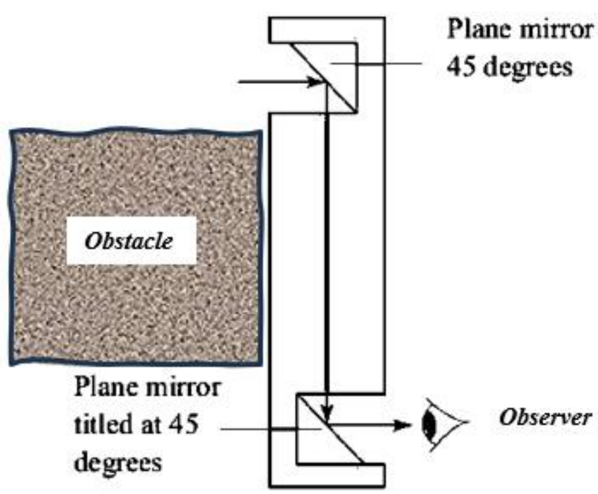
- It does not wet glass.
- It is not volatile.
- It is opaque; so easily seen.
- It does absorb much heat from substance being measured since it has small capacity.
- It is a good conductor of heat.
- It expands steadily.

01 Mark@ = 5 marks

Any five

(ii) To prevent the mercury from falling back quickly after the thermometer is removed from the body, allowing an accurate and stable temperature reading. *01 Mark*

(b) A periscope works by applying reflection of light. It consists of a tube fitted with mirrors at each end. The mirrors are parallel and tilted at an angle of 45°. Light enters the upper of the periscope reflects off the first mirror, travel down the tube and then reflects off the second mirror to the observer's eye. Therefore, a soldier inside a trench can see an enemy outside through that mechanism. *01 Mark*



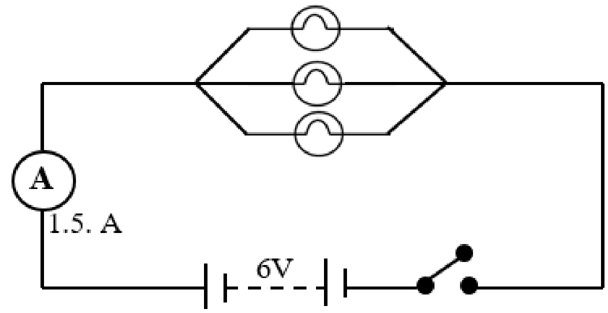
03 Marks

Structure of the periscope

10. (a) (i) State Ohm's law states that "The current flowing through a conductor at constant temperature is directly proportional to the potential difference across the ends of the conductor" ***04 Marks***

(ii) Resistance increases with decrease in cross section area and vice versa. ***03 Mark***

(b) (i) The bulb should be connected in parallel.



03 Marks

Figure 3

(ii) If each resistor has a resistance R

$$R_T = \frac{V_T}{I_T}$$ ***01 Mark***

$$R_T = \frac{6V}{1.5A}$$

$$R_T = 4\Omega$$ ***01 Mark***

Now each resistor (bulb) has a resistance of $\frac{4}{3}\Omega$

In parallel connection

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$ ***02 Marks***

$$\frac{1}{R_T} = \frac{1}{(4/3)} + \frac{1}{(4/3)} + \frac{1}{(4/3)}$$

$$\frac{1}{R_T} = \frac{3}{4} + \frac{3}{4} + \frac{3}{4}$$

$$\frac{1}{R_T} = \frac{9}{4}$$

$$R_T = \frac{4}{9}$$

$$R_T = 0.4\Omega$$

∴ <u>Equivalent resistance is 0.4Ω</u> ***01 Mark***