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

Year: 2025

PHYSICS 1 MARKING SCHEME

1. **Answers**

01 Mark @ (Total 10 marks)

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

2. **Answers**

i	ii	iii	iv	v	vi
K	I	F	E	B	C

01 Mark @ (Total 5 marks)

SECTION B

3. (a) (i) The wave phenomenon is the refraction of water waves. Water waves refract when there is a change of depth. From the figure, straight water waves come from deep water to shallow water which has the shape of biconvex. When water pass through that area they converge to a focus F and diverge after leaving the area just above the biconvex perspex. *03 Marks*

(ii) The main function of the biconvex perspex is to reduce the depth of water to make shallow water of the biconvex shape. This enables refraction. *02 Marks*

(b) The applications of refraction of waves are:

(i). It is used in optical instruments which focus or spread light eg. Camera, microscopes and telescopes. *1 Mark @*

(ii). Spectacles worn by people with visual impairment use principle of refraction of light.

(iii). It is used to identify purity of substances by determining the refractive index of the materials.

(iv). In medicines, refraction is used to determine eye's refractive errors.

4. (a) The coefficient of static friction is typically larger than the coefficient of kinetic friction because it takes more force to initiate motion (static friction) than to maintain it (kinetic friction), due to the increased surface interaction and interlocking of irregularities when objects are at rest *03 Marks*

(b) **Solution**

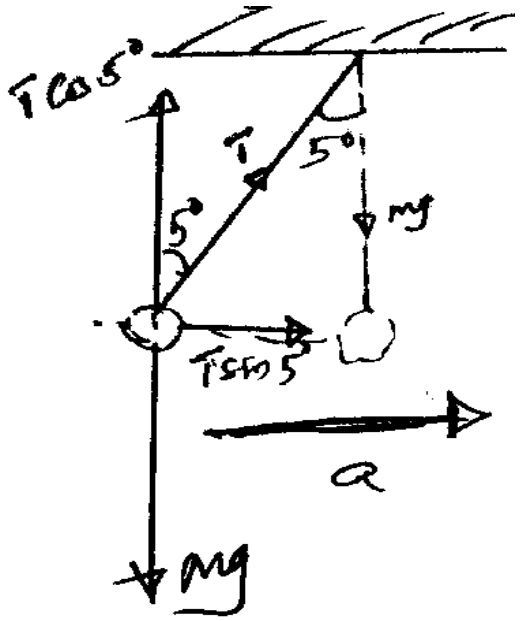
Data

Angle (θ) = 5°

Acceleration (a) = ?

Acceleration due to gravity (g) = 10m/s

Diagram



01 Mark

From the diagram *01 Mark*

Tcos 5° = mg…… (i)

Horizontal force Tsin 5° is the one which causes acceleration.

i.e. Tsin 5° = ma……(ii) *01 Mark*

Divide eqn (ii) by eqn (i)

$\frac{\text{Tsin } 5°}{\text{Tcos } 5°} = \frac{ma}{mg}$ *01 Mark*

Tan 5° = $\frac{a}{g}$ *02 Marks*

a = g Tan 5°

= 0.875m/s^2

∴ **The acceleration of the train is 0.875m/s^2** *01 Mark*

5. (a) **Solution**

Data

Mass (m) = 60kg

Perpendicular distance (d) = 2.5m

Acceleration due to gravity (g) = 10 N/kg

Moment = F*d *01 Mark*

= mgd

= 60 × 2.5 × 10 *03 Marks*

= 1500Nm

∴ **The moment of a force is 1500 Nm** *01 Mark*

Answer

(b) While riding a bicycle, **three** simple machines are effectively used: **wheels and axles**, **pulleys** (the chain), and **levers** (the pedals and handlebars)**.** *04 Marks*

Answer

6. (a) Wearing several clothes is better than a single thick cloth during cold season because several ***clothes trap air*** between them which acts like insulator since air is the poorest conductor of heat. *03 Marks*

(b) Solution *02 Marks*

Data

Refractive indices = 1.3, 1.4 and 1.5

Real depths = 30cm, 16cm and 20cm

Overall apparent depth = ?

$h_1 = \frac{H}{n_1} = \frac{30}{1.3} = 23.1\text{cm}.$

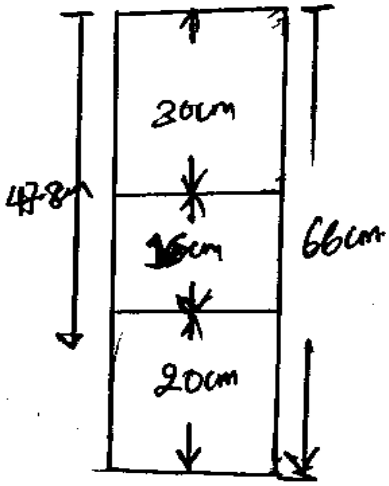
$h_2 = \frac{H}{n_2} = \frac{16}{14} = 11.4\text{cm}.$

$h_2 = \frac{H}{n_3} = \frac{20}{1.5} = 13.3\text{cm}.$

$h = h_1 + h_2 + h_3$

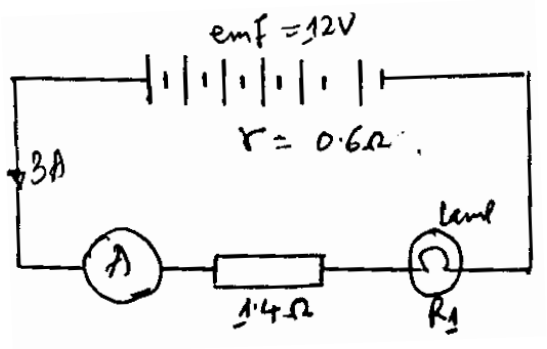
$= 23.1\text{cm} + 11.4\text{cm} + 13.3\text{cm}$

∴ The apparent depth is 47.8cm *04 Marks*



7. (a) **Solution**

Data



01 Mark

(i). Total circuit resistance $= (6 \times 0.1) + 1.4 + R_1$ *01 Mark*

$= 0.6\ \Omega + 1.4\ \Omega + R_1$

$= 2 + R_1$

Total emf (E) $= 6\text{V} \times 2$

$= 12\text{ V}$

From $V = IR$

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

$(2 + R_1) = \frac{12}{3}$

$(2 + R_1) = 4$

$R_1 = 4 - 2$

$= 2\Omega$

∴ The resistance of the filament is 2Ω *01 Mark*

(ii). The p.d across the lamp = $I R_1$
= 3×2
= $6\ V$

∴ The p.d across the lamp is 6V *01 Mark*

(iii). Total external resistance = $(1.4 + 2)\ \Omega$
= $3.4\ \Omega$

P.d across the battery = 3.4×3
= $10.2V$

∴ The p.d across the battery is 10.2V *01 Mark*

(b) **Answer**

The defects of the cell are;

(i). Polarization
(ii). Local action

Polarization is the process of forming hydrogen bubbles around the copper plate *01 Mark*

While

Local action is the process of a cell to be used up when no external current is flowing *01 Mark*

Ways of minimizing

(i). Polarization can be minimized by using a suitable ***oxidizing agent*** called depolarizer eg Potassium dichromate which oxidizes the hydrogen to form water *01 Mark*

(ii). Local action can be overcome by ***amalgamating the zinc plate with mercury***. It is done by rubbing some mercury on the zinc plate. This makes zinc to dissolve only when the cell is supplying current to the external circuit. *01 Mark*

8. (a) **Answer**

(i). Space-based telescopes can observe a wide range of electromagnetic radiation, including **ultraviolet**, **X-ray**, **gamma-ray**, and infrared light, as well as visible light. This is because there is no ozone layer beyond the earth's atmosphere. *$01\frac{1}{2}$ Marks*

(ii). Ground-based telescopes can observe **visible light** and **radio waves**, with some **infrared** wavelengths detectable from high-altitude locations, but not *ultraviolet*, *X-ray*, or *gamma-ray radiation* since they cannot penetrate atmosphere *$01\frac{1}{2}$ Marks*

(b) **Answer**

Three ways of recording pendulum motion in seismograph.

(i). **Mechanical method**.

In mechanical method, a smoked paper is wrapped round a clock driven rotating drum and mounted to move with the Earth. A moving pen connected to the pendulum presses lightly on the paper. The drum rotates so that the recorded lines are not superimposed on each other. Deflection is magnified by single or double multiplying levers. *02 Marks*

(ii). **Mechanical method**.

In mechanical method, a smoked paper is wrapped round a clock driven rotating drum and mounted to move with the Earth. A moving pen connected to the pendulum presses lightly on the paper. The drum rotates so that the recorded lines are not superimposed on each other. Deflection is magnified by single or double multiplying levers. *02 Marks*

(iii). **Electronic method**.

Electromagnetic instruments, a coil is fixed to the mass of the pendulum and move in a magnetic field. The motion of the coil generates the emf in the same way as dynamo does. The voltages produced by motions of the pendulum are passed through electronic circuits for amplifications. *02 Marks*

SECTION C

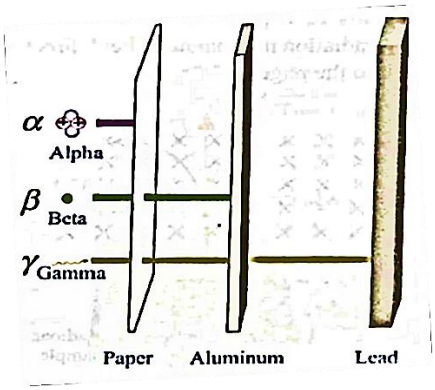
9. (a) **Answer**

(i). α- particles have low penetrating power and can be stopped by a thin sheet of paper. *01 Mark*

(ii). β - particles have moderate penetrating power, they can penetrate a sheet of paper but can be stopped by a thin aluminium sheet. *01 Mark*

(iii). γ-rays (radiation) is highly penetrative as it can penetrate air, sheet of paper and aluminium sheet. But γ-rays can be stopped by several centimetres of lead or concrete *01 Mark*

The figure below shows the penetration ability of different nuclear radiation.



03 Mark

(b) Answer

(i). Focusing anode voltage **should remain unaltered.** *02 Mark*

(ii). Grid voltage **should be altered** since it is the one which control brightness. *02 Mark*

(iii). Accelerating anode current **should remain unaltered.** *02 Mark*

(c) **Solution**

Data

Current gain (β) = 200

Base current (I_B) = 2μA

Collector current (I_C) = ? *01 Mark*

From IC = βI_B

= $2 \times 200 \times 10^{-6}A$ *01 Mark*

= $4 \times 10^{-4}A$

∴ The p.d across the battery is 10.2V *01 Mark*

10. (a) Parts of induction coil

(i). **SG** Spark gap

(ii). **P** Primary coil

(iii). **S** Secondary coil

(iv). **M** Soft iron core

(v). **B** Battery

(vi). **C** Capacitor

(vii). **K** Platinum contact

(viii). **A** Soft iron armature

00$\frac{1}{2}$ Mark@

(b) Application of induction coil

(i). An induction coil is commonly used in ignition systems of internal combustion engines

(ii). A smaller version of induction coil is used to trigger flash bulb tubed used in cameras and strobe light

(iii). An induction coil is also used in wireless telegraph

(iv). An induction coil is used in cooking, example induction cooker

01 Mark@ (Total 4 marks)

(c) **Solution**

Data

Primary turns (N_p) = 100

Secondary turns (N_s) = 10 000

Primary voltage (E_p) = 12V

Secondary voltage (E_s) = ?

Secondary Current (I_s) = ?

Primary Current (I_p) = 5A

Efficiency(E) = 90%

$$\frac{E_s}{E_p} = \frac{N_S}{N_p}$$ *01 Mark*

$$E_s = \frac{E_p \, x \, N_S}{N_p}$$ *01 Mark*

$$N_s = \frac{12 \, x \, 10000}{100}$$

$$= 1200 \, volts$$

∴The magnitude of the secondary voltage is 1200V *01 Mark*

$$Efficiency(E) = \frac{E_s I_s}{E_p I_p} x100\% \quad \textit{01 Mark}$$

$$I_s = \frac{E_p \, x \, I_p \, x \, E}{100 \, x \, E_s} \quad \textit{02 Marks}$$

$$I_s = \frac{12 \, x \, 5 \, x \, 90}{1200 \, x \, 100}$$

$$= 0.045A$$

∴The magnitude of the secondary current is 0.045A *01 Mark*

11. (a) **Solution**

Data

Frequency (f) = 250Hz

First length (l_1) = 31cm

= 0.31m

Second length (l_2) = 99.8cm

= 0.998m

Speed of waves (V) = ?

End correction (C) = ?

From V = $2(l_2-l_1)f$ *01 Mark*

= $2 \times (0.998 - 0.31) \times 250$

= 344 m/s

∴The velocity of sound in air is 344m/s *01 Mark*

Also $l_1 + C = \frac{1}{4}\lambda$.....(i) *01 Mark*

$L_2 + C = \frac{3}{4}\lambda$.....(ii) *01 Mark*

Subtract eqn (ii) by (i)

$l_2 - l_1 = \frac{3}{4}\lambda - \frac{1}{4}\lambda$ *01 Mark*

$l_2 - l_1 = \frac{1}{2}\lambda$

$0.998 - 0.31 = \frac{1}{2}\lambda$

$0.688 = \frac{1}{2}\lambda$

$\lambda = 1.376m$ *01 Mark*

From eqn (i) $l_1 + C = \frac{1}{4}\lambda$

$31 + C = 0.25 \times 137.6$

$C = 0.25 \times 137.6 - 31$

$= 3.4$ cm

∴The end correction is 3.4cm *01 Mark*

(b) **Answer**

(i). The type of wave used in the shown structure is **microwave** *02 Marks @*

(ii). Microwaves are used in long distance communication because they are **not affected** by clouds and other atmospheric conditions.

(c) **Answer**

Other uses of microwaves

(i). Microwaves are used in cooking. *02 Marks@*

(ii). They are used in RADAR systems