

MARKING SCHEME SSC NORTHERN ZONE

PHYSICS 01: PRE-NATIONAL 2026 (SET 02)

01

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

(01 @ Marks)

2

i	ii	iii	iv	v	vi
E	D	J	I	K	G

(01 @ Marks)

3

- (a) (i) In Red light → Red tie will appear Red. (01.5 Marks)
 → Blue spot will appear Black. (01.5 Marks)
- (ii) In Green light → Red tie will appear Black (01.5 Marks)
 → Blue spot will appear Black. (01.5 Marks)

(b) Data given:

Angular Magnification (M) = 7.5

Eye piece focal length (f_e) = ?

objective focal length (f_o) = 75cm.

from: $M = \frac{f_o}{f_e}$ (01)

$f_e = \frac{f_o}{M}$ (01)

$f_e = \frac{75\text{cm}}{7.5}$

$f_e = 10\text{cm}$

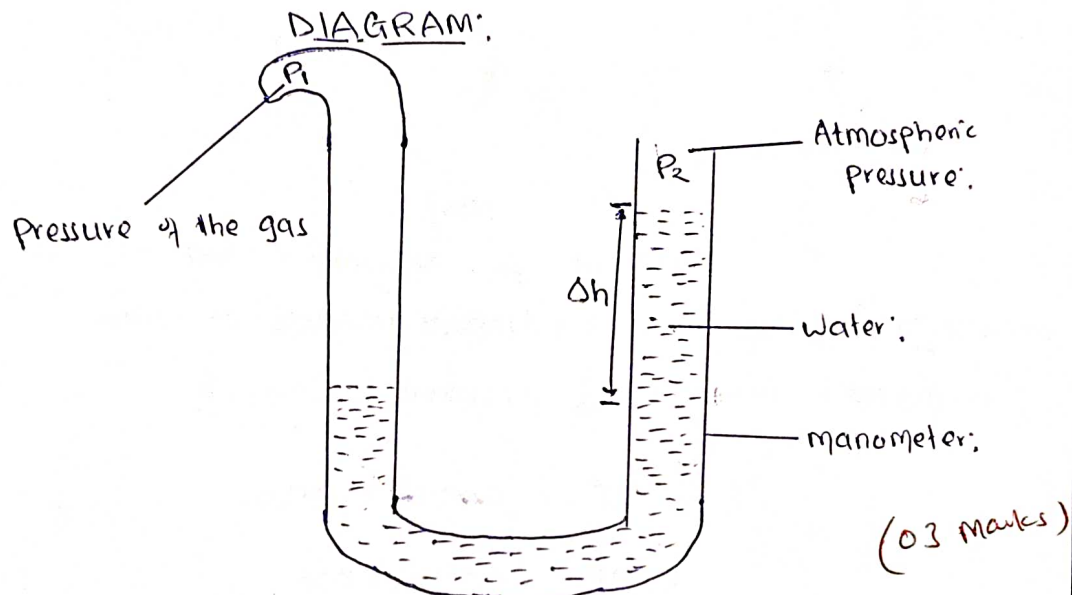
Therefore,

Eye piece focal length = 10cm (01)

Total
03 Marks

4 (a) MECHANISM OF MANOMETER:

Manometer is a device used to measure gas pressure. It is U-shaped tube containing a liquid such as Mercury and Water.



One limb is connected to the fluid (water) supply and the other limb is open to the atmosphere. The pressure exerts on fluid (water) causes the level of liquid on manometer to rise at a certain height as shown in the diagram above. The height risen by fluid (water) is called change in height.

Pressure of a liquid:

$$P = \rho g \Delta h$$

where:

ρ = Density of liquid;

g = Acceleration due to gravity;

Δh = change in height;

Therefore:

$$P_1 = P_2 + \rho g \Delta h$$

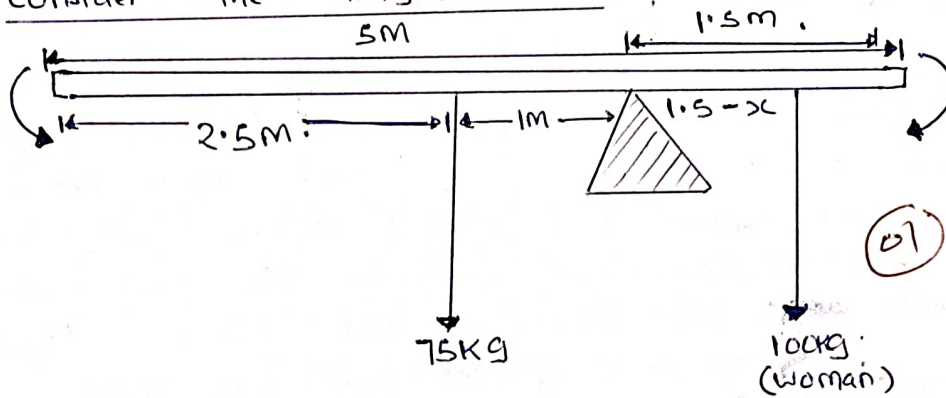
where:

P_1 = Pressure of the gas;

P_2 = Atmospheric pressure;

$\rho g \Delta h$ = pressure of a liquid;

4 (b) consider the diagram below:



from,

The principle of Moment.

sum of clockwise moment = sum of anticlockwise moment.

$$\sum \text{clockwise moment} = \sum \text{Anticlockwise moment} \quad (01)$$

$$100 \text{ kg} \times (1.5 - x) = 75 \text{ kg} \times 1.$$

$$100 \times (1.5 - x) = 75$$

$$1.5 - x = \frac{75}{100}$$

$$1.5 - x = 0.75$$

$$1.5 = 0.75 + x \quad (01)$$

$$x = [1.5 - 0.75] \text{ m.}$$

$$x = (1.5 - 0.75) \text{ m.}$$

$$x = 0.75 \text{ m.}$$

$$x = 0.75 \text{ m} \quad (01)$$

Therefore,

The distance from the edge = 0.75 m.

Total
04
Marks

5 (a) When a gun is held loosely, the butt of the gun is not in firm contact with the shoulder;

→ The gun appears to have a great kick when fired with the butt held loosely against the shoulder because the smaller contact area results in higher pressure from the recoil force. When held tightly, the increased contact area distributes the force, reducing the pressure and thus the perceived kick; (04 marks)

(b) Data given:

Radius (R) = 45cm;

sprocket radius (r) = 4.5cm;

Effort (E) = 160N;

Efficiency (e) = 80%.

Required; Maximum Load;
from:

$$M \cdot A = \frac{\text{Load (L)}}{\text{Effort (E)}}$$

$$\text{But } e = \frac{M \cdot A}{V \cdot R} \times 100\%.$$

$$V \cdot R = \frac{45\text{cm}}{4.5\text{cm}} = 10$$

$$80\% = \frac{M \cdot A \times 100\%}{10}$$

$$M \cdot A = 8$$

$$\text{Then: } M \cdot A = \frac{L}{E}$$

$$L = M \cdot A \times E$$

$$L = (8 \times 160)\text{N} = 1280\text{N}$$

$$L = 1280\text{N}$$

Therefore; Maximum Load = 1280N

TOTAL
05
MARKS

6 (a) (i) Metals are better conductors of heat than insulator because they possess free electrons that can efficiently transfer thermal energy through the materials whereas insulator lack these mobile electrons: (02 marks)

(ii) I will prefer drinking hot soup from a plastic bowl because it is a poor conductor of heat (an insulator) which will keep the outer surface of the bowl cooler. Aluminium is a good conductor of heat, so it would become much hotter and uncomfortable to hold while drinking. (03 marks)

(b) Data given:

specific heat capacity of copper: $(C_c) = 390 \text{ J/kgK}$.

specific heat capacity of water $(C_w) = 4200 \text{ J/kgK}$.

Mass of copper pieces $(M_c) = 40 \text{ g} = 0.04 \text{ kg}$.

Mass of copper calorimeter $(M_{cal}) = 60 \text{ g} = 0.06 \text{ kg}$.

Mass of water $(M_w) = 50 \text{ g} = 0.05 \text{ kg}$. (01)

from.

Heat lost by copper = Heat gained by water + Heat gained by copper calorimeter.

$$H = MC\Delta T$$

$$M_c C_c (\Delta T) = M_w C_w (\Delta T) + M_{cal} C_{cal} (\Delta T)$$

$$M_c C_c (T_s - T_f) = M_w C_w (T_f - T_i) + M_{cal} C_{cal} (T_f - T_i) \quad (01)$$

$$0.04 \times 390 (200 - T_f) = 0.05 \times 4200 (T_f - 25) + 0.06 \times 390 (T_f - 25)$$

$$15.6 (200 - T_f)^\circ\text{C} = 210 (T_f - 25)^\circ\text{C} + 23.4 (T_f - 25)^\circ\text{C}$$

$$3120 - 15.6 T_f = 210 T_f - 5250 + 23.4 T_f - 585$$

$$\frac{249 T_f}{249} = \left[\frac{8955}{249} \right]^\circ\text{C} \quad (01)$$

$$T_f = 35.96^\circ\text{C} = 36^\circ\text{C}$$

$$T = 36^\circ\text{C}$$

Therefore, The equilibrium temperature = 36°C .

7 (a) Defects of a simple cell and minimization:

(i) Local action $\rightarrow$ This is the accumulation of impurities in the zinc plate. Example; of impurities are Iron, lead and carbon. (0.5)

Minimization

Local action can be minimized by using pure zinc or by rubbing Mercury on the zinc plate to form amalgam. (01)

(ii) Polarization $\rightarrow$ This is the accumulation of hydrogen gas on the copper plate. These bubbles act as an insulator, increasing the internal resistance of the cell and reducing the current output. (0.5)

Minimization:

polarization can be minimized by using a depolarizer such as Manganese(IV) oxide and potassium dichromate. These substances react with the hydrogen gas to form water. (01)

TOTAL
0.5
marks

(b) Data given:

Time taken (t) = 3.5 hours; (10:30 PM - 7:00 PM).

Power = 60W, each bulb;

Required: Power consumed by the bulb per day (Kwhr) (01)

from, $P = \frac{E}{T}$

$$E = P \times t$$

$$E = [60W \times 3.5] \text{ whr.} \quad (01)$$

$$E = 210 \text{ whr} = 0.21 \text{ Kwh each bulb;}$$

$$E = 0.21 \text{ Kwh} \times 5 = 1.05 \text{ Kwh.} \quad (01)$$

$$E = 1.05 \text{ Kwh.}$$

Therefore:

Power consumed by the bulbs per day = 1.05 Kwh. (01)

TOTAL
01
marks

8 (a) The inner core is solid due to the high gravitational pressure at this depth which raises the melting point of its constituent materials such as Iron and Nickel above the actual temperature (02 Marks)

→ The outer core is molten due to the high temperature which makes the constituent materials such as Iron and Nickel to be molten state. (02 Marks)

(b) Tides are formed primarily due to the gravitational pull of the moon on the Earth's oceans, creating bulges of water (water waves) on both the near and far sides of the Earth.

→ The sun's gravity also contributes, leading to variations like spring and neap tides.

→ Earth's rotation causes different reaction/location to experience high and low tides as they move through these bulges. (05 Marks)

9 (a) Daughter nucleus has less mass than a parent nuclide because a portion of the parent nuclide's mass is converted into energy during the radioactive decay process.

→ This release energy is carried away by the emitted particles such as alpha particles or beta particles and Gamma rays. (03 Marks)

(b) → Time; minimum time will be needed while using radioactive material.

→ Distance; The workers should maintain a safe distance from the source. (03 Marks)

→ Shielding; Radioactive material should have adequate shielding; Example Lead.

9 ⑥ Data given:

Half-life ($t_{1/2}$) = 24 days

Time taken (t) = 72 days

Initial sample (N_0) = 4×10^5 c.p.s

sample remain (N) = ?

from

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^n \quad (01)$$

$$\text{But } n = \frac{t}{t_{1/2}}$$

$$n = \frac{72 \text{ days}}{24 \text{ days}}$$

$$n = 3$$

Then;

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^n \quad (01)$$

$$\frac{N}{4 \times 10^5 \text{ c.p.s}} = \left(\frac{1}{2}\right)^3$$

$$\frac{N}{4 \times 10^5 \text{ c.p.s}} = \frac{1}{8}$$

$$N = \left[\frac{4 \times 10^5}{8} \right] \text{ c.p.s.}$$

$$N = 5 \times 10^4 \text{ c.p.s.} \quad (01)$$

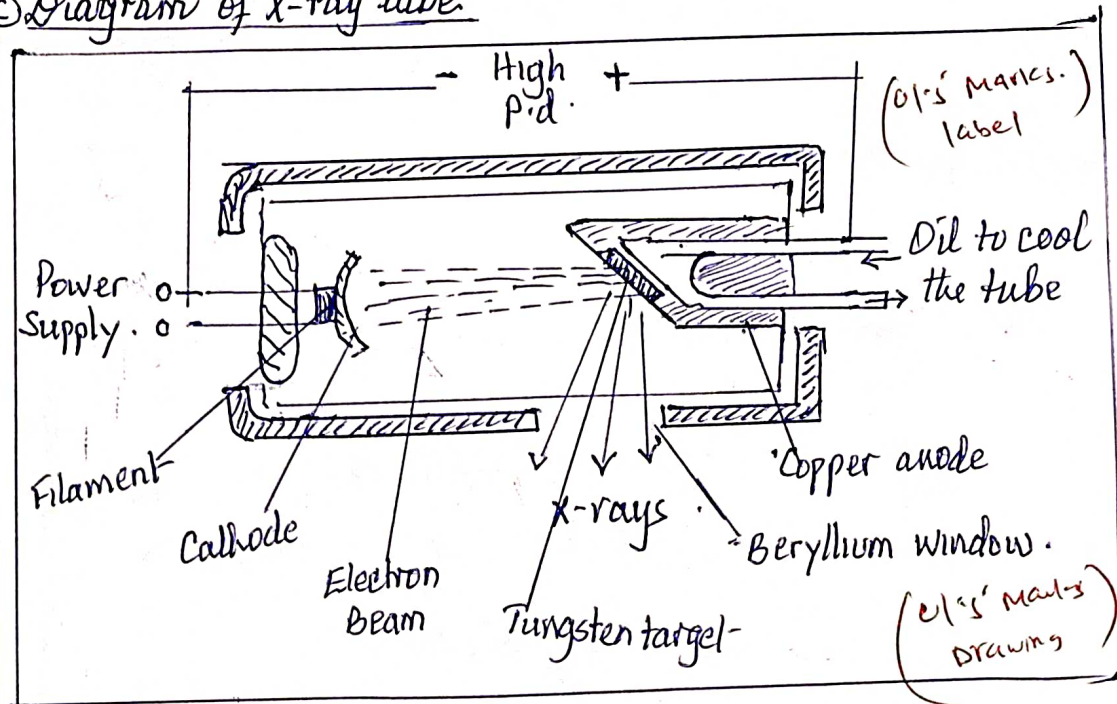
Therefore:

The sample remain undecayed = 5×10^4 c.p.s

TOTAL
03
marks.

9

© Diagram of X-ray tube.



PRODUCTION OF X-RAYS:

The cathode filament is heated causing emission of electrons. A high potential difference accelerates electrons from the cathode towards the metal target (Anode). The fast moving electrons strike the tungsten target. Their kinetic energy is converted into heat and a small amount into X-rays. X-rays produced leave the tube through the Beryllium window. The cooling system removes excess heat from the tungsten.

(03 Marks)

- 10 (a) Sound waves require a medium for propagation and space is a vacuum; Therefore; sound from explosions on other planets can not travel to the Earth.
(03 Marks)

(b) Data given:

First column length (L_1) = 18 cm = 0.18 m;

Second column length (L_2) = 51 cm = 0.51 m

Required; (i) Wavelength of sound in air (λ)

$$L_1 = \frac{1}{4} \lambda$$

$$L_2 = \frac{3}{4} \lambda$$

Then;

$$L_2 - L_1 =$$

$$L_2 - L_1 = \frac{3}{4} \lambda - \frac{1}{4} \lambda$$

$$0.51 \text{ m} - 0.18 \text{ m} = \frac{1}{2} \lambda$$

$$0.33 \text{ m} = \frac{1}{2} \lambda$$

$$\lambda = 0.33 \text{ m} \times 2$$

$$\lambda = 0.66 \text{ m} = 66 \text{ cm};$$

Therefore; Wavelength of sound in air (λ) = 66 cm or 0.66 m.

(ii) Velocity of sound in air (V).

from

$$V = \lambda f;$$

$$\text{But } \lambda = 0.66 \text{ m}, f = 512 \text{ Hz}$$

$$V = (0.66 \times 512) \text{ m/s}$$

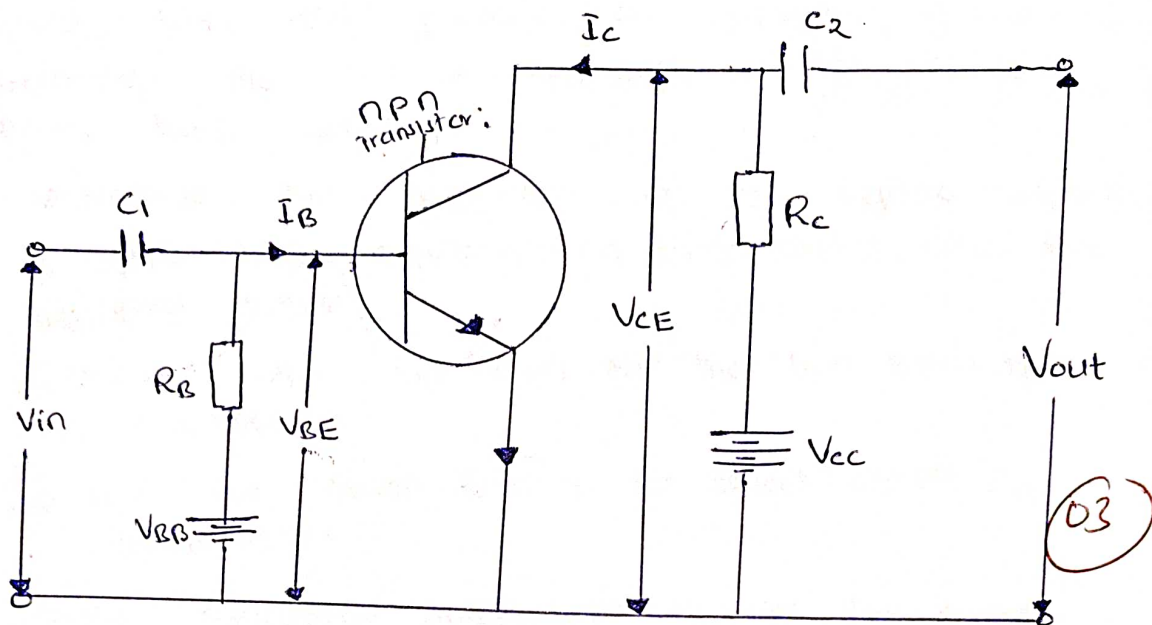
$$V = 338 \text{ m/s};$$

Therefore;

$$\text{Velocity of sound in air} = 338 \text{ m/s};$$

TOTAL
05
Marks.

10 (C) DIAGRAM OF COMMON EMITTER AMPLIFIER:



where:

C_1 and C_2 = coupling capacitors;

R_B = Base resistor

R_C = collector resistor;

V_{in} = Input voltage

V_{out} = output voltage;

V_{BE} = Base - Emitter voltage.

V_{BB} = Base voltage

V_{CE} = collector-emitter voltage;

V_{CC} = collector voltage;

I_B = Base current

I_E = Emitter current

I_C = collector current;

MECHANISM OF COMMON - EMITTER AMPLIFIER:

It involves biasing the transistor to its active using resistor, applying the input A.C signal to the base causing a larger variation in collector current. This varying current through the collector resistor produces a significantly amplified A.C output voltage at the collector with a 180° phase shift relative to the input signal.

11 (A) In an A.c generator, rotating coil cuts magnetic field lines and produces an alternating current (a.c) because the direction of induced current changes every half rotation.

→ Remove the two slip rings and replace them with a split ring commutator (a ring divided into two insulated halves)

→ connect the coil ends to the two halves of the commutator.

→ Use the carbon brushes to collect current from the commutator.

→ The commutator automatically reverses the connection of the coil every half turn, so the current flowing in the external circuit always moves in one direction.

Therefore the output becomes direct current. 06 marks

(B) Factors which hinder normal operational of transformer power losses:

→ Copper windings.

This loss of power is due to the resistance of copper wire.

→ Eddy current.

This causes loss of power in terms of heat generated from it.

→ Hysteresis.

This is the loss of power due to continuing magnetising or demagnetising of the coil.

→ Flux linkage.

This loss is due to the poor magnetic flux linkage between the primary and secondary coils causing flux leakages.

→ Resistance of wire. - Transformer to have finite resistance. 04 marks

11 (c) Data given:

current (I) = 5 A

Voltage (V) = 240 V

Mass (M) = 500 g = 0.5 kg

Initial temperature (T_1) = 30°C

Final temperature (T_2) = 100°C

Specific heat capacity of water (C) = 4200 J/kg°C.

from

$$H = MC\Delta T$$

$$H = (0.5 \times 4200 \times (100 - 30)) \text{ J}$$

$$H = 147000 \text{ J}$$

$$\text{Heat} = 147000 \text{ J}$$

from the law of conservation of energy:

$$\text{Heat energy} = \text{Electrical energy}$$

$$\text{Electrical energy} = 147000 \text{ J}$$

Required, Time (t)

from $H = I t V$

$$t = \frac{H}{IV}$$

$$t = \left[\frac{147000}{5 \times 240} \right] \text{ seconds}$$

$$t = 122.5 \text{ s} = 123 \text{ seconds}$$

Therefore,

$$\text{Time} = 122.5 \text{ seconds or } 123 \text{ seconds (approximately)}$$

05 ^{PM}
Marks.