PHYSICS FORM TWO MARKING SCHEME

SECTION A (15 Marks)

01

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

(10 Marks)

02

I	II	III	IV	V
D	E	A	B	C

(05 marks)

SECTION B (70 Marks)

3 (a) Testable hypothesis.

-▷ If a metal spoon and a wooden spoon are placed in hot tea, then the metal spoon will become hotter because metals are better conductors of heat than wood. (03)

To Investigate; Place identical metal and wooden spoons in two cups of hot water at the same temperature. Measure the temperature of each spoon handle after 2 minutes using a thermometer. The spoon with the higher temperature is the better conductor (02)

(b) Average time for one round.

Total time = Final reading − start reading (01)

= 600.00s − 6.00s

= 594.00s (01)

Average time per round = $\frac{594.00s}{3}$ (01)

= 198.00s.

∴ 198 seconds per round or 3 minutes 18 seconds. (02)

4 (a) Difference in weight (02)

Weight W = mg. Mass is constant, but weight depends on gravity g. The moon's gravity is about $\frac{1}{6}$ of Earth's gravity because the moon has less mass and smaller radius, so $W_{moon} = \frac{1}{6} W_{earth}$. That's why the object weighs six times less on the moon. Mass does not change. (03)

(b) Weight on the moon.

Mass = 200g = 0.2kg

On Earth

Wearth = mg

= 0.2 × 10

= 2.0 N Using g = 10m/s² g = 10m/s²

On Moon.

$W_{moon} = \frac{1}{6} \times 2.0$

= 0.33N

∴ 0.33N. (02)

(c) i) Density = $\frac{mass}{Volume}$. If mass is constant and volume increases, density decreases. They are inversely proportional. (01)

(ii) Volume of water Overflowed.

Volume of water displaced = Volume of lead ball

$V = \frac{m}{\rho}$

$= \frac{200g}{11.3g/cm^3}$

$= 17.7cm^3$

∴ 17.7cm³ or 17.7mL of water will Overflow. (02)

5 (a) i) Can the cable support the anchor while completely submerged.

To know this, compare the apparent weight of the anchor in sea water with the cable's max tension of 5000 N. (01)

step 1 :, Weight of anchor in air

Wair = mg

= 560kg × 10 m/s²

= 5600 N. (01)

step 2 :, Volume of anchor.

$V = \frac{m}{\rho_{iron}}$

$V = \frac{560}{7800}$

$= 0.0718 m^3$ (01)

Step 3; Upthrust in seawater.

$U = \rho_{seawater} \times V \times g$

$= 1025 \times 0.0718 \times 10$

$= 735.95N$ (01)

Step 4; Apparent weight in water.

$W_{water} = W_{air} - U$

$= 5600 - 735.95$

$= 4864.05N$. ($0\frac{1}{2}$)

Step 5; Compare with cable strength.

$4864.05N < 5000 N$.

∴ Yes, the cable can support the anchor while it is completely submerged. The apparent weight of 4864 N is less than the 5000N breaking limit (01)

(ii) Weight in air $= mg$

$= 560 \times 10$

$= 5600 N$. ($0\frac{1}{2}$)

Cable limit $= 5000N$.

$5600N > 5000N$.

∴ No, the cable will break because the anchor's full weight exceeds the cable's breaking strength. (01)

(iii) Cable breaks when apparent weight $= 5000N$.

$W_{apparent} = W_{air} - U_{displaced}$

$5000 = 5600 - \rho_{water} V_{sub} g$

$\rho_{water} V_{sub} g = 600N$.

$V_{sub} = \frac{600}{1025 \times 10}$

$= 0.0585 m^3$

Total volume $V_{total} = \frac{560}{7800} = 0.0718 m^3$

Volume out of water $= 0.0718 - 0.0585 = 0.0133 m^3$ (01)

Percentage out $= \frac{0.0133}{0.0718} \times 100$

$= 18.5\%$

$\therefore$ 18.5% of the anchor will be out of water when the cable breaks.

01

(b) Capillary tubes conclusion:

- The rise of water is due to capillary action, caused by adhesive forces between water and glass and surface tension. The narrower the tube, the higher the water rises. Height $h \propto \frac{1}{r}$, where r is tube radius so we conclude capillary rise is inversely proportion to the diameter of the tube

01

6 (a) Feeling during acceleration / deceleration.

Accelerating; you feel pushed back into the seat. This is due to inertia. your body tends to stay at rest while the car moves foward.

02

Decelerating; you feel thrown foward. Due to inertia, your body tends to stay in motion while the car slows down. This is why seat belts are important.

02

(b)(i) Force applied on piston 1

$P_1 = P_2$

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$

$F_1 = \frac{F_2}{A_2} \times A_1$

$F_1 = \frac{5000N}{0.10m^2} \times 0.02m^2$

$= 1000N$.

$\therefore$ Force on piston 1 is 1000 N.

03

(b)(ii) Distance moved by piston 1.

$$\frac{d_1}{d_2} = \frac{A_2}{A_1}$$

$$d_1 = \frac{A_2}{A_1} \times d_2$$

$$d_1 = \frac{0.10m^2}{0.02m^2} \times 0.3m$$

$$= 1.5m$$

∴ Distance moved by piston 1 is 1.5m. 03

7 (a) Rotating wheel becomes hot after sudden stop.
→ The wheel has kinetic energy while rotating. When it stops suddenly, this K.E is converted to heat energy due to friction between the brake pads and the wheel. Work done by friction = heat produced so the wheel gets hot. 03

(b) Neutralising a charged leaf electroscope.
→ Touch the cap with a finger or an earthed conductor. This provides a path for excess charge to flow to or from the earth. The leaves will collapse because the electroscope becomes neutral. 03

(c) Object and electroscope leaves come closer;
→ If leaves come closer, the charge on the object is opposite to the charge on the electroscope. 02
Explanation; Bringing an oppositely charged object reduces the net charge on the cap, so less charge goes to the leaves. Like charges repel, so less repulsion means leaves collapse. If the electroscope is positively charged, the object is negative and vice versa. 02

8 (a) Bulb with 5Ω connected to 8V battery, internal resistance neglected.

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

$$= \frac{8}{5} = 1.6A$$

Power, $P = VI$

$= 8 \times 1.6$

$= 12.8W$

OR

$P = I^2R$

$= 1.6^2 \times 5$

$= 12.8W.$

$\therefore$ Current $= 1.6A$, power $= 12.8W$. 01

(i) Current through the bulb

Using Ohm's law

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

$$= \frac{8V}{5\Omega}$$

$$= 1.6A$$

$\therefore$ 1.6A 02

(ii) Light and heat energy in one hour.

Energy = power x Time.

$P = VI$

$= 8 \times 1.6 = 12.8W$

Time = 1hour = 3600s

$E = P \times t$

$= 12.8 \times 3600$

$= 46080J$

$\therefore$ 46,080J or 46.1KJ of electrical energy converted to light and heat 02

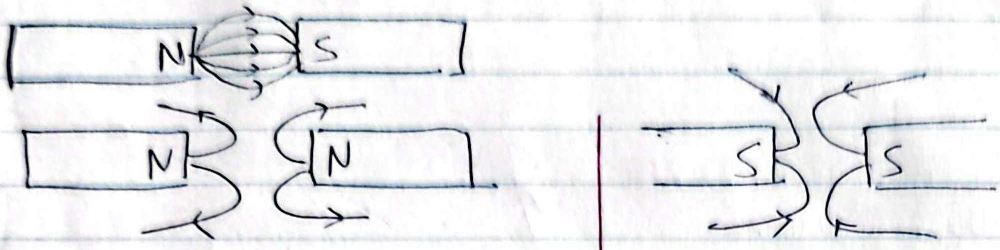
(b)(i) A material is magnetic if it; @ ½ mark.

1. Is attracted by a magnet ;- test with a known bar magnet
2. Can attract iron fillings, pins or nails
3. Can ~~attract~~ be magnetized to become a magnet itself
4. Shows repulsion ; When like poles of two magnets are brought together. Repulsion is the only sure test for magnetism

(ii) Law of polarity

Like poles repel, Unlike poles attract. $0\frac{1}{2}$

Sketch:



N ---- S attracts N ---- S

N ---- N repeals N --- N

S ---- S repeals S ---- S $0\frac{1}{2}$

(iii) 1/ suspend the bar magnet freely ; With thread The end that points to Earth's geographic north is magnet's north pole. 01

2/ Use a compass ; The south pole of the compass needle is attracted to the north pole of the bar magnet. The end that attracts the compass's south pole is the magnet's north pole 01

9 A spherical mirror, $m = -1$, Image on the screen, $V = 50cm$.

Magnification, $m = -1$

Means Image is real, Inverted, same size, This only happens with a concave mirror when the object is at centre of Curvature C 02

(a) Type of mirror ; Concave mirror. 02

(b) Distance from Image to object

For $m = -1$

$m = \frac{-v}{u}$ $0\frac{1}{2}$

$-1 = -\frac{50}{u}$

$u = 50\ cm$. $0\frac{1}{2}$

Object distance = Image distance = 50cm , on same side.
Distance between object and Image.
= 50 - 50 = 0cm.
∴ 0cm - Object and Image coincide at C (02)

(c) focal length.
For object at C, $R = 2f$
$u = R = 50cm$.
so
$F = \frac{R}{2}$

$= \frac{50}{2} = 25cm$. ($0\frac{1}{2}$)

Using mirror formula.
$\frac{1}{F} = \frac{1}{u} + \frac{1}{v}$ ($0\frac{1}{2}$)

$\frac{1}{50} + \frac{1}{50} = \frac{2}{50}$

$F = 25cm$.
∴ 25 cm. (02)

SECTION C (15 marks)
10 Glass block ; $t_1 = 10cm$, $n_1 = 1.5$
Water , $t_2 = 10cm$, $n_2 = \frac{4}{3} = 1.33$

(a) Apparent position of coin
For normal viewing ;
Apparent depth = $\frac{\text{real depth}}{\text{refractive index}}$ ($0\frac{1}{2}$)
Apparent depth due to water
$\frac{10}{4/3} = 10 \times \frac{3}{4} = 7.5cm$. ($\frac{1}{2}$)
Apparent depth due to glass = $\frac{10}{1.5} = 6.67cm$. (01)
Total apparent depth = $7.5 + 6.67 = 14.17cm$ from the top surface (01)

Real depth = 10 + 10
= 20cm.

The coin appears raised by
20 − 14.17
= 5.83 cm.

∴ 14.17cm below the water surface OR 5.83 cm above its real position. 02

(b) Total Internal reflection happens at the water-to-air boundary top surface of water. 03

As you move away from normal, the angle of Incidence In water Increases 02 ~~there is critical angle for water air~~

(c) Spherical Vs parabolic mirror for telescope.

Explanation;

Large spherical concave mirrors suffer from spherical aberration rays far from the principal axis focus closer to the mirror than paraxial rays. This gives blurred images, bad for astronomy. 03

A parabolic mirror focuses all parallel rays from distant stars to a single focal point, giving sharp, high-quality images. All major reflecting telescopes use parabolic or hyperbolic mirrors to avoid spherical aberration. 02

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