GCE O' LEVEL COMBINED SCIENCE (PHYSICS) (5076/02)
Suggested Answers for 2016 O Level
Combined Science (Physics) Paper 2

Section A (45 M)

1a) The liquid was not heated to 100°C. 1
OR
The process takes place slowly

b) Evaporation occurs at a greater rate in the larger sheet 1
because as it has a larger surface area. 1

c) When temperature drops, water molecules do not have as much kinetic energy. 1
Less molecules have enough kinetic energy to overcome intermolecular forces of attraction and escape from the surface of the water and hence rate of evaporation decreases. 1

2a) i) $Volume = 0.21 \times 0.10 \times 0.06 = 0.00126m^3 \approx 0.0013m^3 (2sf)$ 1
ii) $Mass\ of\ 30\ bricks = 0.0013 \times 2300 = 2.99kg$ 2
$W = mg = (2.99)(10) = 29.9N \approx 30N (2sf)$ 1

b) Sum of clockwise moments = sum of anti-clockwise moments

1m for adding the bricks and barrow

$(30 + 110) \times 0.80 = F \times (0.50 + 0.80)$
$F = 86.15N \approx 86N (2sf)$ 1
1

c) The wide plank of wood increases the surface area in contact with the mud. 1
Since pressure = force / area, 1
a large area will result in a smaller pressure on the mud and reduces the risk of the wheelbarrow sinking. 1

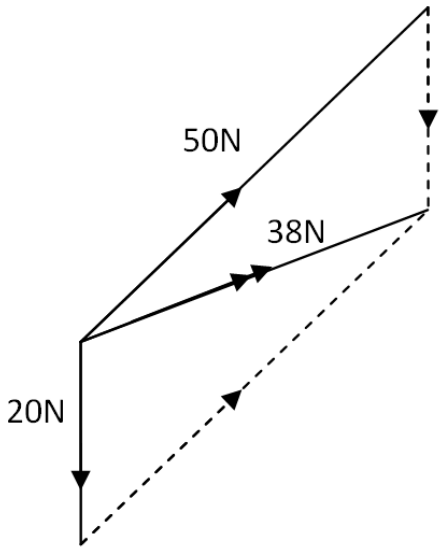
3a) $a = \frac{v - u}{t} = \frac{27.0 - 0}{6.0} = 4.5m/s^2$ 1
$F = ma = (1.1 \times 10^3)(4.5) = 4950N$ 1
$= 5000N (2sf)$ 1

b) $distance = \frac{1}{2} \times 6.0 \times 27.0$ 1
$= 81m$ 1

c) $Work\ done = F \times d = 5000 \times 81$ 1
$= 405\ 000J$ 1

*All solutions/answers are provided by the teachers of AO Studies and MOE or UCLES bears no responsibility for these suggested solutions/answers.

A4)



2

resultant force = 38 N 1

5a) $v = f\lambda$ 1

$v = (5 \times 10^{14})(0.6 \times 10^{-6})$ 1

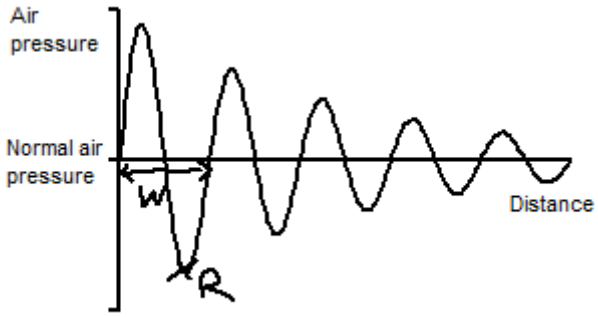
$= 3 \times 10^{8} m/s$ (shown)

b)

Electromagnetic wave	frequency	wavelength	Speed in a vacuum
X-rays	Higher	Shorter	Equal
Radiowaves	Lower	Longer	Equal

1m for each row

6a)



1m for W

1m for R

b) The sound becomes softer and softer until it eventually cannot be heard anymore. 1

7) Rod Y is also positively charged. 1
Since rod X is positively charged and electrons from sphere A will flow into rod X, making sphere A also positively charged. In order for sphere A and B to repel, sphere A and B must have like charges. Therefore, sphere B must also be positively charged, which means rod Y is also positively charged. 1

8a) $Total\ Resistance = \left(\frac{1}{6} + \frac{1}{8+2}\right)^{-1}$ 1
$= 3.75\Omega$ 1

b) $V = IR$
$12 = I(10)$ 1
$I = 1.2A$ 1

c) $P = \frac{V^2}{R} = \frac{12^2}{6}$ 1
$= 24W$ 1

d) $V_T = I_T R_T$
$12 = I(3.75)$ 1
$I = 3.2A$
$Q = It = (3.2)(10 \times 60)$
$= 1920C$ 1

9a) Current in BC direction 1

b) Force on AB: Downwards 1
Force on CD: Upwards 1

Section B (20M)

10a) $K.E = \frac{1}{2}mv^2 = \frac{1}{2}(1.3 \times 10^5)(2.3 \times 1000)^2$ 2
$= 3.4385 \times 10^{11} J$
$= 3.4 \times 10^{11} J (2sf)$ 1

b) When stage 1 detaches, it still has an upward velocity of 2.3km/s. Since it has no more fuel, there is no longer an upward force to keep it accelerating upwards. 1
The resultant force acting on stage 1 is now weight and since its acting downward, it will cause the speed to slow down. 1

c) When it just starts to fall towards earth, its downward velocity is zero, so there is no air resistance. The resultant force is equals to weight and stage 1 falls at $10m/s^2$ 1

As it accelerates towards earth, its velocity increases resulting in an increase in the air resistance. 1

Since weight is a constant, the down resultant force decreases resulting in a decrease in acceleration. 1

Its velocity and air resistance increases until the air resistance is equals to weight and it reaches terminal velocity. There is no resultant force acting on the object and hence acceleration is zero. 1

d) Gravitational potential energy to heat energy 1

11a)

$$n = \frac{1}{\sin c}$$

$$1.60 = \frac{1}{\sin c}$$ 1

$$c = 38.68°$$

$$= 38.7°(2sf)$$ 1

b) i)

$$n = \frac{\sin i}{\sin r}$$

$$1.60 = \frac{\sin 30}{\sin r}$$ 1

$$r = 18.21°$$

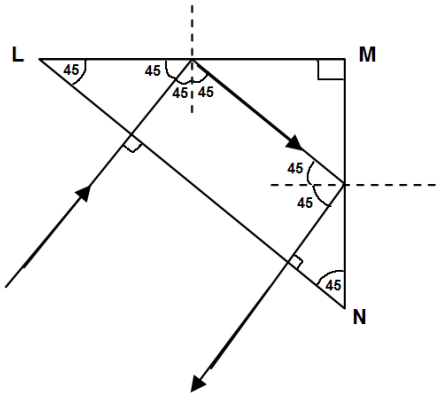
$$= 18.2°$$ 1

ii) $$x = 45 - 18.2 = 26.8°$$ 1

Since the angle of incidence on face LM is lesser than critical angle, 1

refraction will occur. 1

c)



3

Light enters the prism from face LN perpendicularly and hence does not refract. It then hits the surface LM at 45^o which results in total internal reflection as the angle of incidence is greater than the critical angle. It then hits MN and also undergoes total internal reflection there because its angle of incidence is 45^o. Hence it escapes from the surface LN.

12a) Heat from outside the freezer heats up the surface molecules of the freezer causing molecules to vibrate faster about their fixed positions. 1

Surface particles will collide more with neighbouring particles, causing them to also start to vibrate faster until the whole freezer is vibrating at a higher speed. 1

The particles will then collide with the air inside the freezer and causing them to start moving faster as well, in turn transferring heat energy to them. 1

b) $0.58kWh = 0.58 \times 1000 \times 60 \times 60 = 2\,088\,000J$ 1

$P = \frac{E}{t} = \frac{2088000}{24 \times 60 \times 60}$ 1

$= 24.167W = 24W(2sf)$ 1

c) Live wire frayed and touching the neutral wire. 1

When excessive current passes through the circuit, the iron core becomes a strong enough magnet to overcome the pulling force of the spring, resulting in a strong attractive force, attracting the iron armature to the right. 1

this will cause the springy metal to break contact and result in an open circuit. 1