Answer to P1

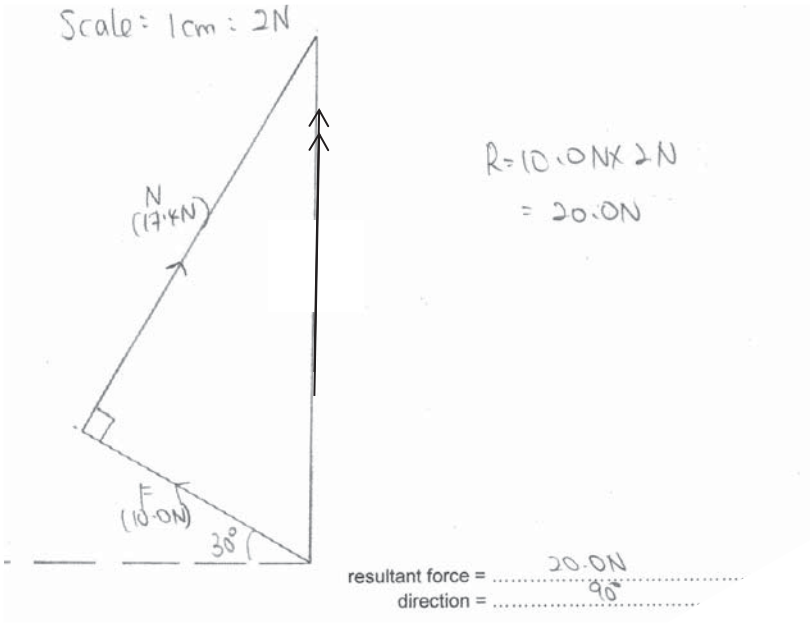
1	**C**	Refer to textbook page 6 and7.
2	**D**	Pascal is unit for Pressure
3	**C**	Diameter = measurement – zero error = 10.13 – (-0.06) = 10.19cm
4	**B**	Period is the time taken for one complete oscillation *(A to B and back to A again)*
5	**C**	Terminal velocity only happens when all forces are balanced (net force is zero), hence zero acceleration and constant velocity.
6	**C**	Higher acceleration means higher gradient (steeper vel-time graph).
7	**D**	Constant speed = zero acceleration = zero resultant force
8	**A**	Friction opposes the relative motion between 2 bodies in contact. The foot is pushing backward in order for the man to move forward. Hence friction pushes the foot forward (opposite direction)
9	**D**	Things to note: Acceleration is the rate of change of velocity. Change in velocity can be either direction or numerical value (speed). When there is an acceleration, a resultant force must be present. (not change in resultant force).
10	**A**	When the container decelerates, the water has bigger mass, bigger inertia as compare with the bubble of air. Hence the water will continue forward and pushes the air bubble backward.
11	**D**	Both cubes are made of the same material.
12	**D**	Least stability = highest C.G (top heavier) and smallest base area.
13	**D**	$P_1 = P_2$ 150/10 = (1500 x 10)/A A= 1000cm^2
14	**B**	When atmospheric pressure drops, mercury column QR decreases, PQ increases. R rises as more mercury flows out of mercury column, hence PR decreases. Height PS is fixed.
15	**A**	Useful work done = gain in mgh = 2000 x0.8 Or useful work done = resultant force x distance in direction of force = (1300-500)(2.0)
16	**A**	$E_k = ½ Mv^2$ New $E_k = ½ (M/2)(2v)^2 = 2 (½Mv^2) = 2E_k$
17	**A**	collisions by air particles Key word is "by" as air particles are moving in continuous and random motion at high speed
18	**C**	The water particles move further apart from each other when heated. This will increase the volume of water and decrease the density. **B** is wrong because particles do not expand when heated.
19	**D**	The gas particles are all moving in a continuous and random motion. The probability of the particles hitting at any point in the container with the same average speed (and force) is the same. **B** and **C** are wrong unless the options contain the word in bold: "**average** number of collisions with the internal walls of the container per unit time" and "move at the same **average** speed".

20	**B**	increases	decreases	
21	**A**	by conduction only C is wrong because the question did not ask for thermal energy transferred within the liquid.		
22	**C**	1.30Ω 40°C = [R - 0.50Ω]/[2.50Ω - 0.50Ω] × 100°C R = 1.30Ω		
23	**B**	1.00 Specific heat capacity is the same for objects from the same material		
24	**A**	21kJ energy removed = 0.20kg × 25°C × 4.20kJ/kg°C = 21kJ		
25	**D**	Speed of water waves decreases in shallow water as wavelength decreases. Frequency is constant.		
26	**C**	Shift the wave to the right by half a waveform		
27	**C**	n = c/v = $3.0x10^8$/ $1.8x10^8$ = 1.67 c= $\sin^{-1}$ (1/1.667) = 36.9°		
28	**D**	Angle of reflection is the same as angle of incidence, i.e. the angle between Normal and incident ray.		
29	**A**	Key words from question “Magnified image …. on a screen” [Real, magnified image] Case 4 from table 12.5 in textbook pg 242 where object is placed between f and 2f.		
30	**D**	Sound need medium to travel and is fastest in solid where particles are very closely packed.		
31	**C**	t diff = [2 x distance from Q to man/ speed] - [2 x distance from P to man/ speed] 2.0 = [2x350 - 2x50] / speed Speed = 300m/s		
32	**B**	4.0Ω 1.5R = 3.0V / 0.50A = 6.0Ω R = 4.0Ω		
33	**B**	Decrease because p.d. across P decreases	Increase because p.d. across Q increase	
34	**C**	5A current = 1100W / 230V = 4.78A		
35	**D**	$40.66 cost = (1.10kW × 7 × 24hrs) × $0.22 = $40.66		
36	**D**	The appliance will continue to work but the external metal casing is at high voltage. Both live and earth wire are at high voltage but are not connected to each other. The fuse is in the live wire. The fuse and the live wire are not connected to the earth wire unless the live wire touches the metal casing. So fuse will not melt because current is flowing through the appliance as normal.		
37	**D**	downwards Positive charge at the top and negative charge at the bottom. This does not require Fleming’s Left hand Rule because the field is not a magnetic field.		
38	**B** Using Fleming’s Left hand Rule b			

39	**B**	← Direction of the magnetic field of the two coils is the same. Using Right Hand Grip, the magnetic field is towards the left.		
40	**D**	320V secondary voltage = [3200 / 200] × 20V = 320V	42.7A power input = power input = $(320V)^2$ / 120Ω = 853.3W primary current = 853.3W / 20V = 42.7A	

Solutions for Section A

1 **(a)**



(b) 20.0N (downward)
Allow ecf from (a)

(c) Force by the block of wood on Earth.
Acting in opposite direction (or upwards) and equal in magnitude as W

2 **(a)** Centre of gravity is a point through which the whole weight seems to act.

(b) Taking moments about the left foot,
ACW = CW
W × 10 = 42 × 180
W = 756N

(c) The student will be unstable, causing him to topple/ lose his balance.
The line of action of weight falls outside the base (right foot),
resulting in a clockwise moment about his right foot.

3 **(a)** **(i)** P = hρg
= (60/100) (1050)(10)
= 6300Pa

(ii) Atmospheric pressure acts at both sides of the crack, i.e. at internal side and the external of the crack.
Accept there is atmospheric pressure at the top of liquid as well outside the crack.

(b) The height of water above the crack decreases.
Since P = hρg, the pressure due to the liquid at the crack decreases.

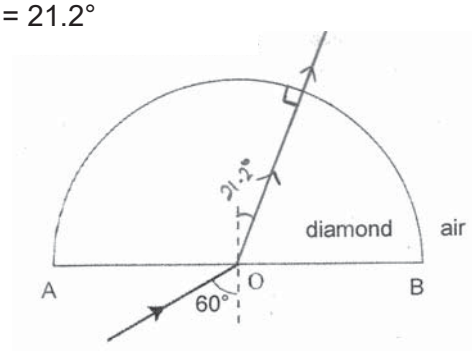
4 **(a)** **(i)** Air particles are travelling at high speed in a continuous and random motion. They collide with the internal walls of the syringe. The average force exerted per unit area is the air pressure.

(ii) KE (and speed) of the air particles decreases. They collide less frequently and with smaller force with the internal wall.
Pressure of trapped air is lower than atmospheric pressure and a resultant force acts downwards on the piston.

5 **(a)** **(i)** The speed of light in vacuum is 2.4 times faster than the speed of light in diamond.

(ii) 2.4 = sin 60/sin r
r = 21.2°

(b)

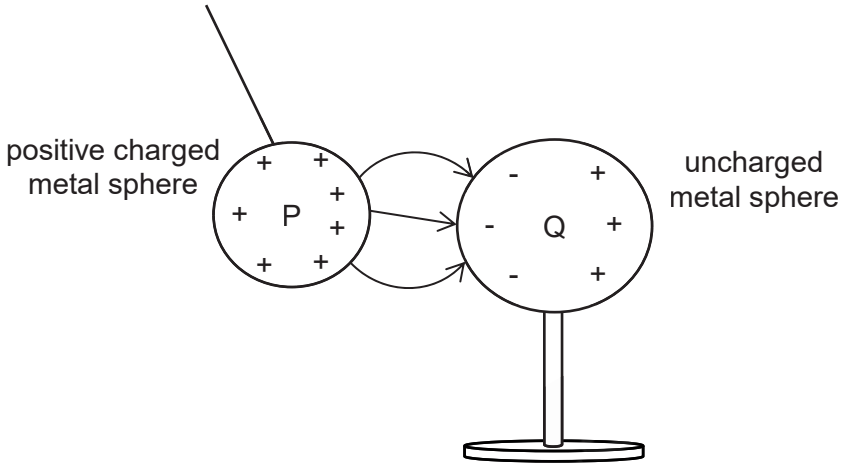


(c) $c = \sin^{-1}(1/n)$
$= \sin^{-1}(1/2.4)$
$= 24.6°$

(d) Ensure the ray of light is incident at the curved surface so that light can enter the diamond block and travel from diamond (more optically denser) towards the boundary with air (optically less dense).

Make sure the angle of incidence in diamond more than critical angle of 24.6°.

6



(a) The direction of the electric force acting on a small positive charge.

(b) See above.
Correct charge distribution
Correct field lines

(c) The induced negative charge on the left side of Q repel the electrons in P to the left side.

(d) The electrons in Q will be attracted by the positive charged P. They will move into P until both spheres are equally positive charged.
P swings away from Q because like charges repel.

(e) current = Q / t
= 20C / 25s [1] = 0.80A

7 **(a)** It will move to the left.

(b) **(i)** 20Hz to 20kHz.

(ii) The cone vibrates and collide with the neighbouring air particles to vibrate. This disturbance (or vibration) is passed on to other air particles.
The vibration of the particles is parallel to the propagation of the sound.
The sound is transmitted in a series of compressions and rarefactions.

(iii) The soft iron bar will always be attracted to the coil regardless of the direction of the magnetic field of the current.
The soft iron bar will not vibrate (and no sound is produced).

8 **(a)** There is a change in the magnetic field lines linkage with the coil.
This induces an emf and thus a current in the coil.

(b) Light is less bright and blink less often (or frequency of blinking decreases or light is emitted a shorter time).

(c) The interaction of the magnetic field of the induced current and the magnet will induce the force (or the induced current in the coil will set up a magnetic field that will exert a force on the magnet).
The direction of the induced force will oppose rotation of the magnet in accordance to Lenz's Law (a like pole will be induced when the magnet is moving towards the coil and an unlike pole will be induced when the magnet is moving away from it).

Solutions for Section B

9 **(a)** **(i)** The ratio of the p.d. across it to the current flowing through it.

(ii) Resistance decreases at a decreasing rate.

(iii) It cannot measure high temperature because the decrease in resistance is insignificant.

(b) peak voltage output = [2.00kΩ / (2.00 + 1.25)kΩ] × 230V
= 142V

(c) **(i)** Y-gain setting = 100V / 4div = 25V/div

(ii) period = 5.0ms/div × 5div = 25.0ms

(iii) time base setting: twice the no. of waveforms or 4 waves are seen
Accept: halved the period/number of divisions needed per waves
Y-gain setting: amplitude is halved or amplitude is 2 div

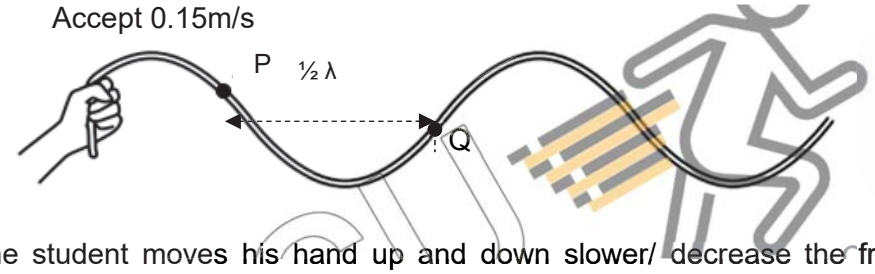
(d) No. The output voltage to c.r.o. is the same as the e.m.f. regardless of the resistance of thermistor.

10 **(a)** **(i)** amplitude = height from crest to tough / 2 = 2.0cm /2 = 1.0cm
Accept 0.9 to 1.1 cm

(ii) wavelength = distance between crest to crest = 6.0cm
Accept 5.8 to 6.2 cm

(iii) v = f λ
= (10/4) (6.0)
= 15 cm/s
Accept 0.15m/s

(b)



(c) The student moves his hand up and down slower/ decrease the frequency/ lower speed/ less times per second

(d) **(i)** *Accept one:*
Can travel in vacuum or
travel at 3.0×10^8 m/s in vacuum.

(ii) Ionisation is the removal of electrons from atoms/molecules to form ions.
Causes damage to living cells and abnormal cell divisions, e.g. cancer, deformed foetus.

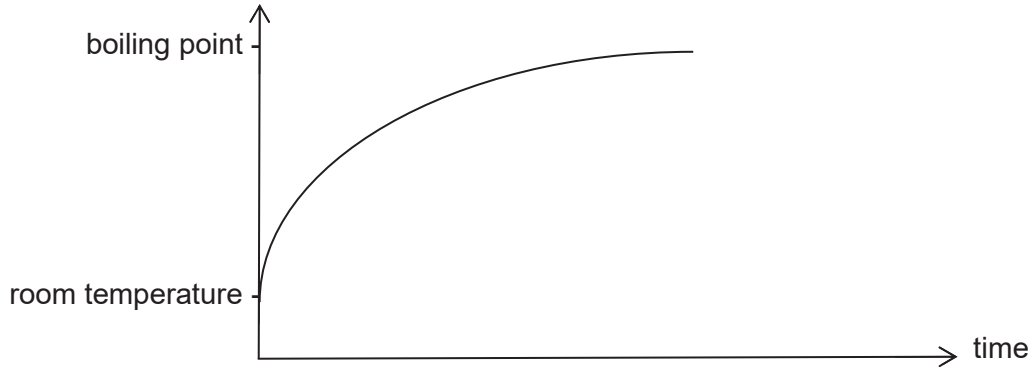
(iii) Radiowave

11 **(a)** Thermocouple or data logger with temperature sensor.

E

(b) Metal (is a good conductor of heat and) transfers thermal energy from the fire to the water quickly.
Shiny and smooth surface is a bad emitter of thermal energy.
Thermal energy is emitted to the surrounding at a slow rate.

(c)



(d) The bigger fire does not increase the temperature of the boiling water. Noodles is still cooked at the same temperature.

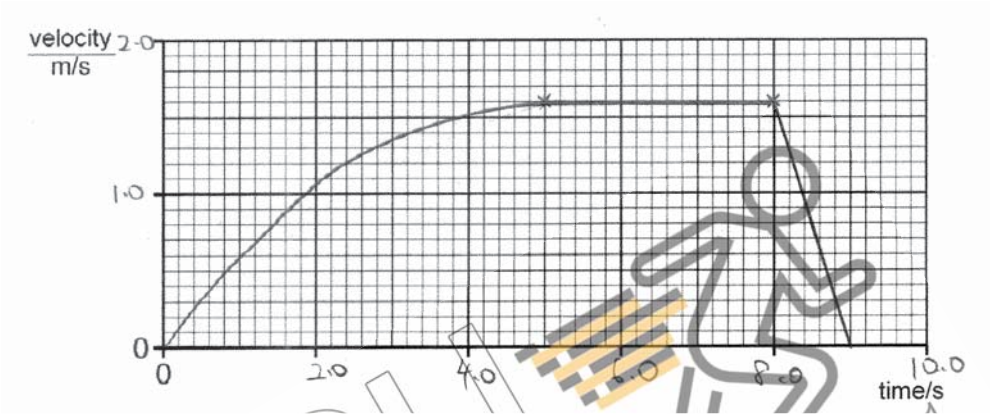
(e) **(i)** 2200kJ of thermal energy is needed to vaporise 1kg of water at boiling point.

(ii) When water is boiling, use a cold flat surface or the lid of the pot to condense the steam.
The mass of steam, m, condensed is measured using a weighing machine.
The time, t, take to condense the steam is measured using a stop watch.

Approx. rate of thermal energy supplied = m × 2200kJ/kg / t

Also accept measuring the different in mass of the pot and boiling water using weighing machine after a specific time.

11 O **(a)**



(b) Area under velocity-time graph

(c) **(i)** Decrease in GPE = mgh
= (25) (10) (2.0)
= 500J

(ii) Work done against the friction present between the moving parts in the ride/ work done against air resistance/ converted to thermal and sound energy
Energy cannot be created or destroyed but converted from one form to another and total energy is the same, i.e. the difference in loss of GPE and gain in KE is the amount of thermal and sound energy or work done against friction/air resistance.

(d) Measurement of least two distances/displacement and corresponding times mentioned.
Description of how the actual measurement is made
- make marking on the ground every second and measure the distances/displacements
- note video position every second and use a scale to find the distance/displacement
- make mark on ground every metre and measure the time as the girl passes

Description of how constant speed/velocity using measurement is proven
- Same distance/displacement travelled between each position for the same time interval
- Same time internal for same distance/displacement
- Constant gradient for distance-time graph/ displacement-time graph plotted.