Preliminary Examination 2022
Secondary Four Express / Five Normal (Academic)
Science (Physics)
Paper 1 (5076/1)

Date of Examination: 31 Aug 2022 **Duration: 30 minutes**

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Name : _____( ) Class : _____

Instructions to Candidates
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class on the answer sheet provided.

There are **twenty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Optical Answer Sheet **(OAS)**.

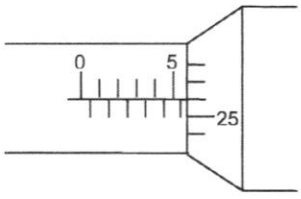
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on this paper.
The use of an approved scientific calculator is expected, where appropriate.

Paper	Marks
1	20

Set by: Mr Tan CG
Vetted by: Mr Calvin Tee, Mr Neal Cooke, Mdm Ivy, Mdm Fiona Tay and Mdm Hartati

This Paper consists of **8** printed pages, including the cover page.

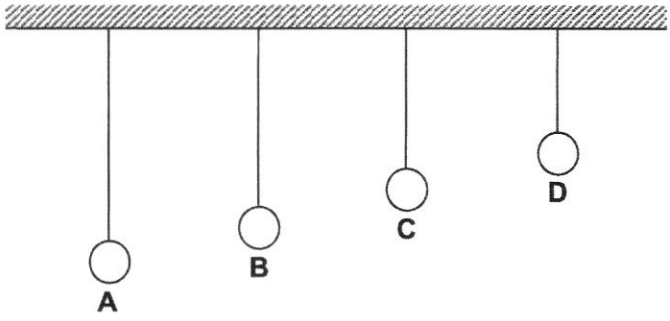
21 The diagram shows part of a micrometer screw gauge.



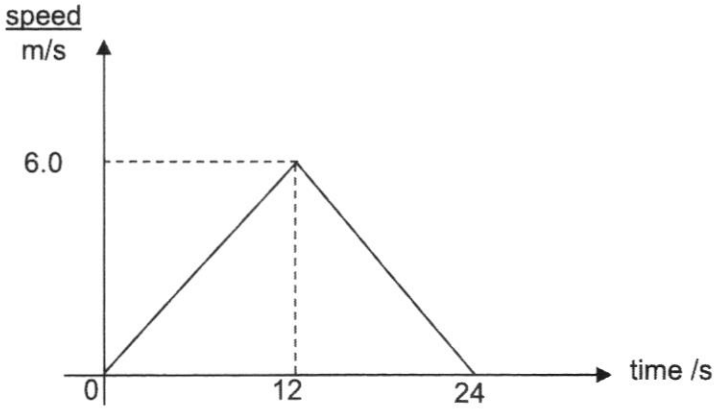
What is the reading shown?

A 5.126 mm
B 5.526 mm
C 5.76 mm
D 6.26 mm

22 Which simple pendulum has the highest frequency of oscillation?



23 The speed-time graph shows the motion of a car over a period of 24 s.



What is the deceleration of the car?

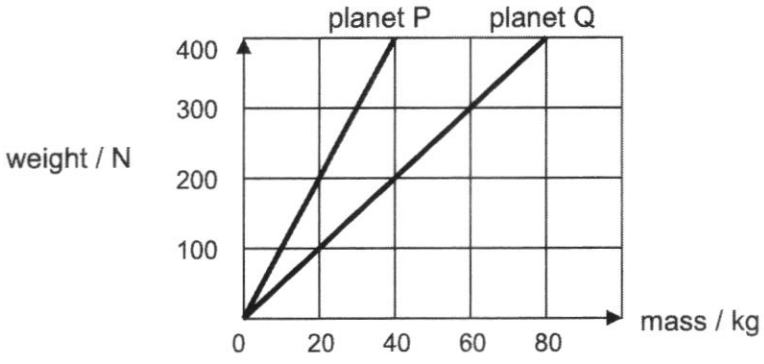
A $-0.50\ m/s^2$
B $0\ m/s^2$
C $0.50\ m/s^2$
D $72\ m/s^2$

24 A trolley is pushed from rest across a frictionless horizontal surface with a constant force.

If the pushing force is removed, what will happen to the box?

A The box will continue to move at a constant speed.
B The box will continue to move with its speed increasing at a constant rate for a while and then slow down.
C The box will start to slow down to a stop.
D The box will stop immediately.

25 The graph shows how weight varies with mass on planet P and planet Q.



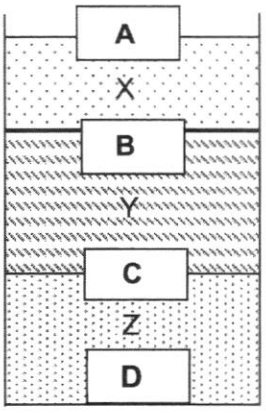
An object weighs 400 N on planet P. The object is taken to planet Q.

What is the mass and weight of the object on planet Q?

	mass of object on planet Q / kg	weight of object on planet Q / N
A	40	200
B	40	400
C	80	200
D	80	400

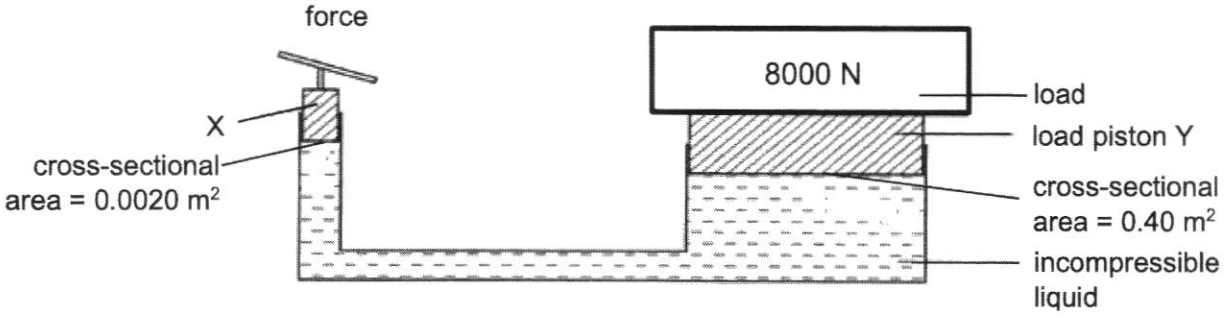
26 The diagram shows a beaker containing three immiscible liquids, X, Y and Z, with varying densities. A solid object which is less dense than Z but denser than X and Y is placed in the beaker.

Where would the position of the object be?



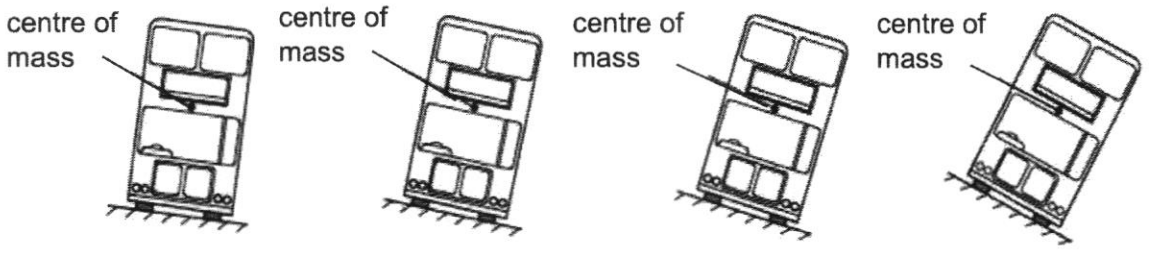
27 The diagram shows a hydraulic jack. The pressure at both cross-sectional areas is the same.

What is the force required at piston X to lift a load of 8000 N at piston Y?



A 40 N
B 320 N
C 80 000 N
D 1 600 000 N

28 The diagram shows four similar buses placed on different ramps tilted at different angles.



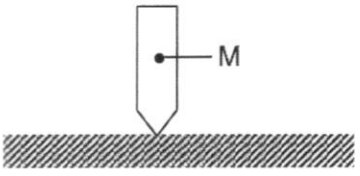
How many bus(es) will fall over?

A 1 **B** 2 **C** 3 **D** 4

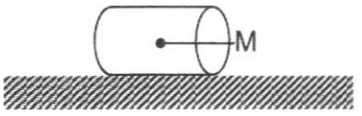
29 The diagrams show how four objects are placed on the ground. Point M indicates the respective centre of gravity for each object. The ground is shown as the shaded region.

Which object is in neutral equilibrium?

A



B



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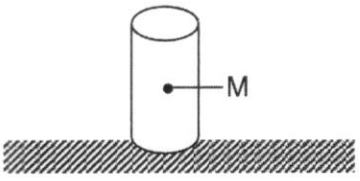
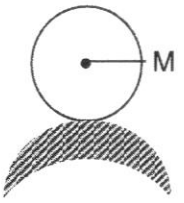
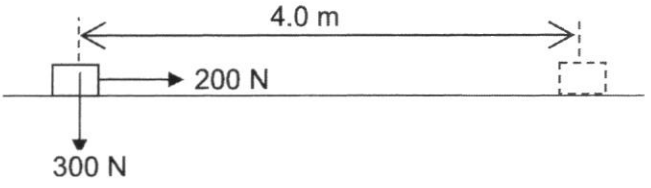


D



30 When a 200 N force is applied to a box weighing 300N, the box moves 4.0 m horizontally in 20 s.



What is the average power used when the box is moved?

A 40 W
B 60 W
C 100 W
D 16 000 W

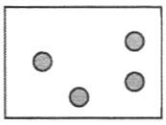
31 Which statement about solids, liquids and gases is correct?

A In a gas, particles move slowly downwards due to the force of gravity.
B In a liquid, particles move slowly in some directions only.
C In a solid, particles vibrate about their fixed positions.
D Liquids and gases can be easily compressed.

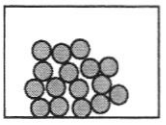
32 The melting and boiling points of mercury are −39 °C and 357 °C respectively.

Which diagram shows the arrangement of mercury atoms at 0 °C?

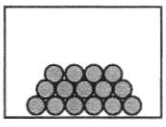
A



B



C



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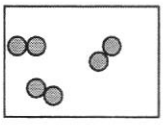
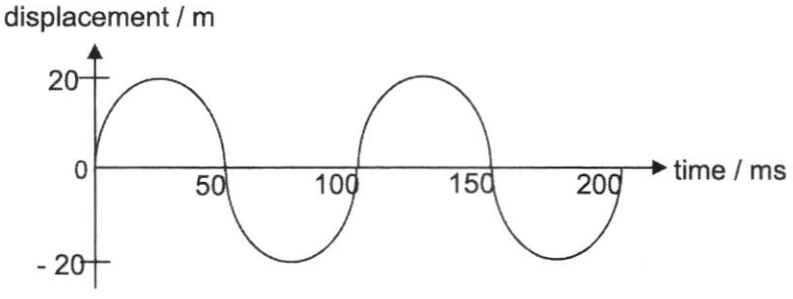


33 Which statement correctly describes what happens when a substance is boiling?

A The boiling substance changes from a gas to a liquid.
B The boiling substance gains thermal energy and therefore its temperature increases.
C The forces of attraction between the particles become weaker.
D There is no transfer of thermal energy and therefore the temperature of the substance remains constant.

34 The graph shows how the displacement of a particle in a wave varies with time.

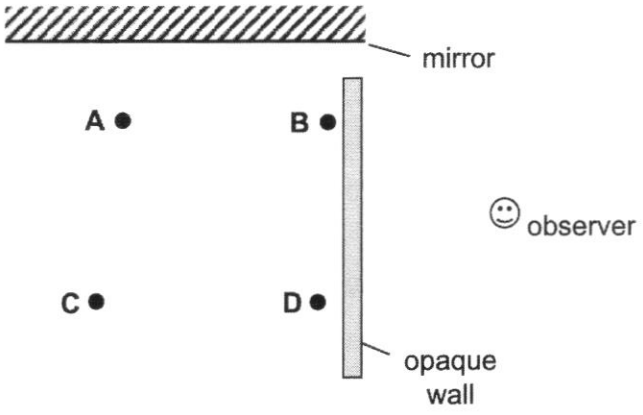


What is the amplitude of the wave?

A 0 m
B 20 m
C 40 m
D 100 m

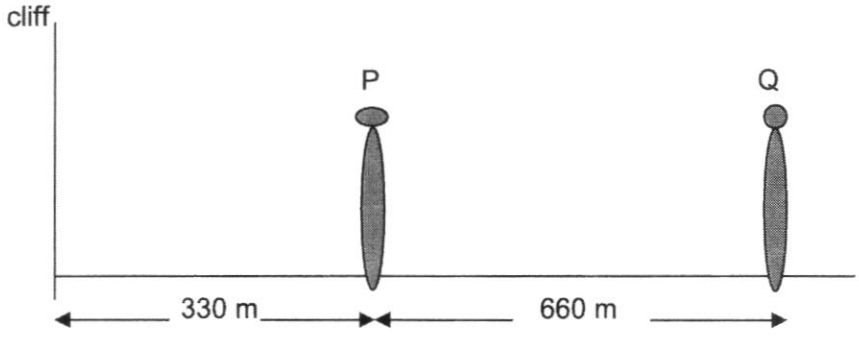
35 Four objects are blocked by an opaque wall.

Which object can be seen by the observer on the mirror?



36 Two people, P and Q stood in front of a vertical cliff. P fired a pistol. The time for the sound to travel directly from P to Q was t_1 seconds and the time for the echo to reach Q was t_2 seconds. Both timings were measured from the instant the pistol was fired.

If the speed of sound in air is 330 m/s, what was the value of $(t_2 - t_1)$?



A 0.5 s **B** 1.0 s **C** 2.0 s **D** 2.5 s

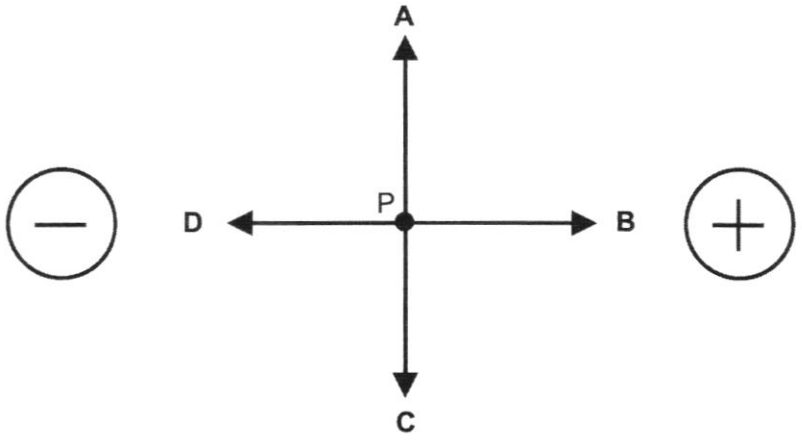
37 The table shows the lengths and diameters of four copper wires.

Which wire has the highest resistance?

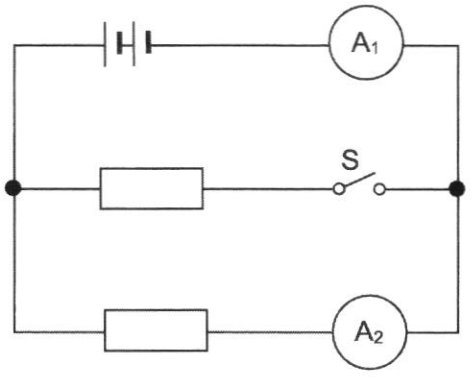
	length / m	diameter / mm
A	0.50	1.0
B	0.50	2.5
C	0.75	1.0
D	0.75	2.5

38 The diagram shows two oppositely-charged particles.

In which direction does the electric field act at the point P between the two charges shown?



39 Two identical resistors are connected as shown in the circuit.



How would the readings of ammeters A_1 and A_2 change when switch S is closed?

	reading of A_1	reading of A_2
A	increases	increases
B	increases	no change
C	no change	decreases
D	no change	no change

40 The cost of a unit of electricity is 26 cents.

What is the cost, to the nearest cent, if a student uses a 500 W computer for 40 minutes?

A \$0.09 **B** \$5.20
C \$52.00 **D** \$86.67

End of Paper 1

Preliminary Examination 2022
Secondary Four Express / Five Normal (Academic)
Science (Physics)
Paper 2 (5076/2)

Date of Examination: 29 Aug 2022 **Duration: 1 hour 15 minutes**

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Name : _____( ) Class : _____

Instructions to Candidates
Write your name, index number and class in the spaces provided on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Section	Marks
A	45
B	20
Total	65

Set by: Mr Tan CG
Vetted by: Mr Calvin Tee, Mr Neal Cooke, Mdm Ivy, Mdm Fiona Tay and Mdm Hartati

This Paper consists of **17** printed pages, including the cover page.

Section A

Answer **all** the questions in the spaces provided.

1 A mass of 50 kg is raised vertically by a wire attached to it.

(a) Draw a free body diagram of the mass showing all the vertical forces acting on it. Label all the vertical forces clearly.

[1]

(b) Calculate the tension in the wire if the mass accelerates upwards at 2.0 m/s^2.

tension = ... N [2]

2 Fig. 2.1 shows a windsurfer in equilibrium with a wind force acting on the sail of his board. The weight of the windsurfer is 600 N.

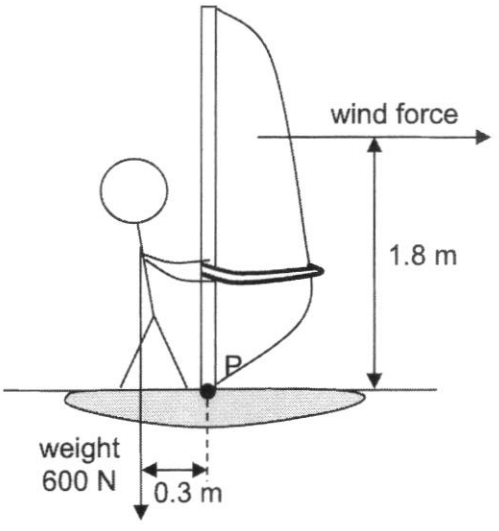


Fig. 2.1

(a) **(i)** Taking moment about pivot P, calculate the moment due to the weight of the windsurfer.

moment = ... Nm [1]

(ii) Hence, determine the force of the wind on the sail.

force = ... N [2]

(b) Explain why the windsurfer needs to lean back more if the wind speed increases in order to balance on his board.

.....

.....

.....[2]

3 Fig. 3.1 shows a ball being dropped from rest from a height of 5.0 m. Assume there is negligible air resistance.

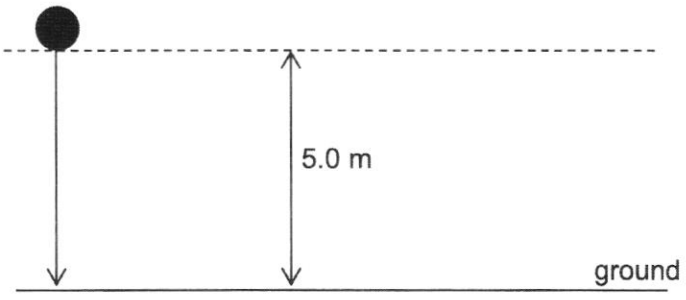


Fig. 3.1

(a) Calculate the speed of the ball just before hitting the ground.

speed = ...m/s [2]

(b) Using the graph provided, sketch a speed-time graph to represent the motion of the ball from the moment it drops till it just hits the ground.

[1]

(c) Calculate the time taken for the ball to reach the ground.

time = ...s [2]

4 Fig. 4.1 shows two ventilation shafts, A and B, built to provide fresh air for the miners in an underground tin mine.

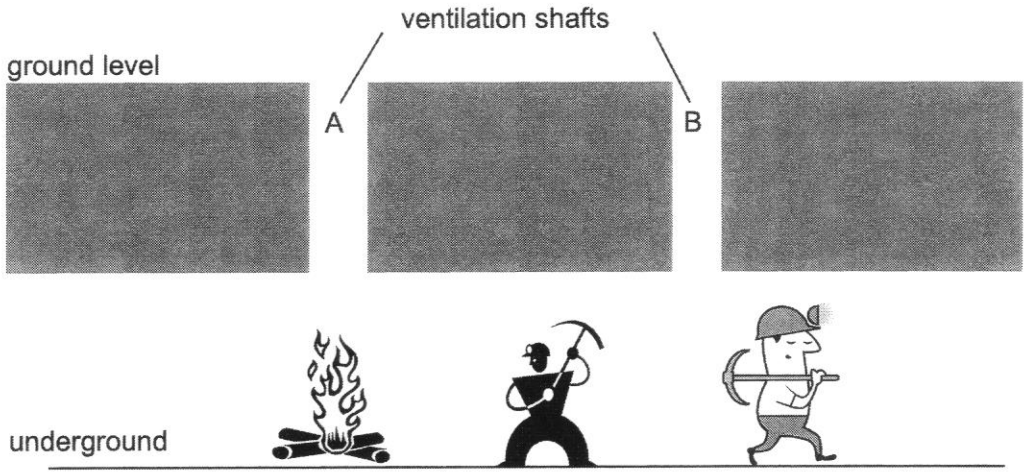


Fig. 4.1

(a) To improve the flow of air, a fire was lit at the bottom of one of the shafts.

Explain how this improves the air flow.

.....

.....

.....[2]

(b) To further improve the ventilation, a miner suggests to light fires at the bottom of both shafts.

Comment whether the miner's idea can further improve ventilation.

.....

.....[1]

5 Fig. 5.1 shows a block of transparent plastic. Light from O reaches the top surface of the transparent plastic at points X, Y and Z. The refractive index of the transparent plastic is 1.6.

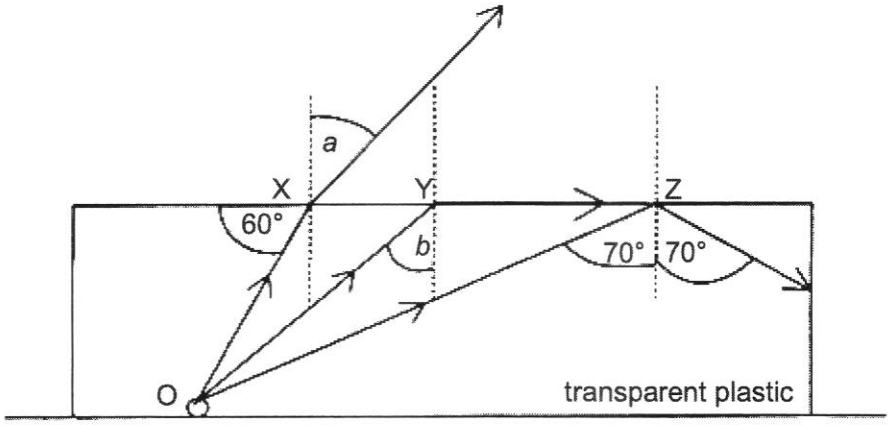


Fig. 5.1

(a) Calculate the value of angle *a*.

angle a = ...° [2]

(b) Calculate the value of angle *b*.

angle b = ...° [2]

(c) Another phenomenon occurs at Z.

State **one** condition required for this phenomenon to take place.

.....

.....[1]

6 Fig. 6.1 shows the side view of a water wave in a ripple tank.

Fig. 6.1 *(not drawn to scale)*

Fig. 6.2 is a scaled diagram of the ripple tank, viewed from the top.

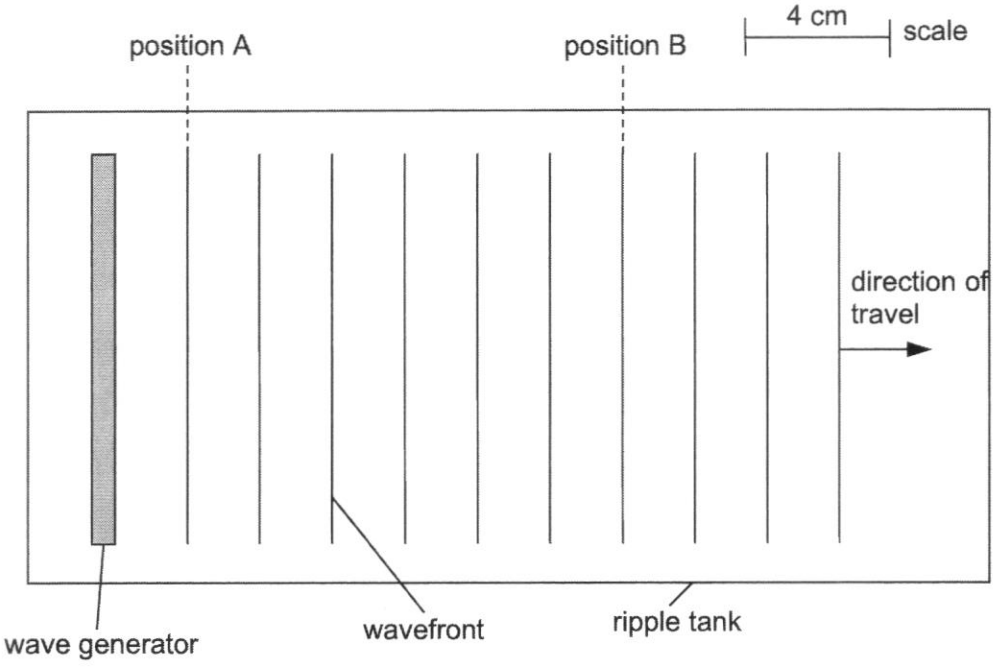


Fig. 6.2 *(drawn to scale)*

(a) State what is meant by the term *wavefront*?

.....

.....[1]

(b) Describe how the water in the ripple tank provides an example of *transverse wave* motion.

.....

.....

.....[1]

(c) The wavefront shown at position A in Fig. 6.2 takes 4.0 s to travel to position B.

Determine

(i) the wavelength,

wavelength = ... cm [1]

(ii) the speed,

speed = ... cm/s [2]

(iii) the frequency of the wave.

frequency = ... Hz [1]

7 Table 7.1 shows the typical frequencies of three types of electromagnetic (EM) waves S, T and U.

Table 7.1

EM Wave	typical frequency	use
S	1.0×10^{10} Hz	mobile communication
T	3.0×10^{12} Hz	intruder alarm, remote control
U	3.0×10^{16} Hz	detect counterfeit notes

(a) Which wave could be ultraviolet ray?

EM wave ..... [1]

(b) State **one** difference between an EM wave and a sound wave of the same wavelength.

.....

.....[1]

8 Fig 8.1 illustrates a sound wave travelling through air. X represents one particular air particle.

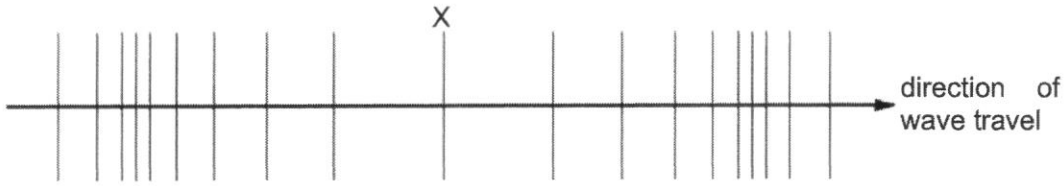


Fig. 8.1

(a) On Fig 8.1, mark clearly

(i) how particle X moves, [1]

(ii) the wavelength of this sound wave. Label this as **L**. [1]

(b) The pitch of the sound wave is raised.

State and explain how, if any, **(a)(ii)** would be affected.

.....

.....

.....[2]

9 Fig. 9.1 shows one method of painting a metal panel using electrostatic charges. The paint spray produces paint droplets which are positively-charged, and the metal panel is negatively-charged.

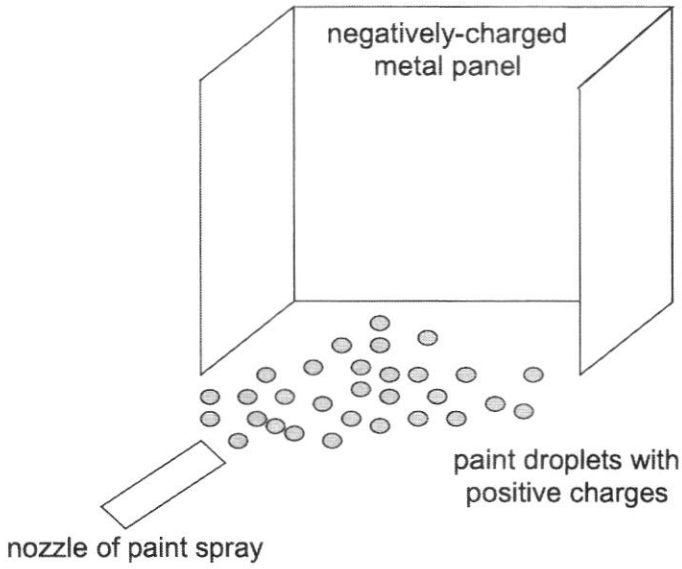


Fig. 9.1

(a) Explain why the paint droplets spread out as they leave the nozzle.

.....

.....

.....[2]

(b) Explain why the metal panel needs to be charged negatively.

.....

.....[1]

10 Fig. 10.1 shows an electrical circuit set up by a student using two similar light bulbs, a 12.0 V battery, a switch, a voltmeter, an ammeter and an unknown component Z.

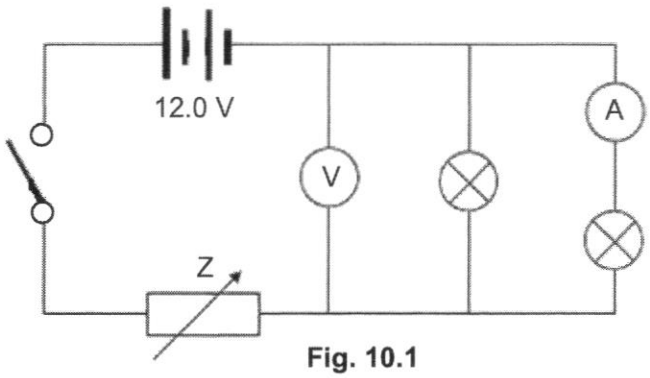


Fig. 10.1

The ammeter reading is 2.0 A when the voltmeter reading is 5.0 V.

Calculate

(a) **(i)** the resistance of one lamp,

resistance = ...Ω [2]

(ii) the potential difference across component Z,

potential difference = ... V [1]

(iii) the current that flows through Z.

current = ... A [1]

(b) Name component Z.

.....[1]

11 An experiment was conducted to test the ability of a vertically held soft iron bar to attract magnetic tacks. All the magnetic tacks were attracted to the soft iron in the presence of a magnet as shown in Fig. 11.1.

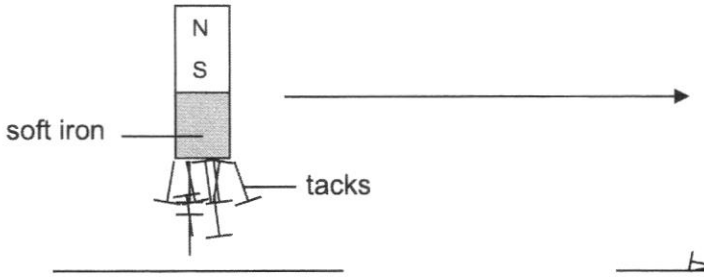


Fig. 11.1

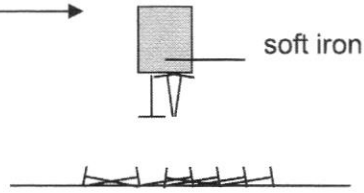


Fig. 11.2

As soon as the bar magnet was removed from the soft iron, most of the tacks that were attracted to the soft iron dropped. Three of the tacks remained attracted to the soft iron even after one hour had passed as shown in Fig. 11.2.

(a) **(i)** Explain why most of the tacks dropped once the magnet was removed.

.....

.....[1]

(ii) Suggest a material that these fallen tacks are made of.

.....[1]

(b) **(i)** Explain why some of the tacks remained attracted to the soft iron even after the magnet was removed.

.....

.....[1]

(ii) Suggest a material that these tacks that remained attracted are made of.

.....[1]

Section B

Answer any **two** questions from this section in the spaces provided.

12 A 50 W immersion heater was used to heat up some water.
The temperature of the water was taken at regular intervals.

Fig. 12.1 shows how the temperature of the water varied with time.

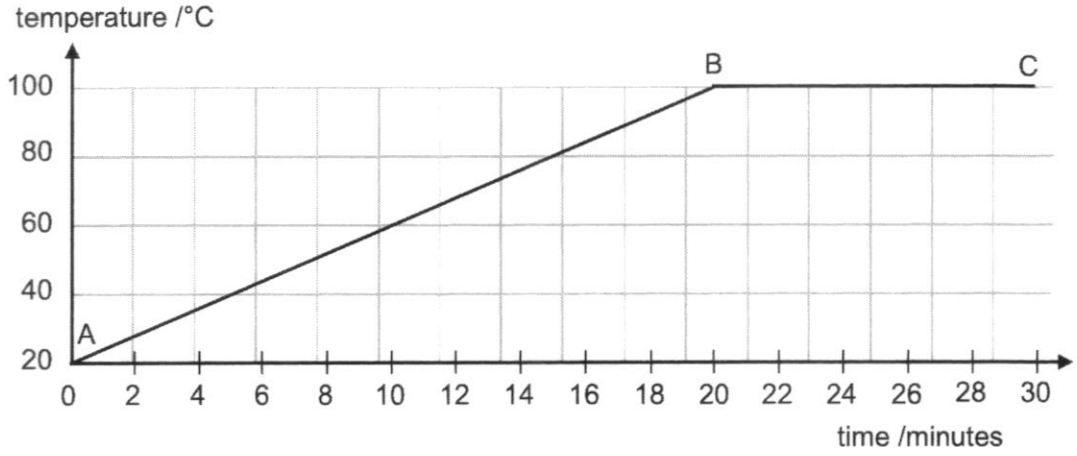


Fig. 12.1

(a) Describe the average speed and average separation of the water molecules

(i) between A and B,

.....

.....

.....[2]

(ii) between B and C.

.....

.....

.....[2]

(b) **(i)** Between B and C, the mass of water in the beaker decreases by 10 g.

Calculate how much energy is needed to boil 10 g of water at 100 °C.

energy = ... [2]

(ii) The amount of heat energy needed to change 10 g of water at 100 °C to steam should be 22600 J.

Explain why this is different from your calculated answer in **(b)(i)**.

.....

.....

.....[1]

(c) The immersion heater was connected to a 240 V power supply.

Calculate the current produced by the heater and hence explain whether a 13 A fuse is suitable for the immersion heater.

current = ...

.....

.....

.....[3]

13 **(a)** An object is placed 6.0 cm away in front of a thin converging lens. The image formed is real, inverted and the same size as the object.

(i) State the focal length of the lens.

focal length = ... [1]

(ii) Describe how the image changes as the object is moved slowly towards the lens until it is approximately 1 cm from the lens.

.....

.....

.....

.....

.....[4]

(b) A ray of blue light travelling in a vacuum enters a glass block of refractive index 1.5.

(i) State the speed of blue light travelling in vacuum.

speed of blue light in vacuum = ... [1]

(ii) Calculate the speed of blue light in glass.

speed of blue light in glass = ... [2]

(iii) State, giving a reason, how the speed of red light compares with the speed of blue light in a vacuum.

.....

.....[2]

14 A car and its passengers have a combined mass of 900 kg.
It starts from rest and moves with a constant acceleration of 2.0 m/s^2 until t = 10 s.
The car then travels at constant speed for the next 10 s.
It then decelerates at a constant rate for 4.0 s until it is at rest.
The opposing force acting on the car during the journey is 2000 N.

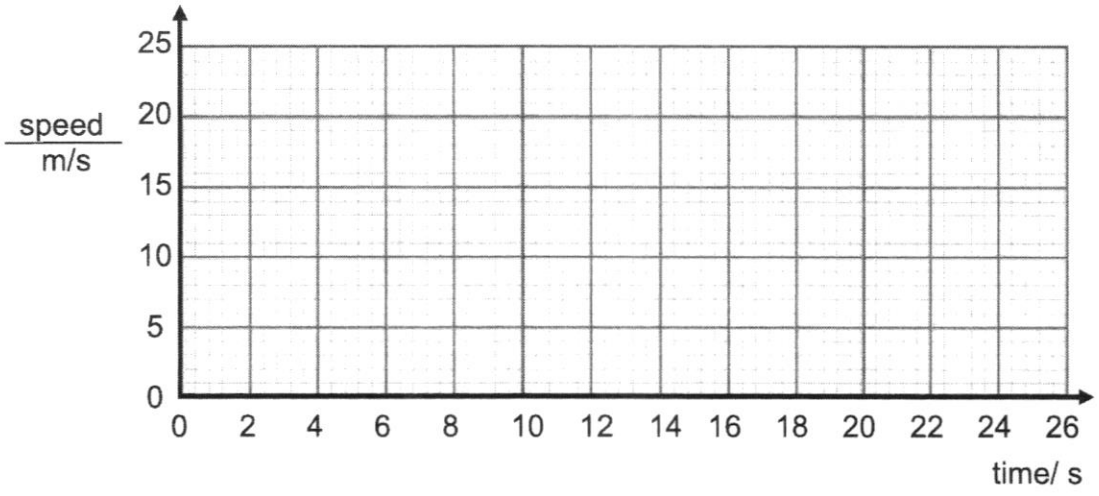


Fig. 14.1

(a) On the grid in Fig. 14.1, plot a graph to show how the speed of the car changes with time. [3]

(b) Calculate

(i) the distance travelled in the first 10 s.

distance = ... [2]

(ii) the energy gained by the car during the first 10 s.

work done = ... [2]

(c) State the driving force when t = 12 s.

driving force = ... [1]

(d) Describe how you would calculate the constant braking force acting on the car in the final 4.0 s of the journey.

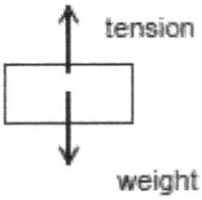
.....

.....[2]

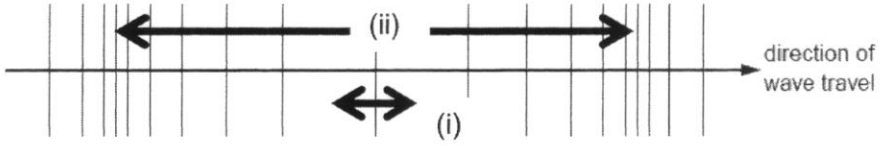
End of Paper 2

Ignore the comment in red.
For fuller version see separate doc 20220908 version
ANS for
4E Sci Phy Prelim 2022

21	C	22	D	23	C	24	A	25	A	26	C	27	A	28	A	29	B	30	A
31	C	32	B	33	C	34	B	35	C	36	C	37	C	38	D	39	B	40	A

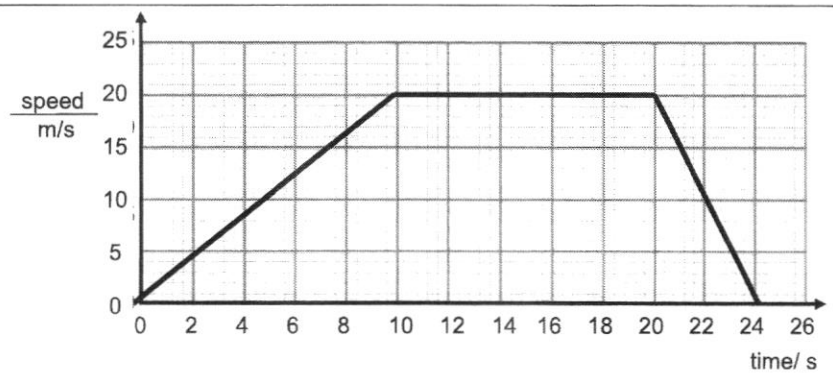
1	a		 Both forces correctly labelled and in correct directions. Many do not know the terminology 'tension'.	[1]
	b		Resultant force, F = ma T – W = 50 x 2 T – 50(10) = 100 T = 600 N Correct substitution of m a give 1m Many just thought the resultant force F is the tension itself	[1] [1]
2	a	i	moments = F x d = 600 N x 0.3 m = 180 Nm Well done, except for a few who cannot remember the formula	[1]
		ii	Acw=cw 180 = 1.8F F = 100 N Well done, except for a few who cannot remember the concept of Principle of moments	[1] [1]
	b		There is greater force on the sail creating a greater clockwise moment. Therefore, the person leans back to increase the distance between his CG and the pivot to obtain a greater anticlockwise moment Quite okie. But shld get students to describe acw, cw instead of saying to balance the moment	[1] [1]
3	a		m(10)(5.0) = ½ mv² [1] v= 10m/s [1] Many used d= sxt formula. Where they somehow use t = 1s.	[1] [1]

			Not many realised this is a Conservation of Energy question.	
	b		1m for a straight line drawn correctly value (10) is not needed ,  Many students didn't realise that it was dropped from rest (fail to read the question properly)	[1]
	c		Area under graph = 5 = ½ (t)(10) [1] t = 1.0 s Badly done Many used d= sxt formula. Which can only be used when acceleration = 0 However in this question acceleration is equal to 10 m/s^2	[1] [1]
4	a		The hot air above the fire will rise (as the hot air is less dense) through shaft A. OR Cooler air being denser will move into the mine from the other shaft, shaft B. This set up a convection current which improves the ventilation. Many omitted the mention of density Common mistake: molecules expand / molecules less dense	[1] [1]
	b		This will not work as hot air will rise from both shafts and there is no inlet for the cooler fresh air. Majority could do this	[1]
5	a		a = $\sin^{-1}$(1.6 x sin (90°-60°)) = 53.1° Many thought the angle of incidence is 60° which is wrong Give 1 m if students show understanding that there is angle of incident is 30°	[1] [1]
	b		b = $\sin^{-1}$(1 / 1.6) = 38.7°	[1] [1]

			Quite okie	
	c		From optically denser to less dense medium OR Incident angle is greater than critical angle Quite okie	[1]
6	a		A wavefront is an imaginary line joining adjacent points that are in phase . Many cannot recall the definition	[1]
	b		The water particles in the ripple tank travels in a direction perpendicular to the direction of the wave. Many cannot recall the definition and describe the transverse wave in relation to the question	[1]
	c	i	2.0 cm	[1]
		ii	speed = distance/time = (6 x 2)/4 **OR** 2/(4/6) = 3.0 cm/s (allow **ecf** from (c)(i)) Or Speed = distance/time = 12/4 =3.0 cm/s Many do not understand the idea of a scaled-drawing.	[1] [1]
		iii	f = v/λ = 3/2 = 1.5 Hz (allow **ecf** from (c)(i) and (ii))	[1]
7	a		U	[1]
	b		Sound wave *requires a medium* while electromagnetic wave does not require a medium for transfer of energy. OR Sound wave is *longitudinal wave* while electromagnetic wave is transverse wave.	[1]
8	a	i ii	 (i) Particles are moving parallel to the direction of wave travel. (double arrow to show) (ii) wavelength from compression to compression	[1] [1]

	b		The wavelength of the sound wave will be shorter Since v=fλ and the speed of sound remains the same, when frequency increases, wavelength is shorter.	[1] [1]
9	a		They all have the same charge. Like charges repel.	[1] [1]
	b		This is so that it can attract the positively-charged paint droplets. Unlike charges attract.	[1]
10	a	i	$R=\frac{V}{I}$ $=\frac{5}{2}$ $=2.5\ \Omega$	[1] [1]
		ii	V=12-5=7.0 V	[1]
	c	iii	4.0 A	[1]
	b		variable resistor / rheostat	[1]
11	a	i	The soft iron and the tacks lose their induced magnetism. Most students could do this	[1]
		ii	Iron. *Will give BOD for answer like nickel and cobalt, but pls warn student that in their syllabus there are only iron (soft magnetic material) and steel (hard magnetic material)*	[1]
	b	i	The tacks retains the magnetism and attracts the soft iron by induction. Most students could do this	[1]
		ii	Steel Most students could do this	[1]
12	a	i	The average speed of the water molecules increases (as the average kinetic energy of the molecules increases due to the increase in temperature) The average separation of the water molecules remains the same	[1] [1]
		ii	The average speed of the water molecules remains the same as temperature remains constant The average separation of the water molecules increases greatly as liquid water changes to the gaseous state	[1] [1]
	b	i	E = Pt = 50 x (10 x 60) = 30000 J	[1] [1]

		ii	Some heat energy is lost to the surrounding instead of being used to heat up the water Thus, more energy is required in reality to change the water into steam .	[1]
	c		Rated current of the heater is I = P/V = 50/240 [1] = 0.208 A [1]. Hence a 13 A fuse might allow excessive current to flow and damage the heater, but it will not blow Or Wire may overheat and catches fire. *(Do not accept if just mention rating is too high)*	[1] [1] [1]
13	a	i	3.0 cm	[1]
		ii	As the object is moved nearer to the lens, the image becomes magnified until it is 3 cm from the lens And/or When it is less than 3 cm from the lens, the image becomes virtual and upright And/or and magnified, and/or the image becomes on the same side of the lens as the object. Any of the 4 underlined: award 4m (the position of the object must be correct for the characteristic mentioned)	[1] [1] [1] [1] [1]
	b	i	3.0×10^8 m/s	[1]
		ii	n = c/v $1.5 = (3 \times 10^8)/v$ $v = 2.0 \times 10^8$ m/s	 [1] [1]
		iii	The speed of red light is the same as the speed of blue light as they are all EM waves which travel at the same speed in vacuum.	[1] [1]

14	a		 Straight line from (0,0) to (10, 20) [1] Horizontal line from end of first line for 10 s [1] Straight line from (20, 20) to (24,0) [1]	[3]
	b	i	distance = area under graph = ½ x 10 x 20 = 100 m	[1] [1]
		ii	gain in KE = 1/2 mv^2 = ½ x 900 x 20^2 = 180 000 J	[1] [1]
	c		2000 N	[1]
	d		Calculate the acceleration (or deceleration) multiplied by the mass of the car, in order to calculate ma As the breaking force + "other opposing forces" = ma Subtract 2000 from ma to find the magnitude of breaking force	[1] [1]

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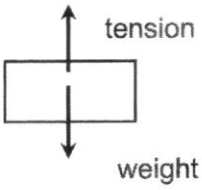
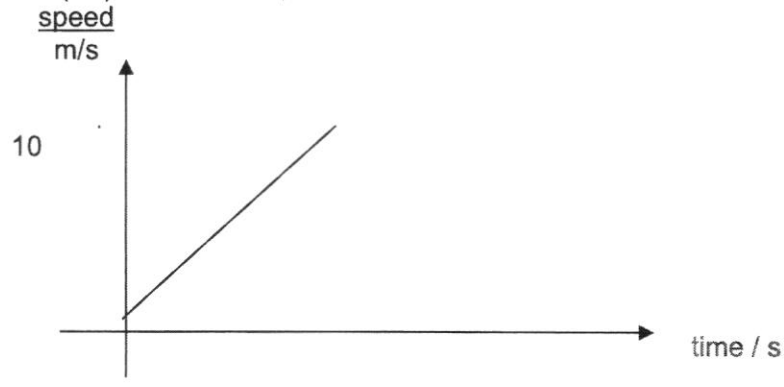
21 C	**22** D	**23** C	**24** A	**25** A	**26** C	**27** A	**28** A	**29** B	**30** A
31 C	**32** B	**33** C	**34** B	**35** C	**36** C	**37** C	**38** D	**39** B	**40** A

1	a		 Both forces correctly labelled and in correct directions. Can accept: Many do not know the terminology "tension" Many also cited (wrongly) air resistance, gravity,	[1]
	b		Resultant force, F = ma T – W = 50 x 2 T – 50(10) = 100 T = 600 N Correct substitution of m,a give 1m Many just thought the resultant force F is the tension itself	[1] [1]
2	a	i	moments = F x d = 600 N x 0.3 m = 180 Nm Well done, except for a few who cannot remember the formula	[1]
		ii	Acw=cw 180 = 1.8F F = 100 N Well done, except for a few who cannot remember the concept of Principle of moment	[1] [1]
	b		There is greater force on the sail creating a greater (clockwise) moment. Therefore, the person leans back to <u>increase the distance between his CG and the pivot</u> to obtain a <u>greater anticlockwise moment</u> Quite okie. But shld get students to describe acw, cw instead of saying to balance the moment	[1] [1]

3	a		m(10)(5.0) = ½ mv^2 [1] v= 10m/s [1] Many used d= sxt formula. Where they somehow use t = 1s. Not many realised this is a Conservation of Energy question.	[1] [1]
	b		1m for a straight line drawn correctly value (10) is not needed ,  Many students didn't realise that it was dropped from rest (fail to read the question properly)	[1]
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4	a		Hot air expands OR The hot air above the fire will rise (as the hot air is less dense) through shaft A. OR Cooler air being denser will move into the mine from the other shaft, shaft B. This set up a convection current which improves the ventilation. Many omitted the mention of density Common mistake: molecules expand / molecules less dense	[1] [1]
	b		This will not work as hot air will rise from both shafts and there is no inlet for the cooler fresh air. Majority could do this	[1]
5	a		a = sin^{-1}(1.6 x sin (90°-60°)) = 53.1° Many thought the angle of incidence is 60° which is wrong Give 1 m if students show understanding that there is angle of incident is 30° formula , n = sin r/ sin i, also can give 1 m	[1] [1]
	b		b = sin^{-1}(1 / 1.6)	[1]

			= 38.7° Quite okie	[1]
	c		From optically denser to less dense medium OR Incident angle is greater than critical angle Many forgot the conditions for TIR to occur	[1]
6	a		A wavefront is an imaginary line joining adjacent points that are in phase . Many cannot recall the definition	[1]
	b		The water particles in the ripple tank travels in a direction perpendicular to the direction of the wave. Many cannot recall the definition and describe the transverse wave in relation to the question	[1]
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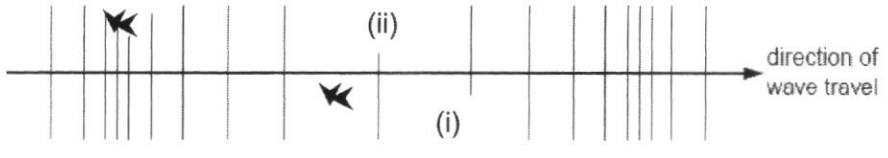
8	a	i ii	 (i) Particles are moving parallel to the direction of wave travel. (double arrow to show) Many students just give arrow in one direction. (give mark this time, but warn them in O level the need to have bidirection arrow) (ii) wavelength from compression to compression, must give exact position of middle of compression to middle of next compression	[1] [1]

	b		The wavelength of the sound wave will be shorter Since v=fλ and (the speed of sound remains the same,) when frequency increases, wavelength is shorter. Many students scored one mark only and missed out the second point.	[1] [1]
9	a		They all have the same charge. Like charges repel. Mostly well done	[1] [1]
	b		This is so that it can attract the positively-charged paint droplets. Unlike charges attract. Mostly well done	[1]
10	a	i	$R = \frac{V}{I}$ $= \frac{5}{2}$ $= 2.5\ \Omega$ Some students left this answer in fraction. They cannot tell if the circuit is series or parallel.	[1] [1]
		ii	$V = 12 - 5 = 7.0\ V$ Some students just used 12V as the answer.	[1]
	c	iii	4.0 A Many students just gave 2A as the answer or calculated wrongly	[1]
	b		variable resistor / rheostat	[1]
11	a	i	The soft iron and the tacks lose their induced magnetism. Most students could do this	[1]
		ii	Iron. *Will give BOD for answer like nickel and cobalt, but pls warn student that in their syllabus there are only iron (soft magnetic material) and steel (hard magnetic material)*	[1]
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12	a	i	The average speed of the water molecules increases (as the average kinetic energy of the molecules increases due to the increase in temperature) The average separation of the water molecules remains the same Many students stated that the ave separation increased (can accept also)	[1] [1]
		ii	The average speed of the water molecules remains the same as temperature remains constant	[1]

			Many students stated that the average speed increases The <u>average separation of the water molecules increases</u> greatly as liquid water changes to the gaseous state	[1]
	b	i	E = Pt = 50 x (10 x 60) = 30000 J Some students forgot to convert minutes to seconds. Some students did not recognise that the 50W was provided in the question.	[1] [1]
		ii	Some <u>heat energy is lost to the surrounding</u> instead of being used to heat up the water Thus, more energy is required in reality to change the water into steam . Most could answer this	[1]
	c		Rated current of the heater is I = P/V = 50/240 [1] = 0.208 A [1]. Hence a 13 A fuse might allow <u>excessive current to flow</u> and <u>damage the heater, but it will not blow</u> Or Wire may overheat and catches fire. *(Accept also if just mention rating is too high) : BUT pls caution the student to explain why too high is dangerous, it shld be explained as well* *Most students stated this and thus did not get the mark*	[1] [1] [1]
13	a	i	3.0 cm Many students stated 6 cm as the answer	[1]
		ii	As the object is moved nearer to the lens, the image <u>becomes magnified</u> until it is 3 cm from the lens And/or When it is less than 3 cm from the lens, the image becomes <u>virtual</u> and <u>upright</u> And/or and <u>magnified</u>, and/or the image becomes on the <u>same side of the lens as the object</u>. Any of the 4 underlined: award 4m (the position of the object must be correct for the characteristic mentioned) This was mostly well done	[1] [1] [1] [1] [1]
	b	i	3.0 x 10^8 m/s Many students left out the unit	[1]
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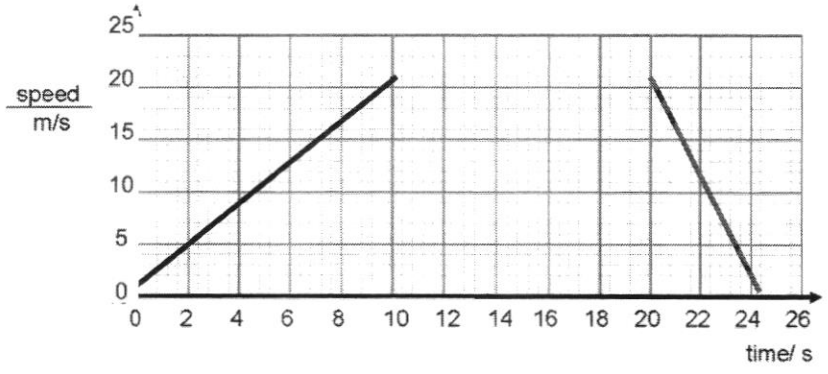
			$1.5 = (3 \times 10^8)/v$ $v = 2.0 \times 10^8$ m/s Many students left out the unit	[1] [1]
		iii	The speed of red light is <u>the same</u> as the speed of blue light as <u>they are all EM waves/ all light which travel at the same speed in vacuum</u>. Many students left out the second part and so scored just one mark	[1] [1]
14	a		 Straight line from (0,0) to (10, 20) [1] Horizontal line from end of first line for 10 s [1] Straight line from (20, 20) to (24,0) [1] Quite well done, although some students ended at 26 s instead of 24 s	[3]
	b	i	distance = area under graph $= \frac{1}{2} \times 10 \times 20$ = 100 m Mostly well done	[1] [1]
		ii	gain in KE = $1/2\ mv^2$ $= \frac{1}{2} \times 900 \times 20^2$ = 180 000 J Poorly done. Many students still cannot use PCE/ COE to solve this.	[1] [1]
	c		2000 N Quite well done. However, some students just put the answer as 0 N as they thought the question was asking for the resultant force.	[1]
	d		Calculate the acceleration (or deceleration) multiplied by the mass of the car, in order to calculate ma As the breaking force + "other opposing forces" = ma Subtract 2000 from ma to find the magnitude of breaking force Many students left out the second part and so scored just one mark	[1] [1]