



END OF YEAR EXAMINATION 2017

Secondary 3 Express / 3 NA (Express Science)

SCIENCE (PHYSICS)

5076

Paper 1

4th October 2017

Time: 10.10 a.m. – 11.25 a.m. (for both P1 and P2)

Duration: 1 hour 15 minutes

Additional material: OTAS Paper

INSTRUCTIONS TO STUDENTS:

1. Write your name, class and register number on the question cover sheet.
2. This paper consists of fifteen multiple choice questions. 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 2B pencil on the separate OTAS Paper. Should you wish to change your answer, make sure that you have completely erased the wrong oval.
3. At the end of the examination hand in the OTAS paper and the question paper separately.
4. Usage of calculators is permitted in this examination.

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.

Name of Student: _____ ()

Class: _____ Band: _____

Parent's Signature: _____

For Examiner's Use	
Total	15

Setter: Mr. Jonathan Ho

This question paper consists of 6 printed pages including the cover page.

[Turn over

SECTION A MCQ [15 marks]

Choose the most appropriate answer and record your choice in the OTAS provided.

- 1 **Fig 1.1** shows a micrometer screw gauge that is used to measure the thickness of a current-carrying wire.

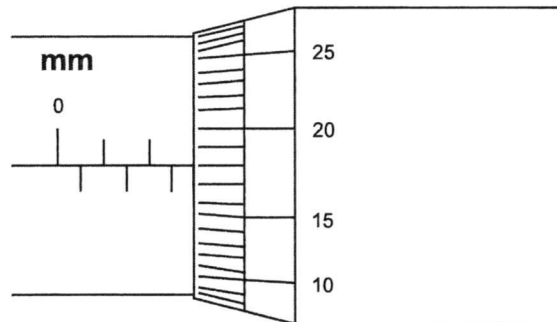


Fig. 1.1

What is the thickness of the wire?

- A 2.18 mm
 B 2.68 mm
 C 5.18 mm
 D 5.68 mm
- 2 **Fig 2.1** shows a set of vernier callipers used to measure the thickness of a dictionary. The vernier callipers are known to have a zero error of -0.02 cm.

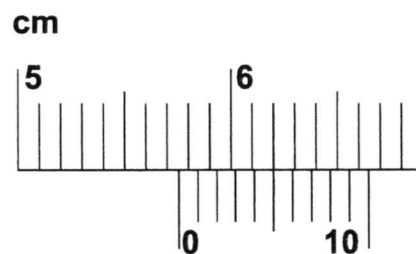


Fig 2.1

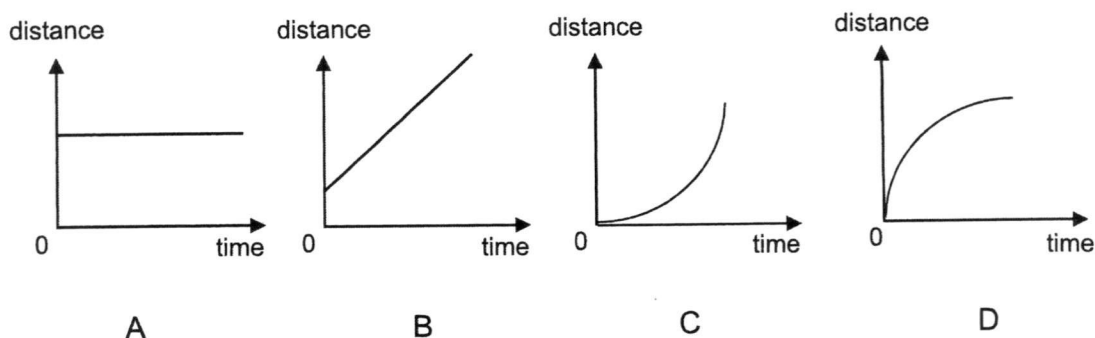
What is the actual thickness of the dictionary?

- A 5.73 cm
 B 5.77 cm
 C 6.73 cm
 D 6.77 cm

- 3 Which of the following does not show the SI unit of the corresponding physical quantity?

	physical quantity	SI unit
A	mass	kilogram
B	length	metre
C	energy	joule
D	temperature	degree Celsius

- 4 Which graph shows the motion of an object moving at uniform speed?



- 5 A weather balloon is released into the atmosphere and rises at a constant speed of 5.0 m/s. It has a total weight of 22 N. What is the resultant force acting on the balloon while it is rising?

- A 0 N
- B 4.4 N
- C 22 N
- D 110 N

- 6 A car is moving forward with uniform acceleration. Two forces act on the car as shown in the diagram below.



Which statement is correct?

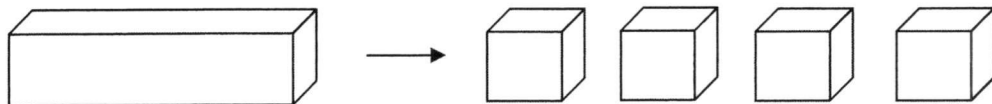
- A The resistive force is smaller than the driving force.
- B The resistive force is larger than the driving force.
- C The resistive force is equal to the driving force.
- D The driving force is equal to the resultant force.

- 7 A full space suit has a weight of 960 N on Earth. What is its weight on the Moon?

(Take gravitational field strength of the Earth = 10 N/kg, and gravitational field strength of the Moon = 1.6 N/kg)

- A 60 N
- B 154 N
- C 600 N
- D 960 N

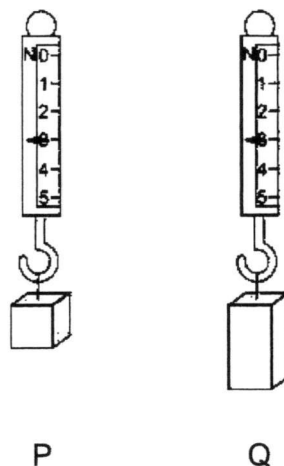
- 8 A uniform rectangular block has a density of 1250 kg/m^3 . The block is cut into four identical smaller blocks.



What is the density of each small block?

- A 312.5 kg/m^3
- B 625 kg/m^3
- C 1250 kg/m^3
- D 5000 kg/m^3

- 9 Two metal blocks P and Q are hanging from spring balances on Earth next to each other as shown below.



Which of the following is true about P and Q?

- A They have same mass but different weights.
- B They have same weight but different masses.
- C They have the same mass and weight.
- D They have different masses and weights.

- 10 A car engine uniformly converts 8 MJ of useful energy in 20 seconds.

What is the power of the car engine?

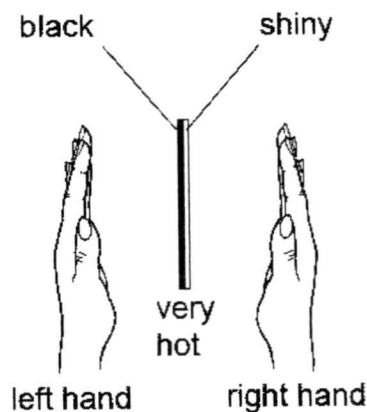
- A 400 μ W
- B 400 kW
- C 4 MW
- D 160 MW

- 11 A balloon is heated, and the pressure of the air inside increases.
Why is this so?

- A The number of air molecules increases.
- B The air molecules are moving faster.
- C The air molecules collide less frequently.
- D The air molecules have a larger mean free path.

- 12 The figure below shows a thick copper plate that is very hot. One side is black, the other side is shiny.

A student places her hands the same distance away from each side.



Her left hand feels warmer than her right hand.

Which statement is the correct conclusion from the experiment?

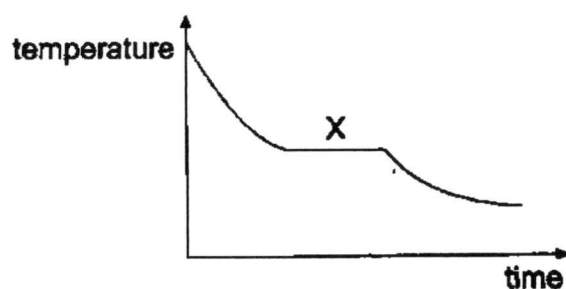
- A The black side is cooler than the shiny side.
- B The black side radiates more radiant heat.
- C The shiny side is cooling down faster than the black side.
- D The shiny side radiates more radiant heat.

13 In the process of conduction, energy is transferred _____.

- A by the diffusion of molecules throughout a fluid
- B by the vibration of molecules about a mean position
- C because of density differences in a fluid
- D because of temperature differences in a solid

14 A hot liquid is carefully poured into a beaker. The graph shows how its temperature changes as it cools towards room temperature.

Which processes are taking place at region X?



- A evaporation only
- B condensation only
- C boiling and evaporation
- D solidification and evaporation

15 Which statement concerning the process of evaporation is NOT correct?

- A A moist atmosphere decreases the rate of evaporation from a water surface.
- B A stream of air across a liquid surface assists evaporation.
- C Evaporation can cause cooling.
- D Evaporation requires energy to be supplied from outside the liquid.

END



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Paper 2

4th October 2017

Time: 10.10 a.m. – 11.25 a.m. (for both P1 and P2)

Duration: 1 hour 15 minutes

INSTRUCTIONS TO STUDENTS:

Write your name, class and register number on the question cover sheet.
Write in blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions on the Question Paper.

Section B

Answer **all** questions 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

Usage of calculators is permitted in this examination.

Name of Student: _____ ()

Class: _____ Band: _____

Parent's Signature: _____

Setter: Mr. Jonathan Ho

For Examiner's Use	
P1	15
P2A	35
P2B	10
Total	60

This question paper consists of 11 printed pages including the cover page.

[Turn over

Section A (35 marks)

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

- 1 **Fig. 1.1** shows how the temperature of liquid molten wax changes as it is cooled in a room.

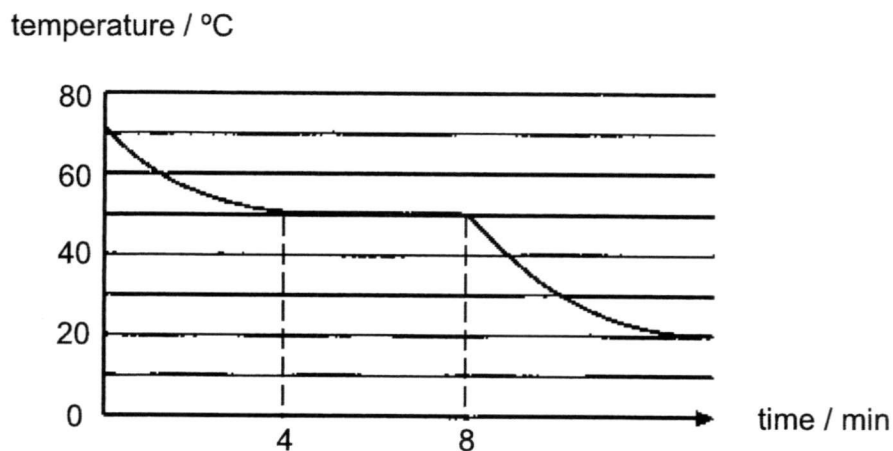
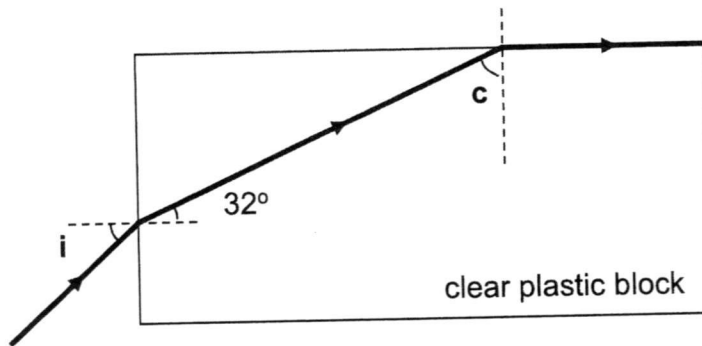


Fig. 1.1

- a State the freezing point of the wax. [1]
- b Identify the state/s of matter of the wax at time = 6 min. [1]
- c Energy is being lost at a steady rate. Explain why the temperature does not change from time = 4 min to time = 8 min, even though energy is being removed from the wax as it is cooled. [2]

- 2 **Fig. 2.1** shows the path of a ray of light entering a rectangular clear plastic block at an angle of incidence, i .



(Figure not drawn to scale)

Fig. 2.1

- a Determine the value of the critical angle, c of the glass block. [1]

critical angle $c =$ _____ $^\circ$

- b Hence, determine the refractive index of the glass block. [2]

refractive index = _____

- c Hence, calculate the angle of incidence, i . [2]

angle of incidence $i =$ _____ $^\circ$

- 3 **Fig. 3.1** shows a uniform wooden block resting on a bench top in two different positions.

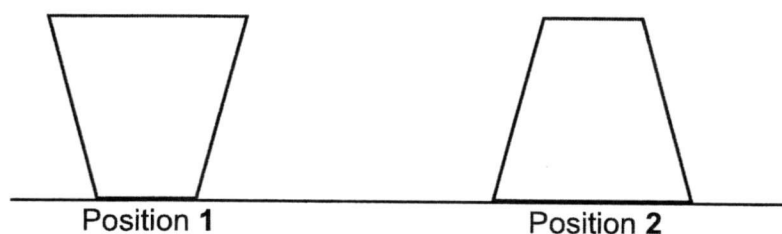


Fig. 3.1

- a Give two reasons why the wooden block at position 1 is less stable than at position 2. [2]

- b State the position that will cause a greater pressure to be exerted by the block on the bench top. Give a reason for your answer. [2]

- 4 The mass of an empty plastic bottle is 100 g.

When this plastic bottle is fully filled with water, it has a total mass of 1100 g.

When the same plastic bottle is fully filled with liquid L, the total mass of the plastic bottle and the liquid L is 900 g.

The density of water is 1.00 g/cm^3 .

Calculate the density of liquid L. [3]

density of liquid L = _____ g/cm^3

- 5 A block has a mass of 8 kg. **Fig 5.1**, not drawn to scale, shows that the block starts from rest at **A**, and slides down a slope to **B**.

Take $g = 10 \text{ N/kg}$.

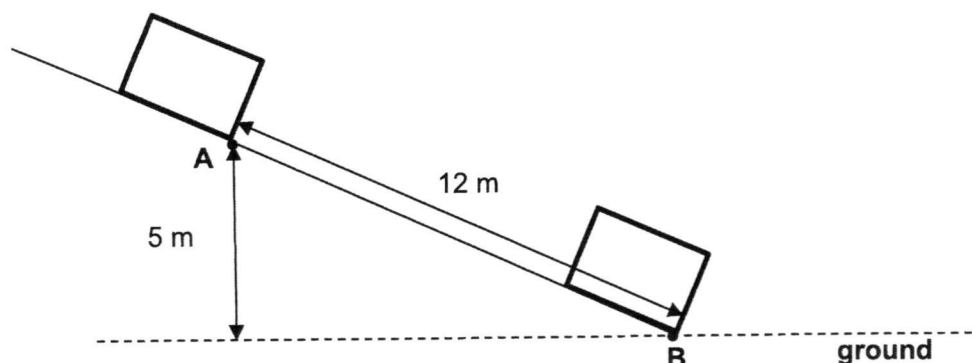


Fig 5.1

- a Calculate the change in gravitational potential energy between A and B. [2]

change in gravitational potential energy = _____ J

- b During the journey down the slope, 120 J of energy is converted to thermal and sound energy due to friction on the slope.

- i Find the kinetic energy of the block at point **B**. [1]

kinetic energy = _____ J

- ii Hence, find the speed of the block at point **B**. [2]

speed = _____ m/s

- 6 **Fig. 6.1** shows two identical glass cylinders containing equal volumes of water, initially at room temperature. Identical electric heaters were placed in the cylinders, near the top in cylinder A and near the bottom in cylinder B

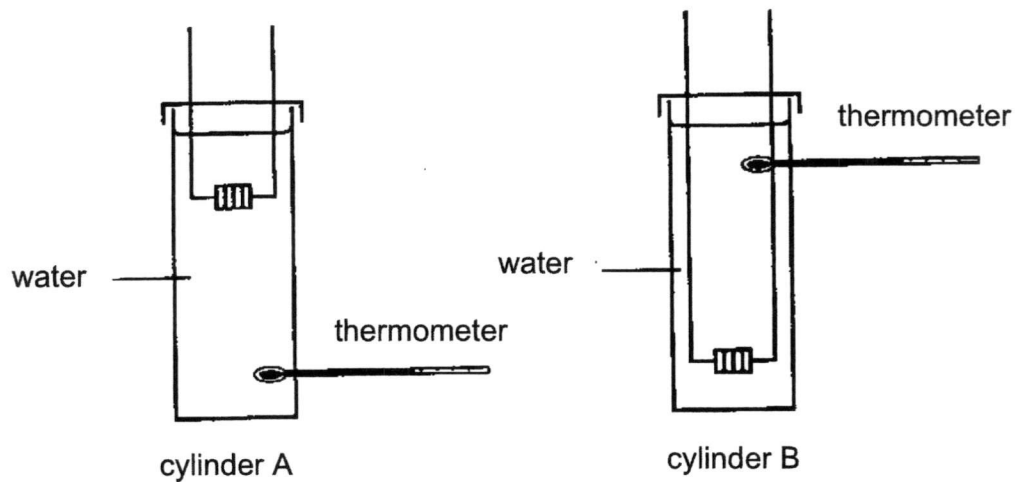


Fig. 6.1

The heaters were switched on at the same time. The readings of the thermometers changed and are shown in **Fig. 6.2**.

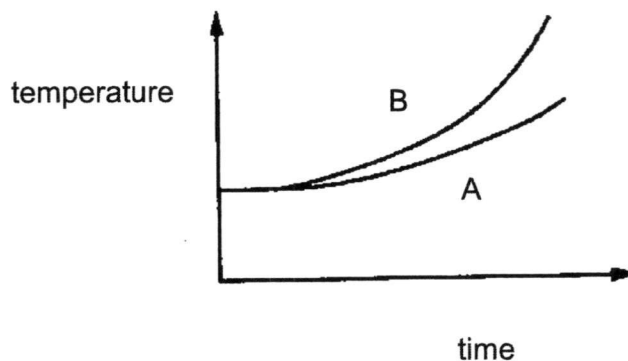


Fig. 6.2

Explain why the thermometer reading in cylinder A shows a slower rate of increase in temperature than that in cylinder B. [2]

- 7 Fig. 7.1 shows a diver of weight 720 N standing on one end of a uniform diving board. The board has a weight of 100 N and a length of 3.00 m. It is fixed by two supports, P and Q which are 1.00 m apart.

Take $g = 10.0 \text{ N/kg}$

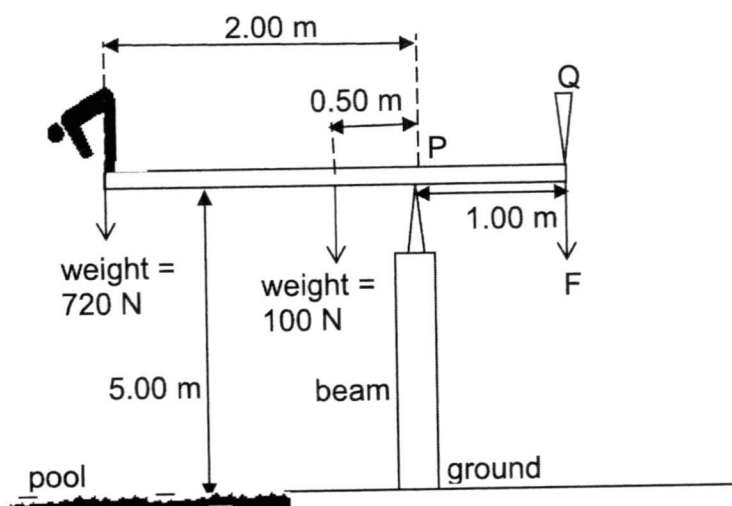


Fig. 7.1

- a Taking P as the pivot, calculate the total anticlockwise moments about the pivot. [2]

total anticlockwise moments = _____ Nm

- b To maintain equilibrium, support Q is applying a downward force on the board. Calculate this downward force. [2]

downward force = _____ N

- 8 **Fig. 8.1** shows an object O placed near a converging lens L. F is the focal point of the lens.

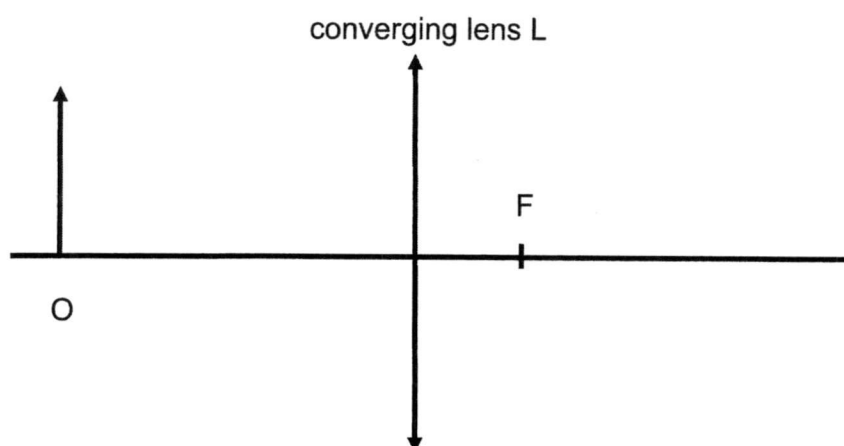


Fig. 8.1

- a On Fig. 8.1, draw two rays from the top of the object through the lens. Use the rays to find the position of the image. Draw the image and label it i. [2]
- b State two properties of the image produced. [2]
-
-
- c Suggest one instrument which uses a lens in this way. [1]
-

- 9 Fig. 9.1 shows the displacement-distance graph of a particular wave.

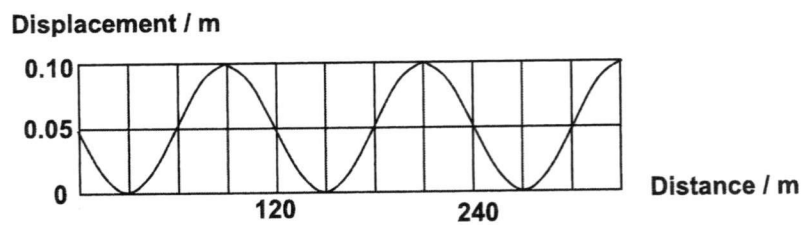


Fig 9.1

- a Find the wavelength of the wave. [1]

wavelength = _____ m

The frequency of the wave is known to be 0.02 Hz.

- b Find the speed of the wave. [2]

speed = _____ m/s

Section B (10 marks)

Answer the **long structured question** in this section.

Write your answers in the spaces provided.

- 10 A car of mass 1500 kg goes on a journey on a straight horizontal road. It produces the speed-time graph as shown in Fig. 10.1.

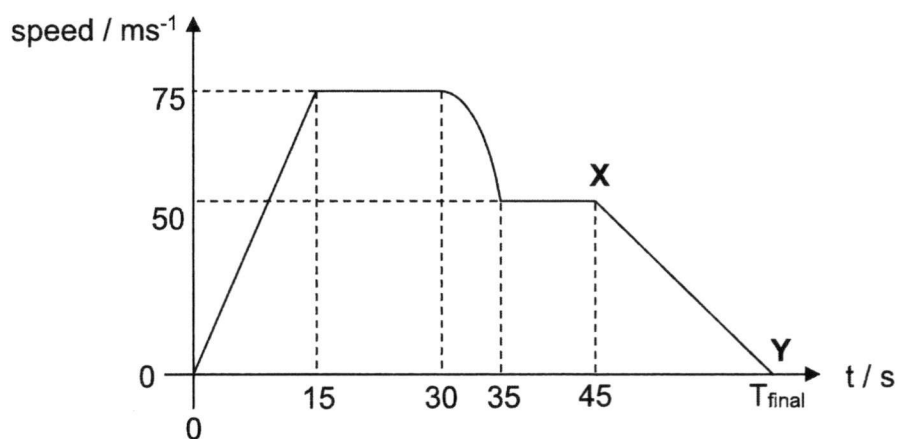


Fig. 10.1

- a i Find the acceleration of the car during $t = 0$ s to $t = 15$ s. [2]

acceleration = _____

- ii Hence, find the resultant force acting on the car during $t = 0$ s to $t = 15$ s. [2]

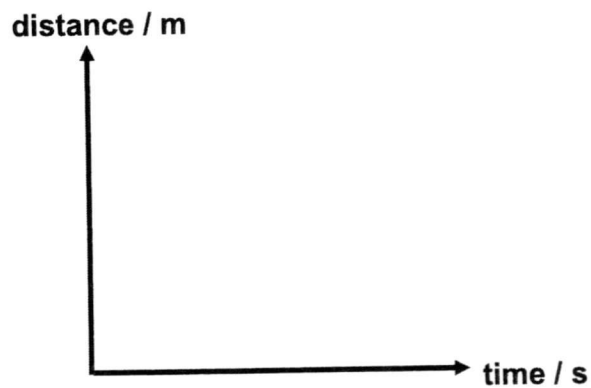
resultant force = _____

- b Calculate the distance travelled by the car in the first 30 s. [2]

distance = _____

- c Describe the motion of the car from $t = 30$ s until the time where the car comes to a complete stop. [3]

- d On the graph below, sketch the distance-time graph of the car for the section XY of Fig. 10.1. [1]



END

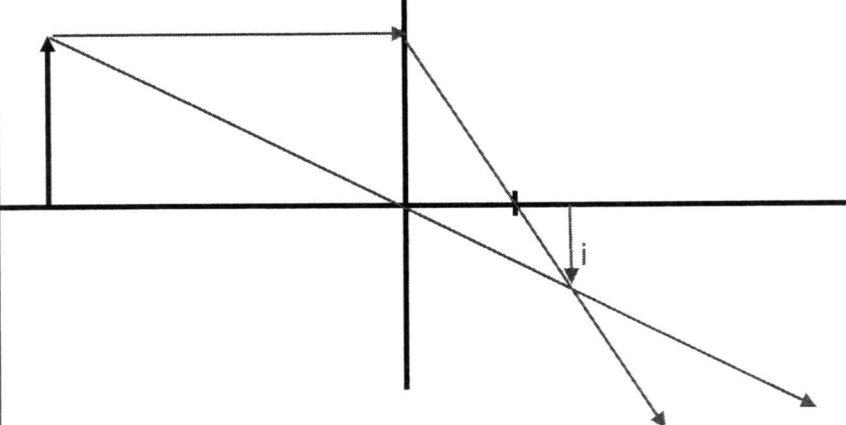
Hillgrove Secondary School

Sec 3 Express Science Physics MYE 2017 Marks Scheme

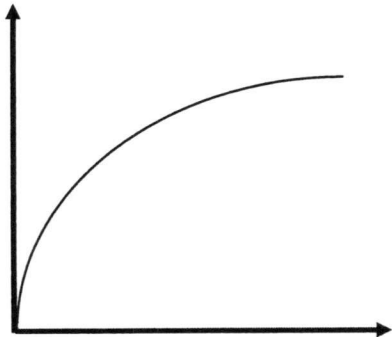
MCQ Answers

Qn	Ans	Description
1	B	
2	B	
3	D	The SI unit of temperature is Kelvin.
4	B	Speed is the gradient of a distance-time graph, uniform speed
5	A	Constant speed = no acceleration = zero resultant force
6	A	
7	B	Mass = $960/10 = 96$ kg Weight on moon = $96 \times 1.6 = 154$ N
8	C	Density does not change with cutting.
9	C	If weights are the same, masses are the same.
10	B	
11	B	
12	B	
13	B	
14	D	At X, it is solidifying, but there is still liquid during the process, which undergoes evaporation at any temperature that it is a liquid.
15	D	Evaporation does not need an external energy source.

	Section A (45 marks)	
1a	50 °C	1
1b	Both solid and liquid (both required) (cannot 'or')	1
1c	Substance is changing state / changing from liquid to solid / freezing / undergoing Energy is being released by the forming of intermolecular bonds. – M1 No change in KE so no change in temperature. – M1 (any 2 of 3)	2
2a	$90^\circ - 32^\circ = 58^\circ$	1 1
2b	$n = 1/\sin C$ $= 1/\sin(58)$ 1.18 (accept ecf from 2a)	1 1
2c	$n = (\sin i)/(\sin r)$ $1.18 = (\sin i)/(\sin 32)$ $i = 38.7^\circ$	1 1
3a	higher center of gravity smaller base area	1 1

3b	Position 1 Same weight, but the base area is smaller.	1 1
4	When bottle filled with water: Mass of water = $1100 - 100 = 1000 \text{ g}$ Volume of water = $m/d = 1000/1 = 1000 \text{ cm}^3$ Volume of Liquid L is the same, 1000 cm^3 Mass of Liquid L = $900 - 100 = 800 \text{ g}$ Density of Liquid L = $800/1000$ (any 2 of 4 workings gets the working 2 marks) $= 0.8 \text{ g/cm}^3$	1 1 1 1 1
5a	$GPE = mgh = 8 \times 10 \times 5 = 400 \text{ J}$	1 1
5bi	$400 - 120 = 280 \text{ J}$ accept ecf from 5a	1
5bii	$KE = 0.5mv^2$ $280 = 0.5 \times 8 \times v^2$ $v = 8.37 \text{ m/s}$ accept ecf from 5bi	1 1
6	Cylinder A heater is at the top, hot water will rise, convection to the bottom will not take place , will take a longer time to heat the bottom where the thermometer is through conduction. Cylinder B heater is at bottom, hot water rise, will heat up the ickly where the thermometer is through convection.	1 1
7a	$(720 \times 2) + (100 \times 0.5) = 1490 \text{ Nm}$	1 1
7b	$1490 / 1 = 1490 \text{ N}$ accept ecf from 7a	1 1
8a	 <p>Straight line diagonally through the center from arrowpoint with directional arrow (1) Line that goes horizontally and through the focal point and makes the cross with the straight line through the center with directional arrow (1) (either of the above gets the 1 mark) (if no directional arrow, cannot give the mark)</p>	3

	Correct image arrow with label i (1)	
8b	(any 2) Real / the other side of the lens as the object (both mean the same point), inverted, diminished	2
8c	camera	1
9a	120 m	1
9b	$v = f\lambda = 0.02 \times 120 =$ 2.4 m/s accept ecf from 9a	1 1

	Section B (10 marks)	
10ai	$a = (v-u)/t$ $a = (75-0)/15$ $= 5 \text{ ms}^{-2}$	1 1
10ai i	$F = ma = 1500 \times 5 =$ 7500 N	1 1
10b	Distance travelled = area under the graph Area of triangle = $75 \times 15 / 2 = 562.5 \text{ m}$ Area of rectangle = $15 \times 75 = 1125 \text{ m}$ Final area = $562.5 + 1125 = 1687.5$ (Any one of these workings gets the 1 working mark) Approx. 1690 m (3.s.f.)	1
	The key here is to STRICTLY enforce that they need to SEGMENT their answers clearly. They need to identify the exact time frame for each description. From $t = 30$ seconds to $t = 35$ seconds, increasing deceleration (both words required) from 75 m/s to 50 m/s From $t = 35$ seconds to $t = 45$ seconds, constant speed of 50 m/s From $t = 45$ seconds to $t = t(\text{final})$, uniform deceleration to 0 m/s	1 1 1
10d	 <p>Curve to a plateau. The very end part must end reasonably flat (end with 0 gradient), but cannot be a full flat line for a long line. No part of the curve must be straight lines.</p>	1