NA

MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION
General Certificate of Education Normal (Academic) Level

CANDIDATE NAME

CENTRE NUMBER | S | | | | |

INDEX NUMBER | | | | |

SCIENCE

Paper 2 Physics

5105/02

September/October 2020

Papers 1 and 2: 1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE ON ANY BARCODES.

Answer **all** questions in Section A and any **two** questions in Section B.
The use of an approved scientific calculator is expected, where appropriate.
In calculations, you should show all the steps in your working, giving your answer at each stage.
You are advised to spend no longer than 30 minutes on Paper 1.
You may proceed to answer Paper 2 as soon as you have completed Paper 1.

At the end of the examination, hand in your answers to Paper 1 and Paper 2 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **11** printed pages and **1** blank page.

Singapore Examinations and Assessment Board

Cambridge Assessment International Education

DC (LK/FC) 181223/4

Section A

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

1 The table gives details of some units of energy.

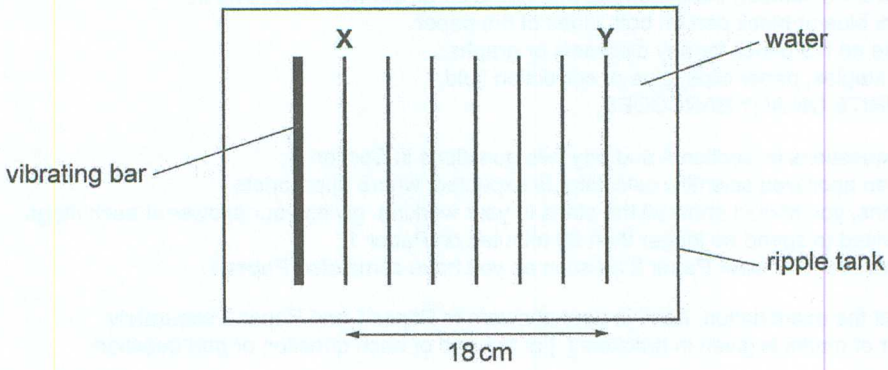
Complete the table by filling in the blank spaces.

unit	symbol	multiple of the SI unit (J)
joule	J	1
kilojoule	kJ	
gigajoule		1 000 000 000
	mJ	0.001

[2]

2 A vibrating bar is positioned so that it touches the surface of the water in a ripple tank.

The lines on the diagram represent the crests of the wave produced.



(a) Explain why each crest is also a wavefront. .....

..... [1]

(b) Calculate the wavelength of the wave produced by the vibrating bar.

wavelength = ... cm [1]

(c) The wave took six seconds to travel from position **X** to position **Y**.

Calculate the frequency of the wave.

frequency of wave = ... Hz [1]

(d) Calculate the speed of the wave.

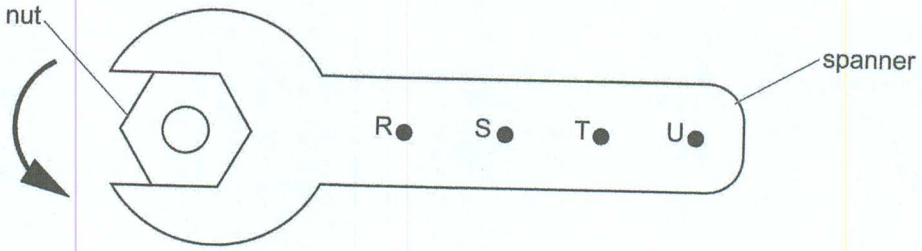
Give the unit for your answer.

speed of wave = ...

unit .....

[2]

3 A spanner is used to turn a nut in the direction shown by the arrow.



(a) Force is applied to the spanner at one of the positions shown.

Draw an arrow from point R, S, T or U to show the position and direction of the smallest force needed to turn the nut.

[1]

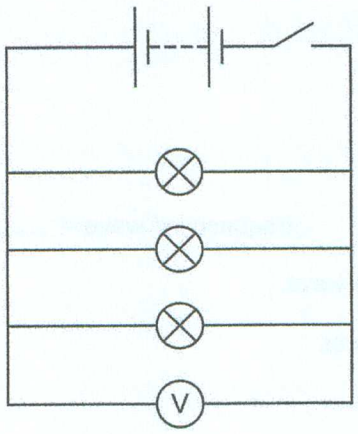
(b) Explain your answer to **(a)**.

.....

.....

..... [1]

4 A student is given the circuit shown.



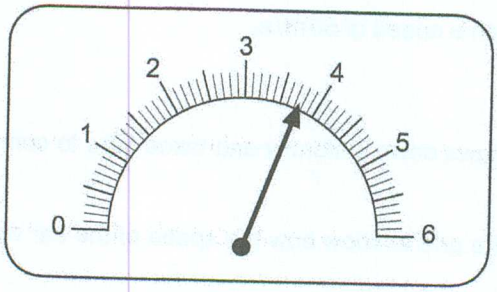
(a) The student uses an ammeter to measure the **total** current flowing through all three lamps.

On the circuit diagram, show the position of this ammeter by drawing the correct symbol. [1]

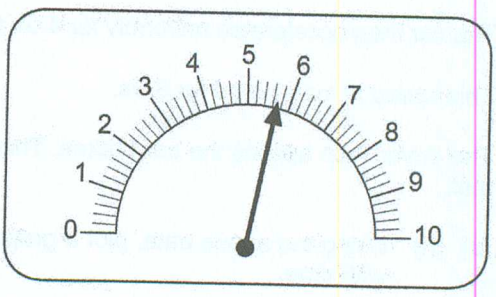
(b) (i) The student closes the switch.

The readings on the meters appear as shown.

Read and record the current and voltage values.



A



V

current = ... A voltage = ... V

[1]

(ii) Use your readings from **(b)(i)** to calculate the effective resistance of the three lamps.

effective resistance = ... Ω [1]

(iii) The resistance of each of the three lamps used by the student is identical.

Use your answer from **(b)(ii)** to determine the resistance of a single lamp.

Show your working.

resistance of a single lamp = ... Ω [2]

Section B

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

5 A car accelerates uniformly from rest for 3.0 s and reaches a speed of 10 m/s.

The car then accelerates uniformly for 4.0 s to reach a speed of 50 m/s.

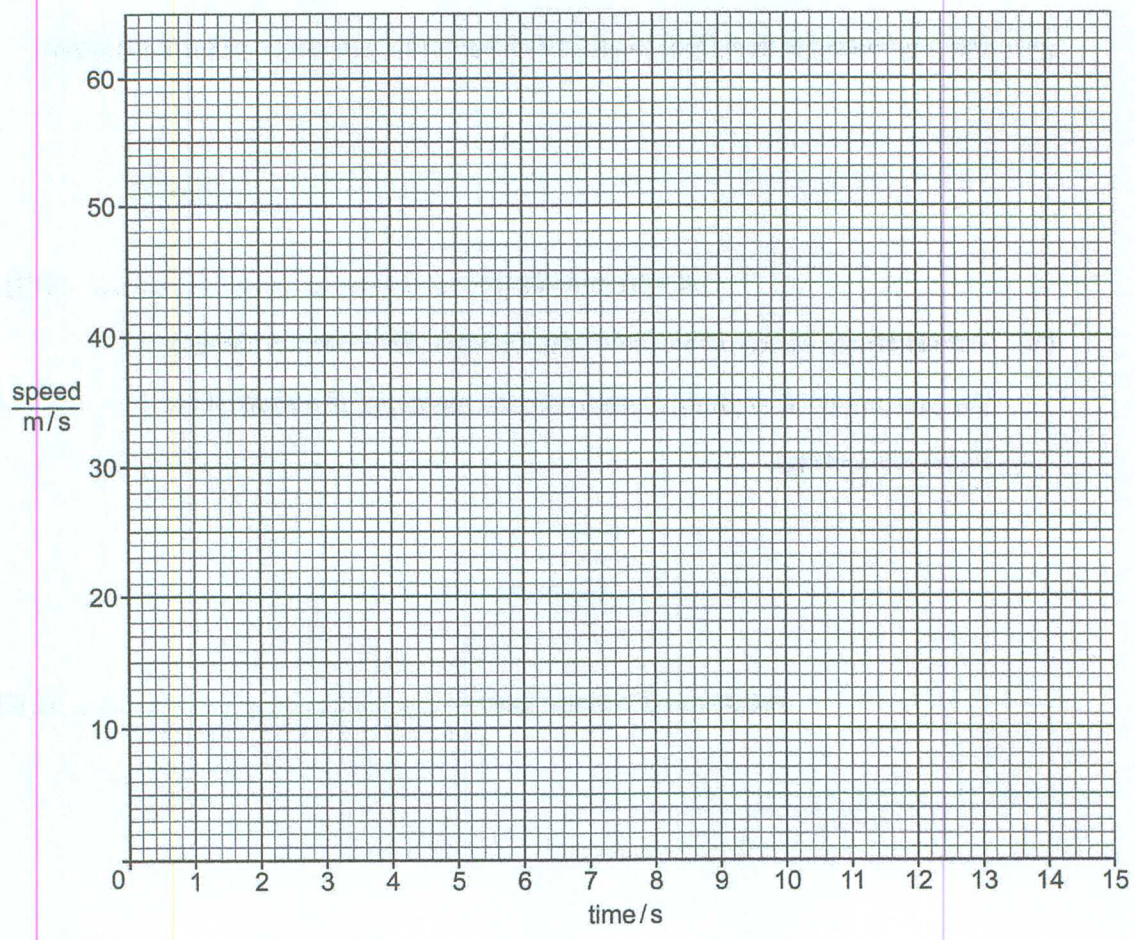
This speed is maintained for 3.0 s.

The driver then applies the car brakes. The car slows down uniformly and takes 5.0 s to come to rest.

(a) (i) Using the above data, plot a graph on the grid to show how the speed of the car varies with time.

Mark each point with a cross (x). [1]

(ii) Draw lines to complete your speed–time graph. [1]



(b) **(i)** Calculate the acceleration of the car as its speed increases from 10 m/s to 50 m/s.

acceleration = ... m/s^2 [1]

(ii) Calculate the distance the car travels from time 3.0 s to time 10.0 s.

Show your working.

distance travelled = ... m [2]

(c) State whether speed is a scalar or vector quantity. Explain your answer.

.....

..... [1]

(d) Describe how the energy of the car changes when the car slows down.

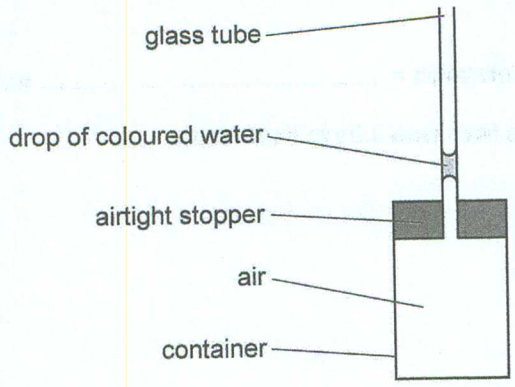
.....

.....

..... [2]

6 A student uses the apparatus shown in the diagram to investigate the effect of colour on the absorption of infra-red radiation.

Four identical containers E, F, G and H are each painted a different colour.



container	colour of container
E	silver
F	white
G	black
H	grey

The containers E, F, G and H are placed at equal distances from an electric heater emitting infra-red radiation.

The electric heater is switched on for 10 minutes.

(a) Explain why the drop of coloured water rises up the glass tube when the electric heater is switched on.

.....

.....

..... [2]

(b) State and explain which of the containers, E, F, G or H, will cause the drop of coloured water to rise up the tube the fastest.

container .....

explanation .....

..... [1]

(c) The electric heater has a power of 1.8 kW.

An electricity company charges 22 cents per kW h used.

Calculate the cost of using the electric heater for 10 minutes.

cost = ... cents [1]

(d) The 1.8 kW electric heater is connected to a 240 V supply.

Calculate the current flowing through the electric heater.

current flowing = ... A [1]

(e) The student has a choice of 1A, 2A, 5A, 10A and 13A fuses. State which fuse should be placed in the plug that is fitted to the electric heater. Explain your choice of fuse.

fuse .....

explanation .....

..... [1]

(f) The student then plans a new experiment.

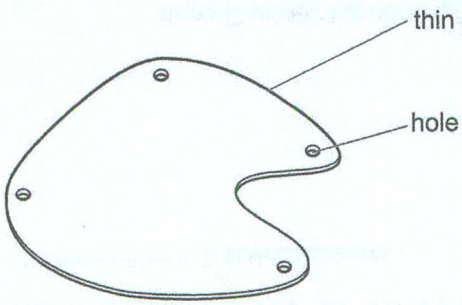
The student takes one set of apparatus but replaces the glass tube with a thermometer. The bulb of the thermometer is inside the container.

The student plans to measure the temperature of the air inside the container before the electric heater is turned on, and then turn on the electric heater and measure the temperature of the air inside the container at one-minute intervals for 10 minutes.

Construct a results table for the student to use. The table should contain all appropriate headings and units.

[2]

7 (a) Describe how a student can find the centre of gravity of the thin piece of metal shown below.



The metal has four small holes drilled around the edge.

The student is provided with the following apparatus to set up the experiment.

- cork with pin passing through it
- retort stand with boss and clamp
- piece of string and small mass

.....

.....

.....

.....

.....

..... [4]

(b) A 2 kg mass is dropped a distance of 0.60 m onto a bench. The effects of air resistance should be ignored.

(i) Calculate the change in the gravitational potential energy of the mass.

Use g = 10 N/kg in your calculations.

change in the gravitational potential energy = ... J [1]

(ii) How much kinetic energy does the mass have just as it hits the bench?

kinetic energy = ... J [1]

(iii) Calculate the velocity of the mass just as it hits the bench.

velocity of the mass = ... m/s [2]