IGCSE Cambridge Topical Past Papers

PHYSICS 9-1

0972 Paper 3

2020 — 2025

1 - (0972/31_Summer_2020_Q1)

Fig. 1.1 shows a coil of wire.

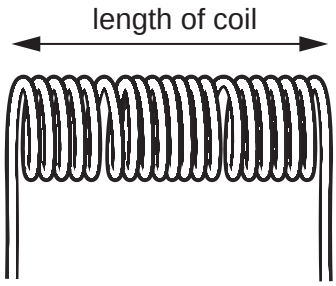

Fig. 1.1 (not to scale)

(a) A student measures the length of the coil using a ruler. His measurement is 3.8 cm.

There are 20 turns of wire in the coil. The student uses his measurement to calculate the average thickness of the wire.

(i) Show that the average thickness of the wire is about 0.2 cm.

average thickness of wire = ... cm [2]

(ii) The student's measurement of 3.8 cm is inaccurate.

Suggest **one** reason why the measurement is inaccurate.

.....

..... [1]

(b) The volume of the wire in the coil is 16.6 cm^3 and its mass is 148 g.

Calculate the density of the metal used for the wire in the coil.

density = ... g/cm^3 [3]

(c) The student has a measuring cylinder and a beaker of water, as shown in Fig. 1.2.

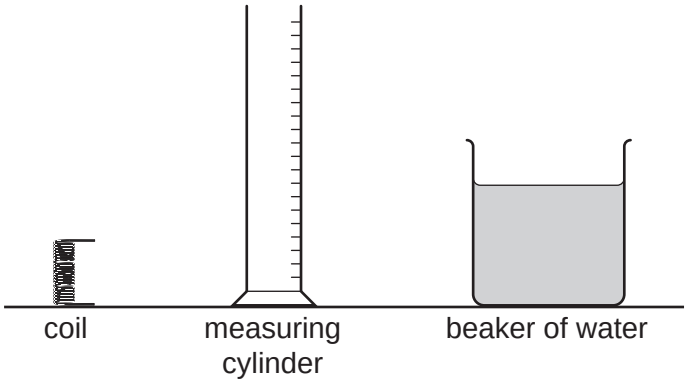

Fig. 1.2

Describe how the student can determine the volume of the coil by using the equipment shown in Fig. 1.2.

.....

.....

.....

.....

.....

..... [4]

[Total: 10]

2 - (0972/31_Summer_2020_Q2)

(a) A student stretches a spring by adding different loads to it. She measures the length of the spring for each load. She plots a graph of the results.

Fig. 2.1 shows the graph of her results.

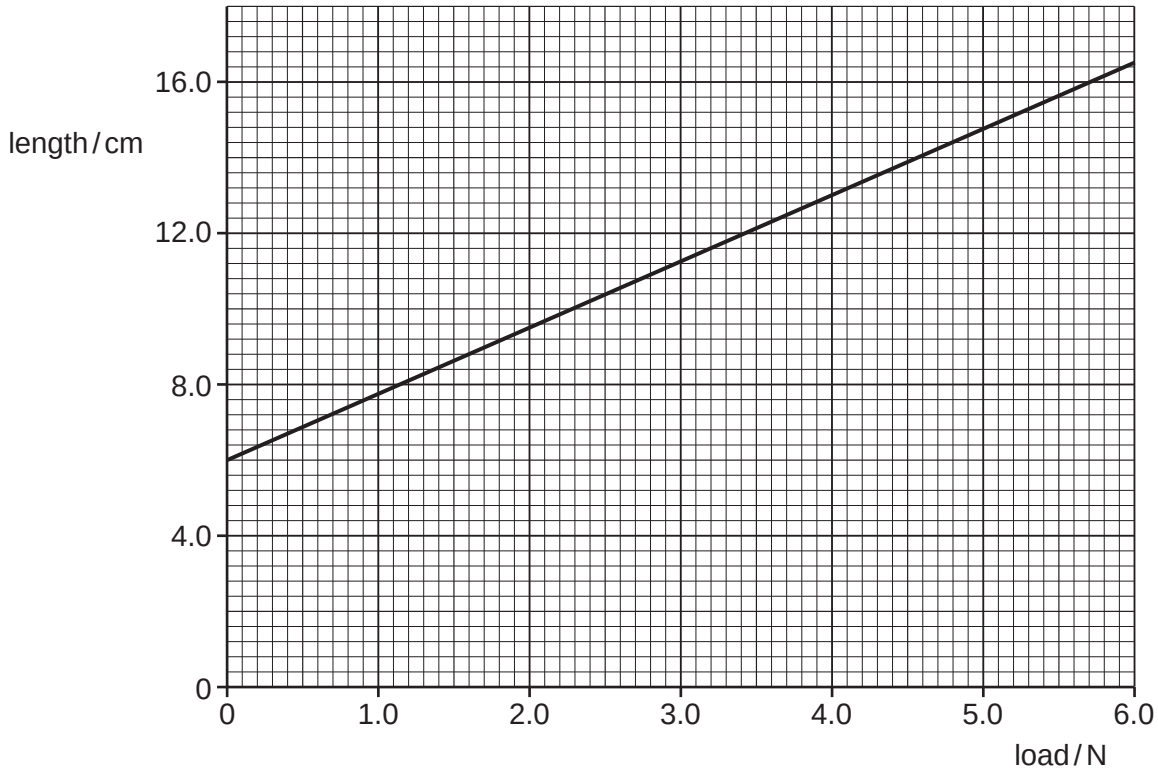

Fig. 2.1

Use the graph to determine:

(i) the length of the spring without a load

length = ... cm [1]

(ii) the length of the spring with a load of 4.0 N

length = ... cm [1]

(iii) the extension due to a 4.0 N load.

extension = ... cm [1]

(b) Complete the sentence about effects of forces. Choose words from the box.

colour	friction	pressure	shape	size	speed

Stretching a spring with a load is an example of how a force can change the

..... and the ..... of an object. [2]

[Total: 5]

3 - (0972/31_Summer_2020_Q3)

Some gas molecules are in a box at room temperature.
Fig. 3.1 shows the position of some of the molecules and the direction of movement of each molecule.

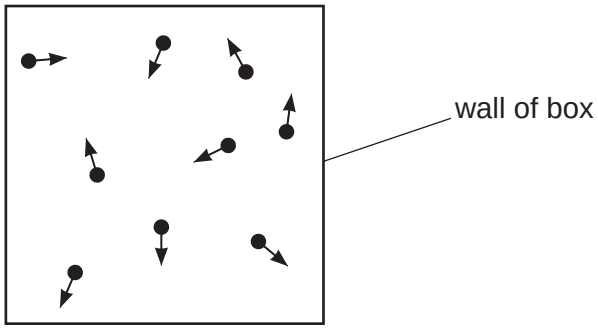

Fig. 3.1

(a) (i) Describe the movement of the gas molecules.

.....

.....

..... [2]

(ii) Describe how the molecules exert a pressure on the walls of the box.

.....

.....

.....

..... [2]

(b) The gas in Fig. 3.1 is cooled. The gas turns into a liquid then into a solid.

State how the average separation of molecules in the gas is different from the average separation of molecules in the solid.

.....

..... [1]

[Total: 5]

4 - (0972/31_Summer_2020_Q4)

(a) During part of a race, a skier travels a distance of 200 m in a time of 6.4 s.

Calculate the average speed of the skier.

average speed = ... m/s [3]

(b) Fig. 4.1 shows a speed–time graph for the skier in another part of the race.

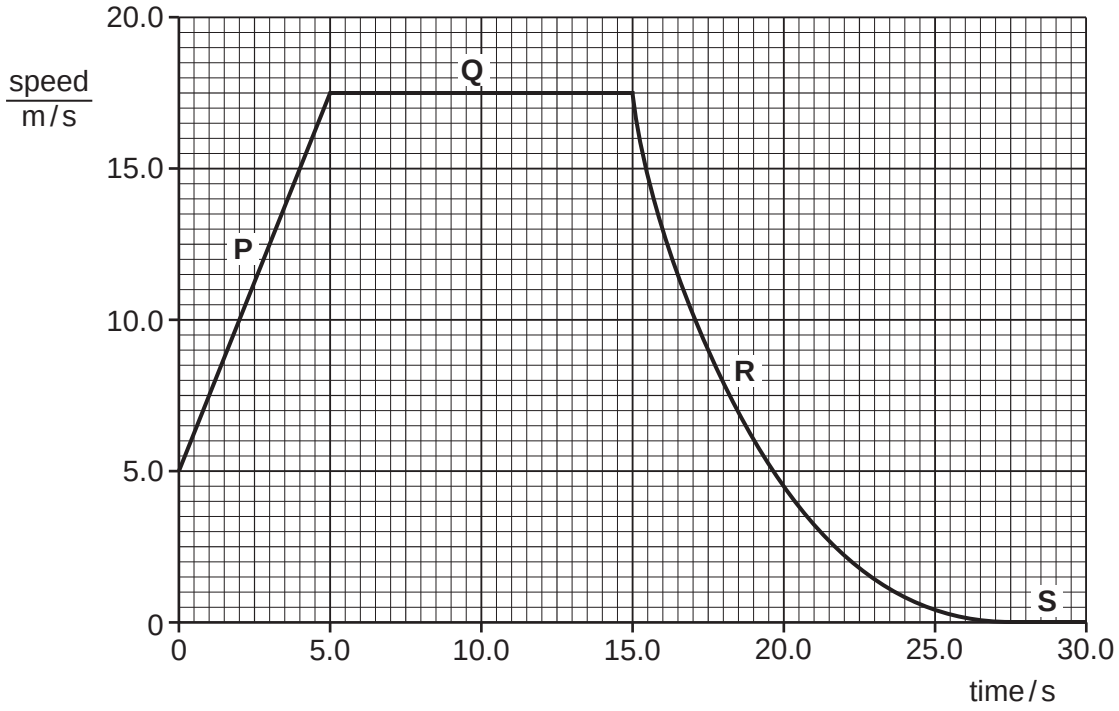

Fig. 4.1

Describe the motion of the skier at each point **P**, **Q**, **R** and **S** on the graph.

P .....

Q .....

R .....

S .....

[4]

(c) Skis are strapped to a skier's feet and are longer and wider than the skier's feet.

Explain how the skis prevent the skier from sinking into soft snow.

..... [2]

[Total: 9]

5 - (0972/31_Summer_2020_Q5)

A metre rule is balanced on a pivot by three vertical forces, as shown in Fig. 5.1.

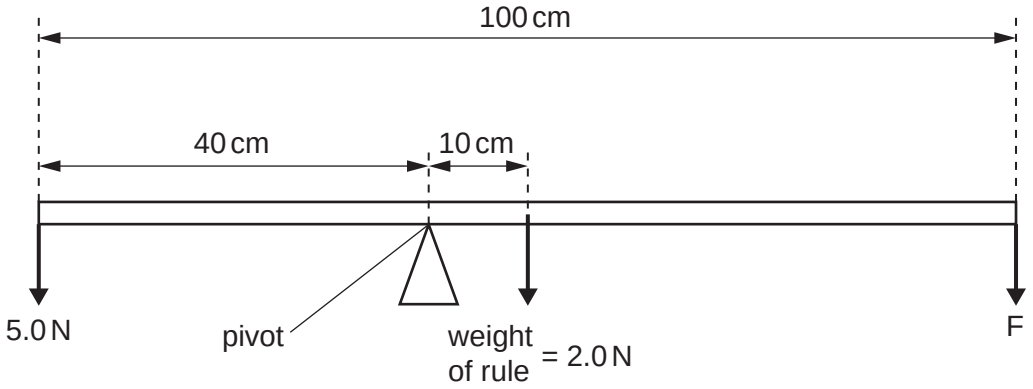

Fig. 5.1 (not to scale)

(a) Show that the moment of the 5.0 N force about the pivot is 200 N cm.

[2]

(b) Calculate the size of force F.

F = ... N [4]

[Total: 6]

6 - (0972/32_Summer_2020_Q1)

Some students observe drops of water falling from a tap that leaks, as shown in Fig. 1.1.

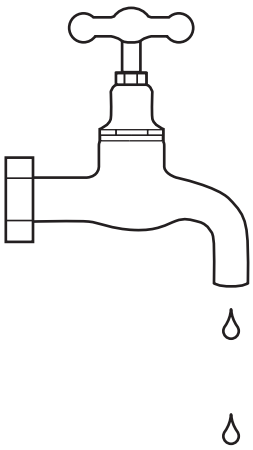

Fig. 1.1

(a) The students measure the time for 50 drops to fall from the tap. The time for 50 drops to fall is 20 s.

Calculate the average time between two drops falling.

average time = ... s [2]

(b) The students collect some drops of water.

(i) The students measure the volume of the water they collect.

State the term for the equipment that is suitable for measuring the volume accurately.

..... [1]

(ii) In a similar experiment, another student collects 0.21 kg of water.

Calculate the weight of this water.

weight of water = ... N [3]

[Total: 6]

7 - (0972/32_Summer_2020_Q2)

(a) Some students determine the speed of a car on a road. The students measure the time for the car to travel 30 m along the road. The time is 5.4 s.

Calculate the average speed of the car.

average speed = ... m/s [3]

(b) Another car moves at a constant speed of 16 m/s for 4.0 seconds. During the next 2.0 seconds, the car decelerates from a speed of 16 m/s to a speed of 13 m/s. It then continues at a constant speed of 13 m/s for 3.0 seconds.

On Fig. 2.1, plot the speed–time graph for the motion of the car during these 9.0 s.

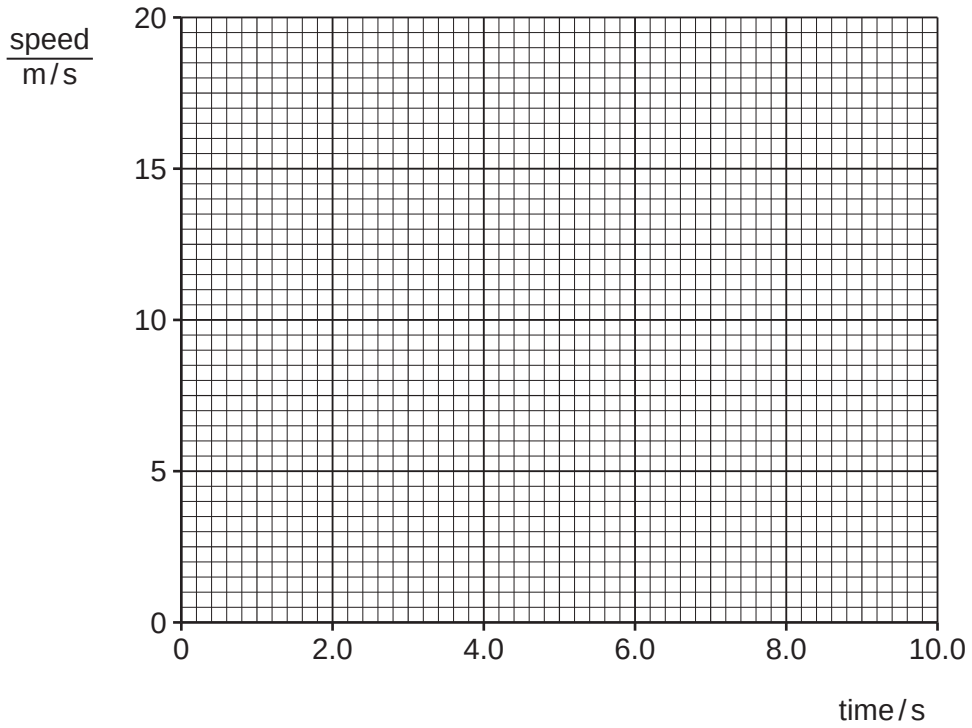

Fig. 2.1

[3]

(c) A motorcycle accelerates as shown in Fig. 2.2. Calculate the distance the motorcycle travels while it is accelerating. Use information from Fig. 2.2.

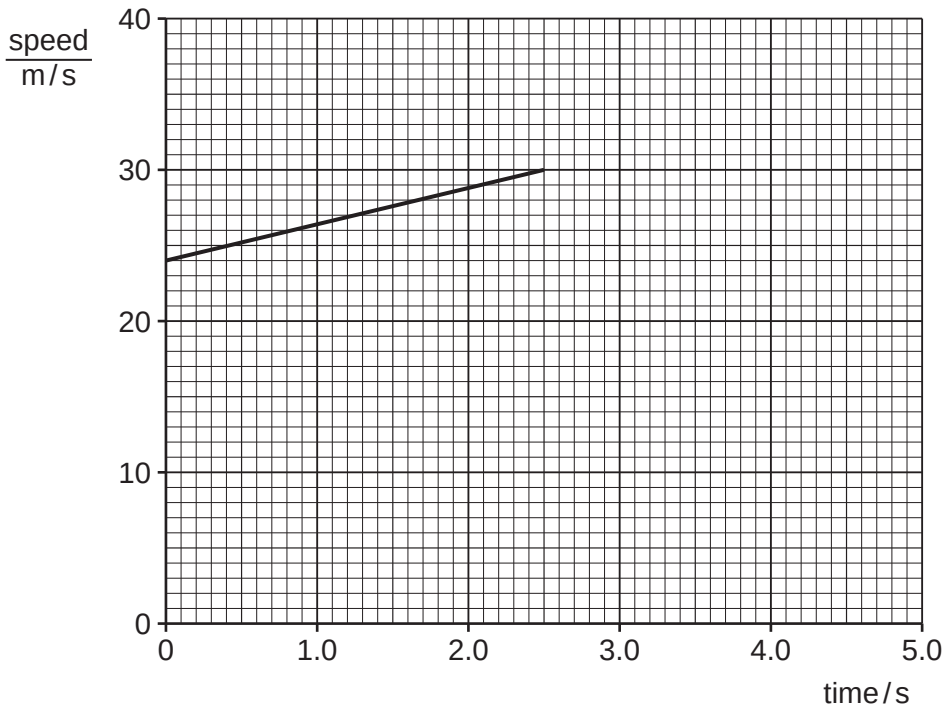

Fig. 2.2

distance travelled = ... m [3]

[Total: 9]

8 - (0972/32_Summer_2020_Q3)

Fig. 3.1 shows an archer pulling the string of a bow.

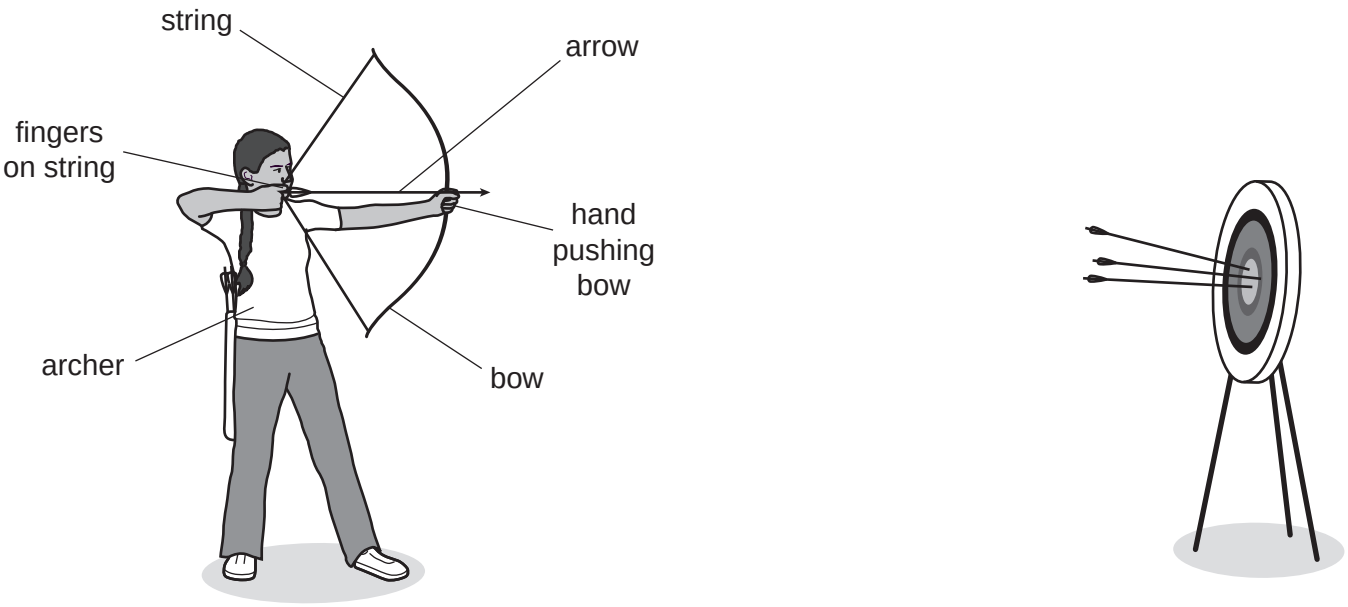

Fig. 3.1

(a) The archer uses a force of 120 N. The force acts on an area of 0.5 cm^2 on the archer's fingers.

Calculate the pressure on the archer's fingers.

pressure on fingers = ... N/cm^2 [3]

(b) The archer's other hand is pushing the bow with the same force of 120 N. This force acts on a larger area than the force in **(a)**.

State whether the pressure on this hand is greater than, the same as or less than the pressure on the fingers holding the string.

..... [1]

(c) State the type of energy stored in the bow when the archer bends it as shown in Fig. 3.1.

..... [1]

[Total: 5]

9 - (0972/31_Winter_2020_Q1)

Student P and student Q run in a 100 m race.
Fig. 1.1 shows the distance–time graph for each student during the race.

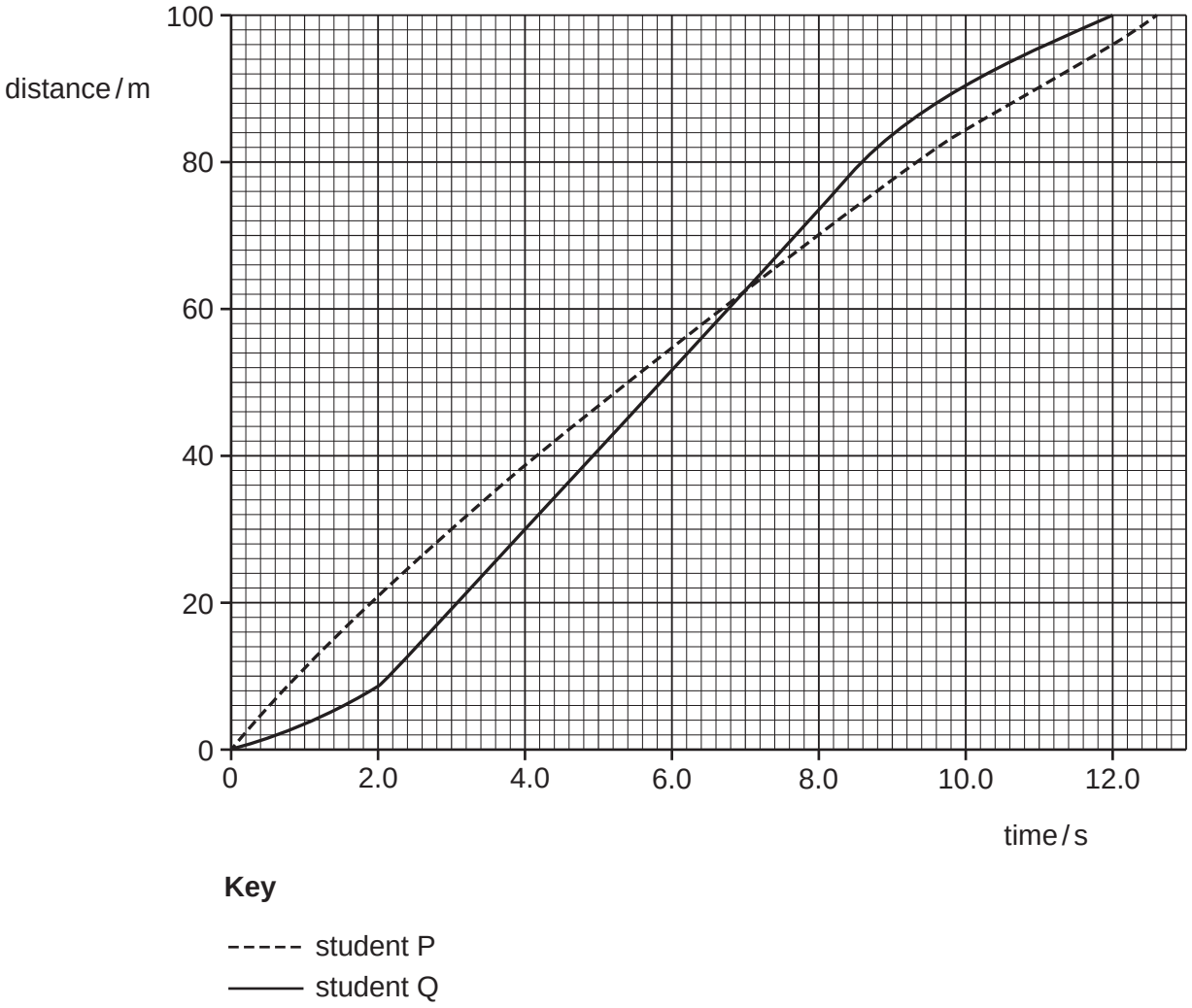

Fig. 1.1

(a) Determine the time taken for student Q to run 100 m.

time = ... s [1]

(b) Determine the distance between the two students as Q reaches 100 m.

distance = ... m [1]

(c) Calculate the average speed of student Q during the 100 m race.

average speed = ... m/s [3]

(d) State which student has the faster speed between 3.0 s and 6.0 s.

Explain how Fig. 1.1 allows you to compare speeds without calculation.

.....

.....

..... [1]

[Total: 6]

10 - (0972/31_Winter_2020_Q2)

Fig. 2.1 shows a beaker containing liquid on a top pan balance.

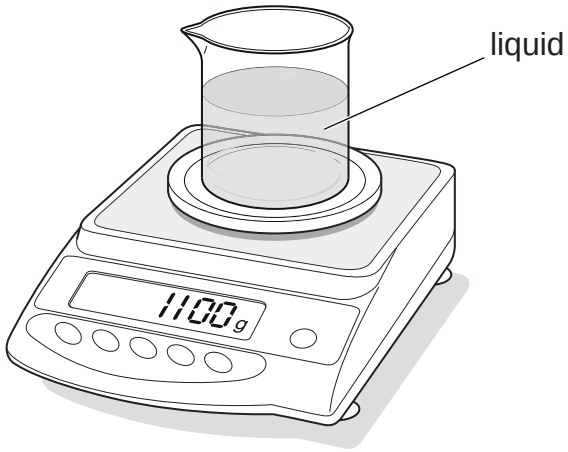

Fig. 2.1

The mass of the empty beaker is 400 g.

(a) Using the information in Fig. 2.1, determine the mass of the liquid in the beaker.

mass = ... g [1]

(b) The beaker contains 750 cm^3 of liquid.

Calculate the density of the liquid.

density = ... g/cm^3 [3]

(c) Calculate the weight of the empty beaker.

weight = ... N [4]

[Total: 8]

1 - (0972/31_Summer_2020_Q1)

(a)(i)	(average thickness =) 3.8 ÷ 20	**C1**
	(average thickness =) 0.19 (cm) (which is about 0.2 cm)	**A1**
(a)(ii)	any **one** from: wire(s) not touching OR wire stretched (in places) OR ruler not at zero (owtte) OR wire(s) overlapping OR eye not directly above ruler (owtte)	**B1**
(b)	density = mass ÷ volume OR $\rho = \frac{m}{V}$ in any form.	**C1**
	(ρ =) 148 ÷ 16.6	**C1**
	(ρ =) 8.9 (g / cm^3)	**A1**
(c)	measuring cylinder partially filled with water coil submerged in water (owtte) new volume noted volume of wire = difference or increase in volume(s)	**B4**

2 - (0972/31_Summer_2020_Q2)

(a)(i)	6.0 (cm)	**B1**
(a)(ii)	13.0 (cm)	**B1**
(a)(iii)	(ii) – (i)	**B1**
(b)	shape	**B1**
	size	**B1**

3 - (0972/31_Summer_2020_Q3)

(a)(i)	high speed	**B1**
	(in) any or all directions or random (motion)	**B1**
(a)(ii)	collisions	**M1**
	(of molecules) with walls of box	**A1**
(b)	widely separated (owtte) in gas to very close / touching in solid	**B1**

4 - (0972/31_Summer_2020_Q4)

(a)	(s =) d ÷ t in any form	**C1**
	(s =) 200 ÷ 6.4	**C1**
	(s =) 31 (m / s)	**A1**
(b)	P – (constantly) accelerates (from 5 m / s)	**B1**
	Q – constant speed (of 17.5 m / s)	**B1**
	R – (non-constant) decelerates (from 17.5 m / s to rest)	**B1**
	S – at rest or stationary	**B1**
(c)	(skis have) large (surface) area	**B1**
	(so) less pressure (on snow / ground)	**B1**

5 - (0972/31_Summer_2020_Q5)

(a)	(moment =) force × distance (from pivot)	**B1**
	(moment =) 5.0 × 40	**B1**
(b)	(sum of) clockwise moments = (sum of) anticlockwise moments	**C1**
	200 = (2.0 × 10) + (F × 60)	**C1**
	F = (200 – 20) ÷ 60 OR 180 ÷ 60	**C1**
	(F =) 3.0 (N)	**A1**

6 - (0972/32_Summer_2020_Q1)

(a)	(time =) 20 ÷ 50	**C1**
	0.4 (s)	**A1**
(b)(i)	measuring cylinder	**B1**
(b)(ii)	W = m x g	**C1**
	(W =) 0.21 × 10	**C1**
	2.1 (N)	**A1**

7 - (0972/32_Summer_2020_Q2)

(a)	(s =) d ÷ t OR $s = d \div t$ in any form	**C1**
	(average speed =) 30 ÷ 5.4	**C1**
	5.6 (m / s)	**A1**
(b)(i)	first section and third section horizontal straight lines	**B1**
	second section line with negative gradient	**B1**
	first section horizontal line at 16 m / s AND third section horizontal line at 13 m / s at correct times	**B1**
(b)(ii)	(d =) $\frac{1}{2} \times (a + b) \times t$ OR area under graph	**C1**
	$\frac{1}{2} \times (24 + 30) \times 2.5$ OR $(24 \times 2.5) + (\frac{1}{2} \times 6 \times 2.5)$	**C1**
	67.5 (m)	**A1**

8 - (0972/32_Summer_2020_Q3)

(a)	P = F ÷ A in any form	**C1**
	120 ÷ 0.5	**C1**
	240 (N / cm^2)	**A1**
(b)	Less (than)	**B1**
(c)	elastic OR strain OR potential	**B1**

9 - (0972/31_Winter_2020_Q1)

(a)	12.0 (s)	**B1**
(b)	(distance = 100 – 96 =) 4.0 (m)	**B1**
(c)	(av. speed =) distance ÷ time in any form	**C1**
	(av. speed =) 100 ÷ 12.0	**C1**
	(av. speed =) 8.3 (m / s)	**A1**
(d)	(student Q)	**M0**
	the steeper the line the faster(the runner) ORA	**A1**

10 - (0972/31_Winter_2020_Q2)

(a)	(1100 – 400 =) 700 (g)	**B1**
(b)	density = mass ÷ volume OR $\rho = m \div V$ in any form	**C1**
	(ρ =) 700 ÷ 750	**C1**
	(ρ =) 0.93 (g / cm^3)	**A1**
(c)	400 (g) = 0.4 (kg)	**B1**
	$w = m \times g$ in any form	**C1**
	0.4×10	**C1**
	(weight =) 4(.0) (N)	**A1**