Motion – 2019 June

1. 0625/31/M/J/19/No.3

A teacher investigates the reaction time of five students. A 0.50 m ruler is held above the hand of a student before being allowed to fall. The arrangement is shown in Fig. 3.1.

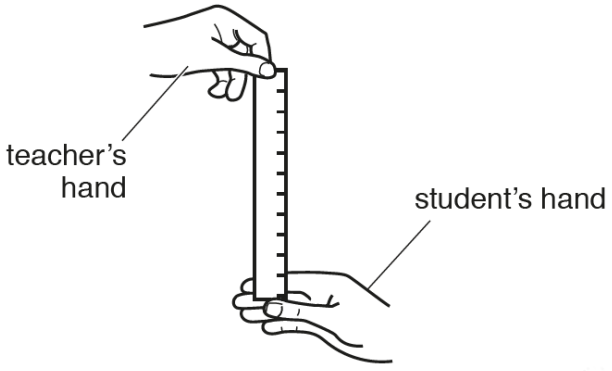

Fig. 3.1

As soon as the ruler falls the student closes their hand, catching the ruler. The further the ruler falls, the greater the reaction time of the student. The results obtained are shown in Fig. 3.2.

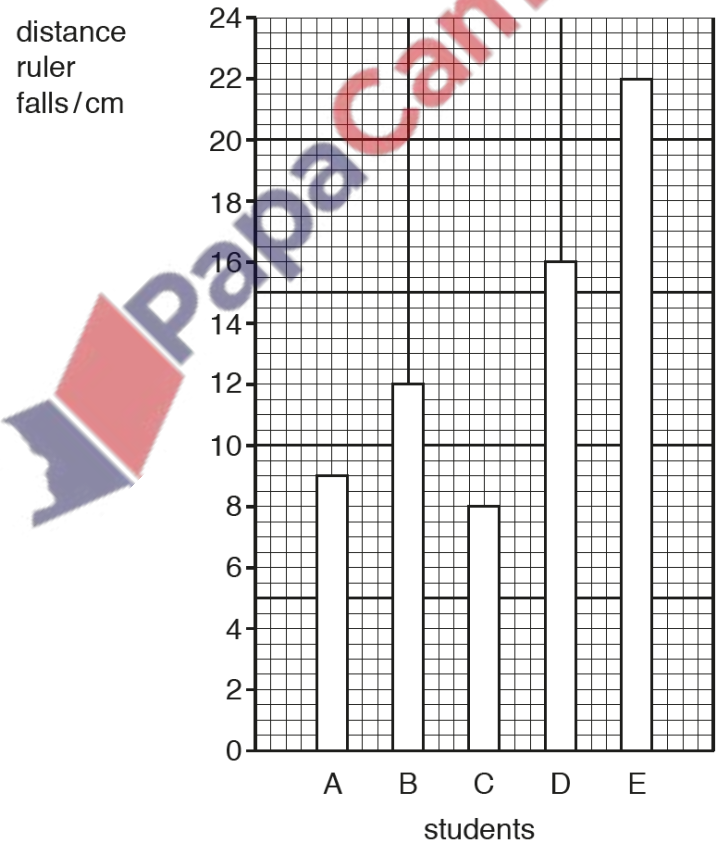

Fig. 3.2

(a) Using the results shown in Fig. 3.2, calculate the average distance that the ruler drops.

average distance = ... cm [2]

(b) List the students in order of their reaction times, with the shortest reaction time at the top of the table. One has been done for you.

order	student
1st	
2nd	
3rd	B
4th	
5th	

[2]

(c) In a similar investigation, a ruler drops a distance of 11.0 cm and has an average speed of 16 cm/s.

Calculate the reaction time.

reaction time = ... s [3]

[Total: 7]

2. 0625/32/M/J/19/No.1

A student moves a model car along a bench.

Fig. 1.1 is the speed-time graph for the motion of the model car.

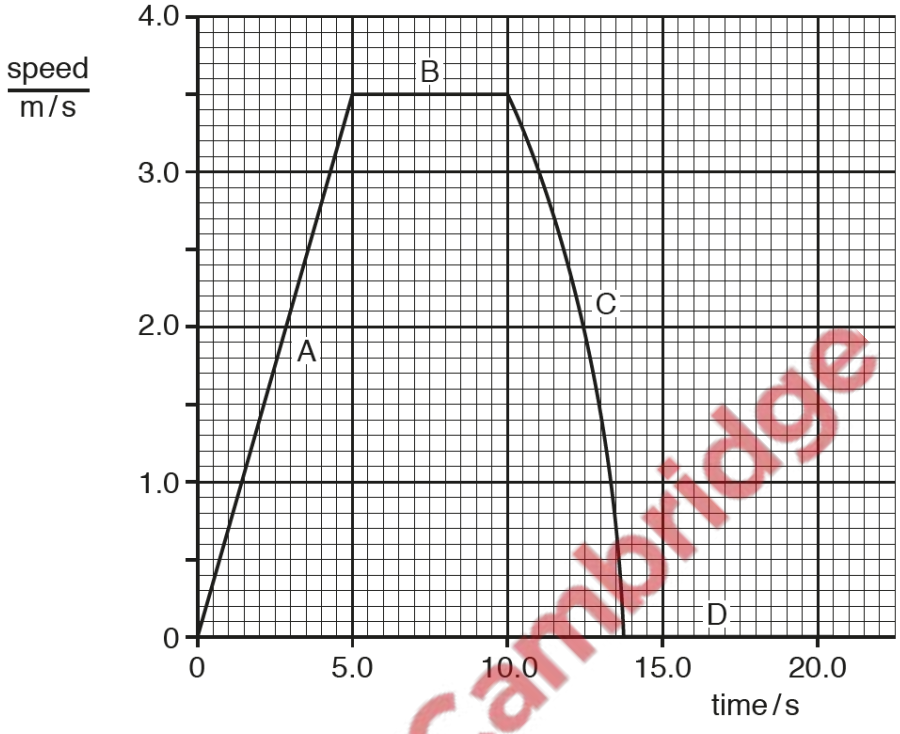

Fig. 1.1

(a) Describe the motion of the car in each of the sections A, B, C and D.

A .....

B .....

C .....

D .....

[4]

(b) Determine the distance moved by the model car in the first five seconds.

distance = ... m [3]

[Total: 7]

3. 0625/33/M/J/19/No.2

Fig. 2.1 shows a distance-time graph for a man walking from home to a café. At the café the man stops for a drink. On the return journey from the café, the man stops to rest.

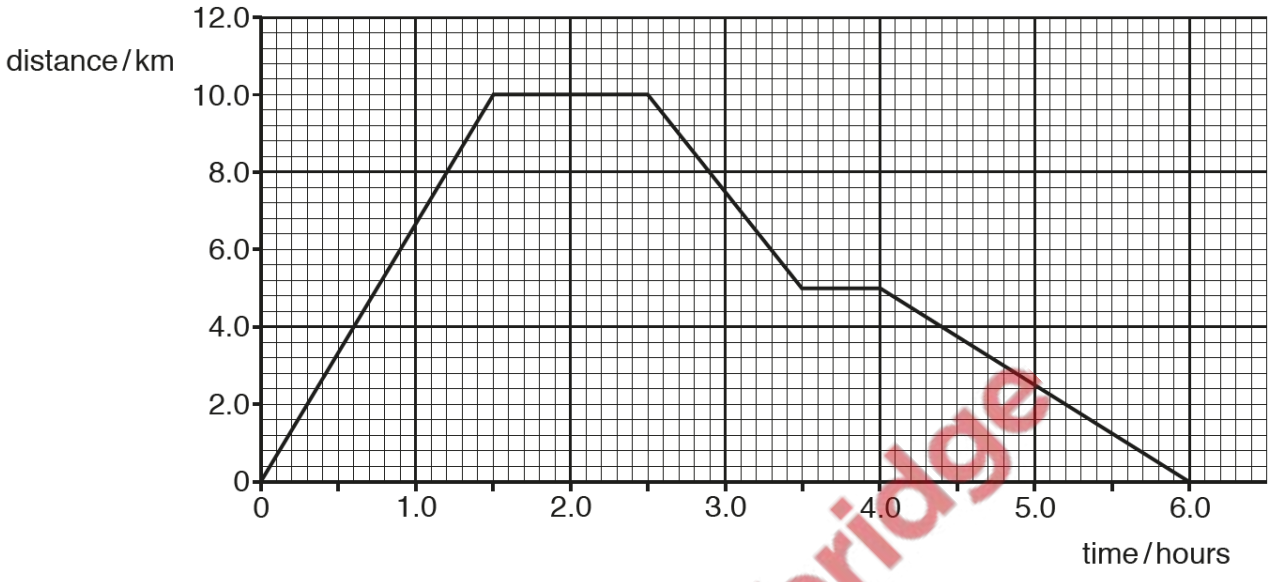

Fig. 2.1

(a) Using Fig. 2.1, determine

(i) the distance from the man's home to the café.

distance = ... km [1]

(ii) the time taken to walk to the café.

time = ... hours [1]

(iii) the speed, in km / hour, of the man as he walks to the café.

speed = ... km / hour [3]

(b) On the return journey from the café, the man stopped to rest.

(i) The man left home at 13:00.

Determine the time when the man began his rest.

time when rest began ..... [1]

(ii) For how long did the man rest on the return journey? State the time in minutes.

time = ... minutes [1]

(iii) Describe, in words, how the graph in Fig. 2.1 shows that the man travelled at a slower speed on the return journey after resting.

.....

..... [1]

[Total: 8]

4. 0625/41/M/J/19/No.1

A rocket is stationary on the launchpad. At time $t = 0$, the rocket engines are switched on and exhaust gases are ejected from the nozzles of the engines. The rocket accelerates upwards.

Fig. 1.1 shows how the acceleration of the rocket varies between time $t = 0$ and time $t = t_f$.

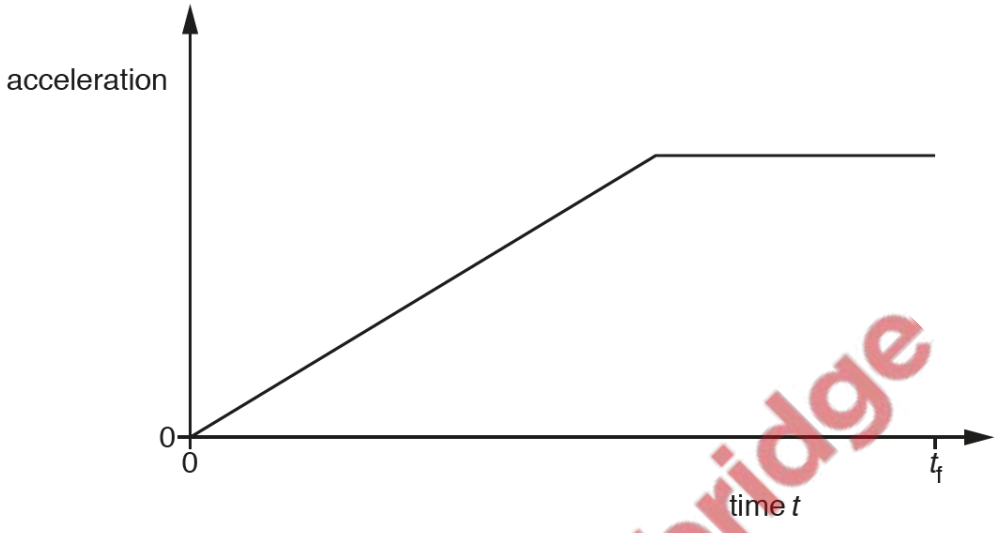

Fig. 1.1

(a) Define *acceleration*.

.....

..... [1]

(b) On Fig. 1.2, sketch a graph to show how the speed of the rocket varies between time $t = 0$ and time $t = t_f$.

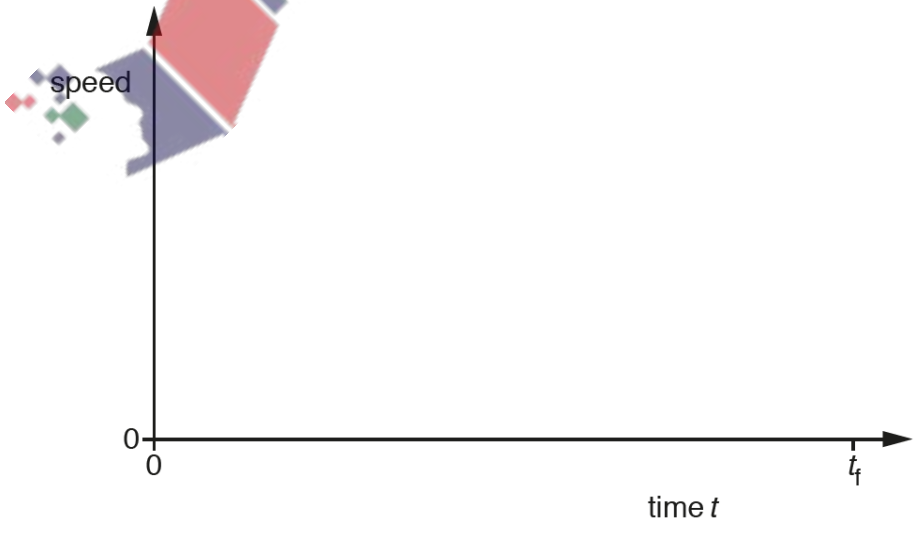

Fig. 1.2

[3]

(c) Some time later, the rocket is far from the Earth. The effect of the Earth's gravity on the motion of the rocket is insignificant. As the rocket accelerates, its momentum increases.

(i) State the principle of the conservation of momentum.

.....

.....

..... [2]

(ii) Explain how the principle of the conservation of momentum applies to the accelerating rocket and the exhaust gases.

.....

.....

.....

..... [2]

[Total: 8]

5. 0625/42/M/J/19/No.1

A bus is travelling between points A and D. There are bus stops at A, B, C and D but the bus does not stop at B and C. Fig. 1.1 is a speed-time graph for the bus.

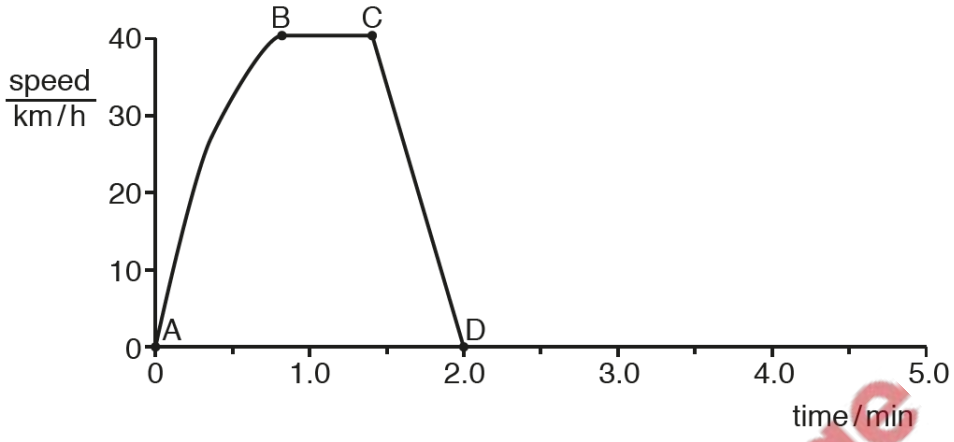

Fig. 1.1

(a) Describe the motion of the bus between each of the bus stops. Select the appropriate description from the list below.

constant acceleration **decreasing acceleration**

increasing acceleration **moving backwards at constant speed**

moving forwards at constant speed **stationary**

1. between A and B .....

2. between B and C .....

3. between C and D .....

[3]

(b) The average speed of the bus between A and D is 23 km/h.

Calculate the distance between A and D.

distance = ... [3]

(c) The bus stops at D for 1 min and then travels at a constant acceleration for 30 seconds.

On Fig. 1.1, sketch a possible graph for this additional motion. Label X when the bus starts to accelerate and label Y for 30 seconds later. [3]

[Total: 9]

6. 0625/43/M/J/19/No.1

Fig. 1.1 shows a distance-time graph for a cyclist travelling between points P and V on a straight road.

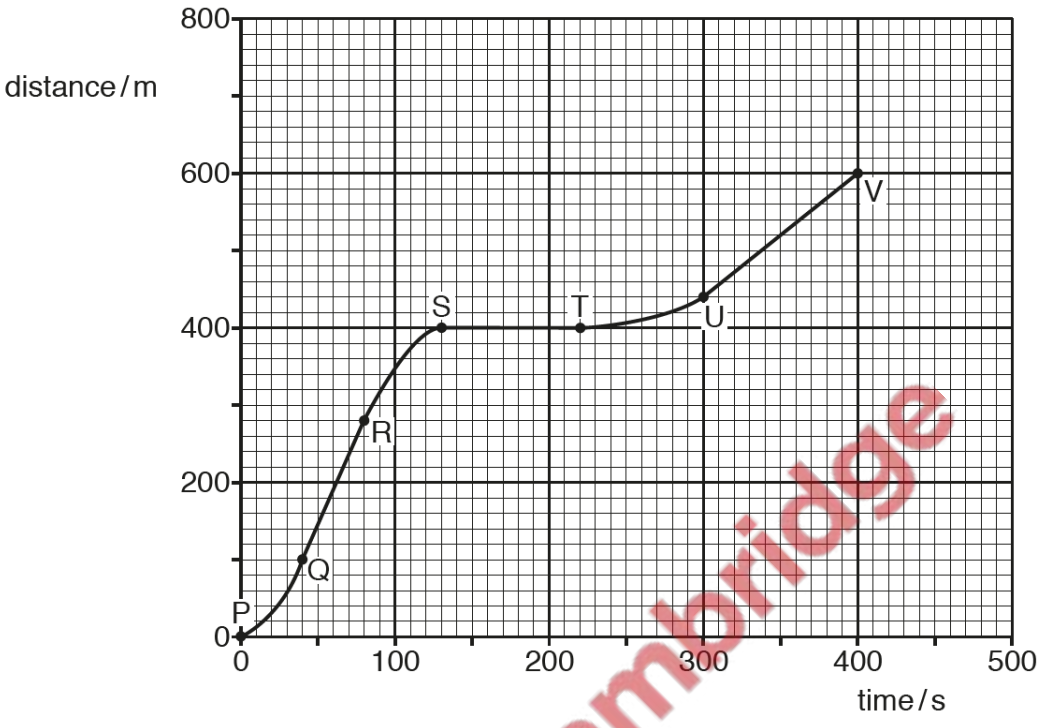

Fig. 1.1

(a) Describe the motion between:

Q and R .....

R and S .....

S and T. .....

[3]

(b) Calculate the speed between U and V.

speed = ... [2]

(c) After point V, the straight road continues down a steep hill. The cyclist travels down the steep hill. He does not apply the brakes and all resistive forces can be ignored.

On Fig. 1.1, sketch a possible motion for the cyclist after V. [1]

[Total: 6]

7. 0625/32/F/M/19/No.2

Fig. 2.1 shows students getting onto a school bus.

Fig. 2.1

(a) A student describes part of the journey.

The bus accelerates from rest at a constant rate for 10 s. It reaches a maximum speed of 10 m/s.

The bus maintains a constant speed of 10 m/s for 60 s.

The bus then decelerates at a constant rate for 15 s, until it stops.

On Fig. 2.2, draw the speed-time graph for this part of the journey made by the bus.

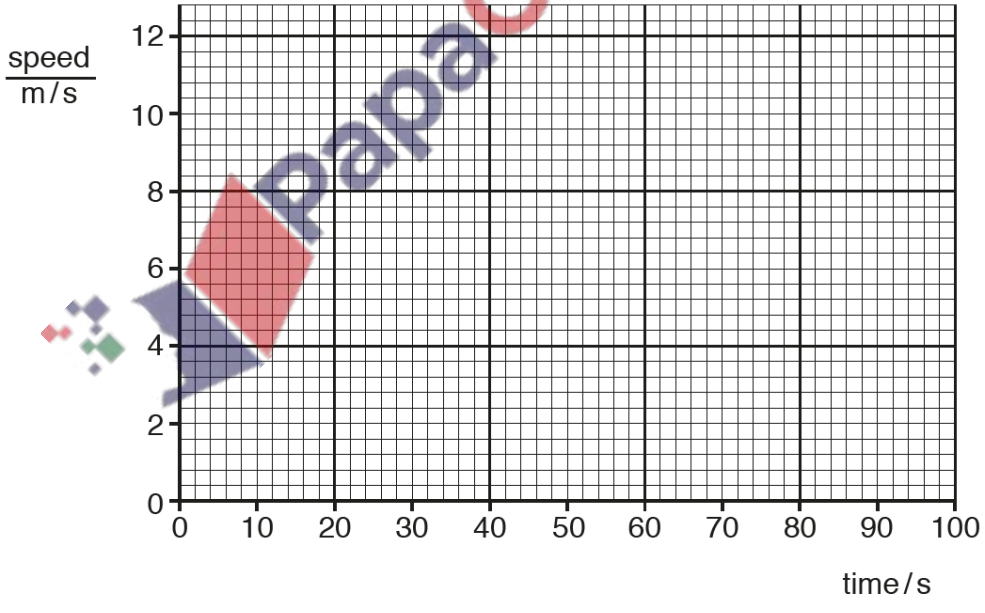

Fig. 2.2 [5]

(b) On another part of the journey, the average speed of the bus is 7.5 m/s.

Calculate the distance the bus travels in 150 s.

distance = ... m [3]

[Total: 8]

8. 0625/42/F/M/19/No.1

(a) Define *acceleration*.

..... [1]

(b) Fig. 1.1 shows the distance-time graph for the journey of a cyclist.

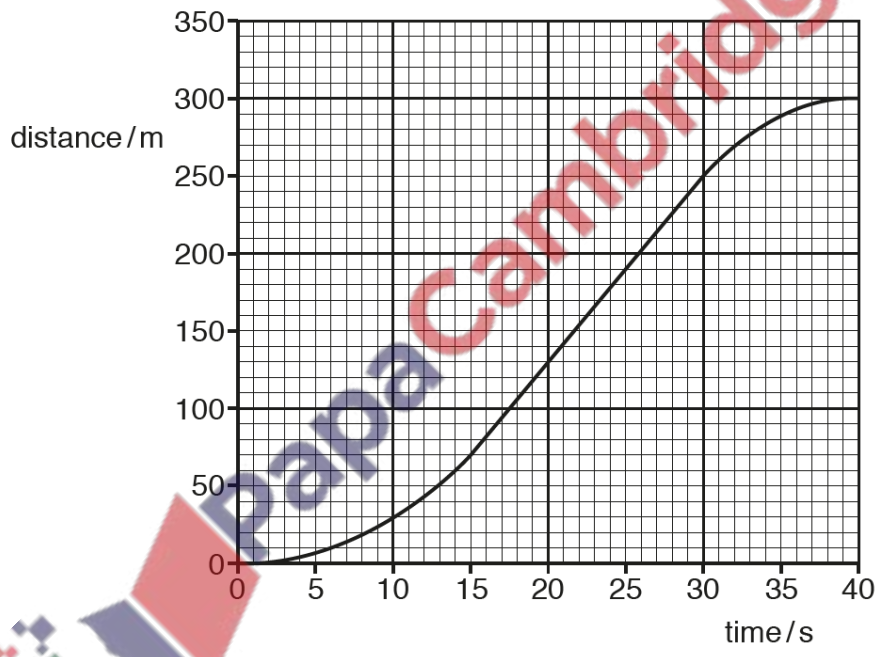

Fig. 1.1

(i) Describe the motion of the cyclist in the time between:

1. time = 0 and time = 15 s

.....

2. time = 15 s and time = 30 s

.....

3. time = 30 s and time = 40 s.

.....

[3]

(ii) Calculate, for the 40 s journey:

1. the average speed

average speed = ... [2]

2. the maximum speed.

maximum speed = ... [2]

[Total: 8]