1 Some students investigate the speed of cars.
They measure the time it takes each car to travel a distance of 80 m.

(a) State **two** measuring instruments the students should use.

(2)

1 .....

2 .....

(b) The table shows some of their results.

colour of car	distance travelled / m	time / s
green	80	5.0
red	80	4.0
blue	80	5.5
black	80	4.3
white	80	5.6

(i) State the colour of the slowest car.

(1)

colour of the slowest car .....

(ii) Calculate the speed of the black car.

(2)

speed of the black car = ... m/s

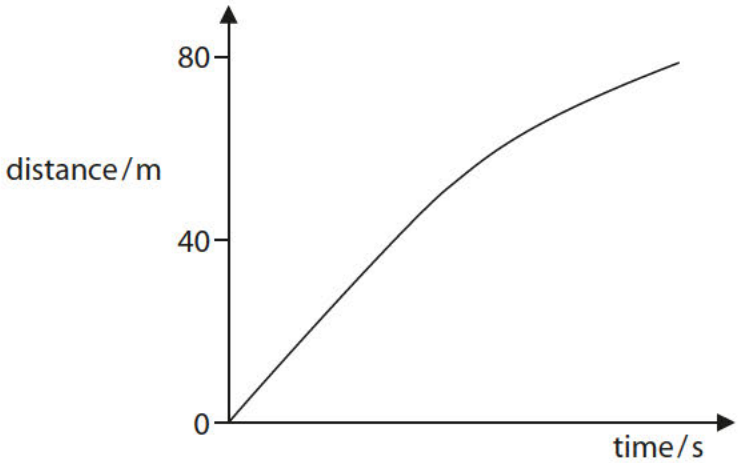
(iii) 20 miles per hour is approximately 9 m/s.

Estimate the speed, in miles per hour, of the black car.

(1)

speed of the black car = ... miles per hour

(c) The distance-time graph for another car is shown below.



Describe what the graph shows about the speed of the car as it travels the 80 m.

(2)

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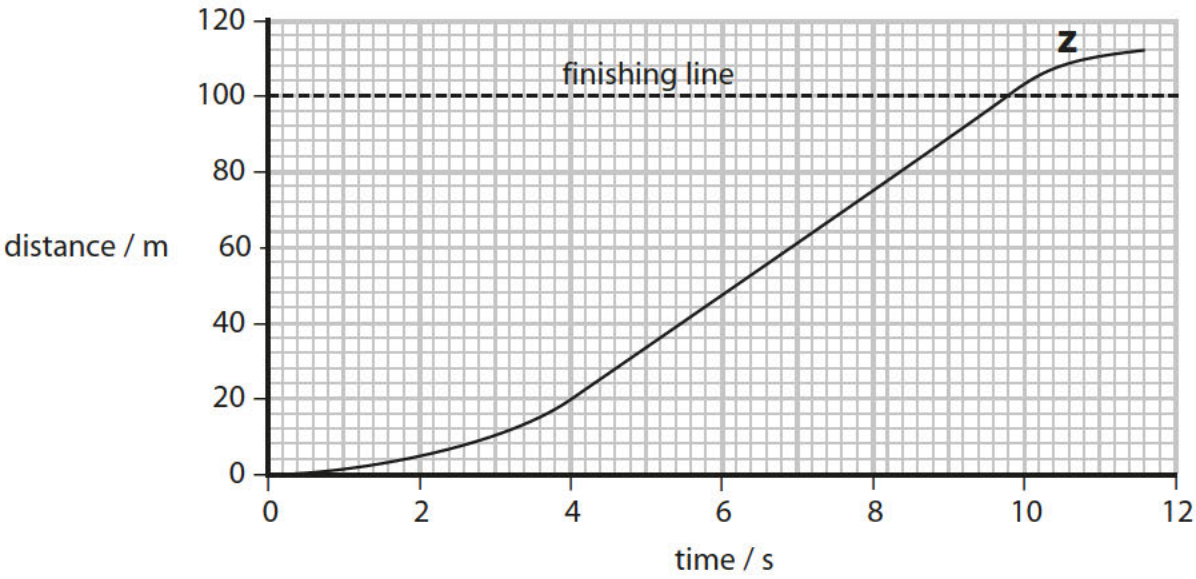
(Total for Question = 8 marks)

100 m race

2 The photograph shows the beginning of a 100 m race.



David wins the race.
The graph shows David's distance-time graph.



(a) Use the graph to find the distance David ran in the first 4 s.

(1)

distance in the first 4 s = ... m

(b) David runs 100 m in a time of 9.80 s.

Calculate his average speed.
State the unit.

(3)

average speed = ... unit .....

(c) Explain why David's average speed is less than his top speed.

(2)

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(d) Complete the sentences by putting a cross (☒) in the box next to your answer.

(i) In the section of the graph marked **Z**, David is

(1)

- ☐ **A** running at constant speed
- ☐ **B** slowing down
- ☐ **C** speeding up
- ☐ **D** stopped

(ii) Velocity is

(1)

- ☐ **A** speed in a circle
- ☐ **B** the same as speed
- ☐ **C** constant speed
- ☐ **D** speed in a stated direction

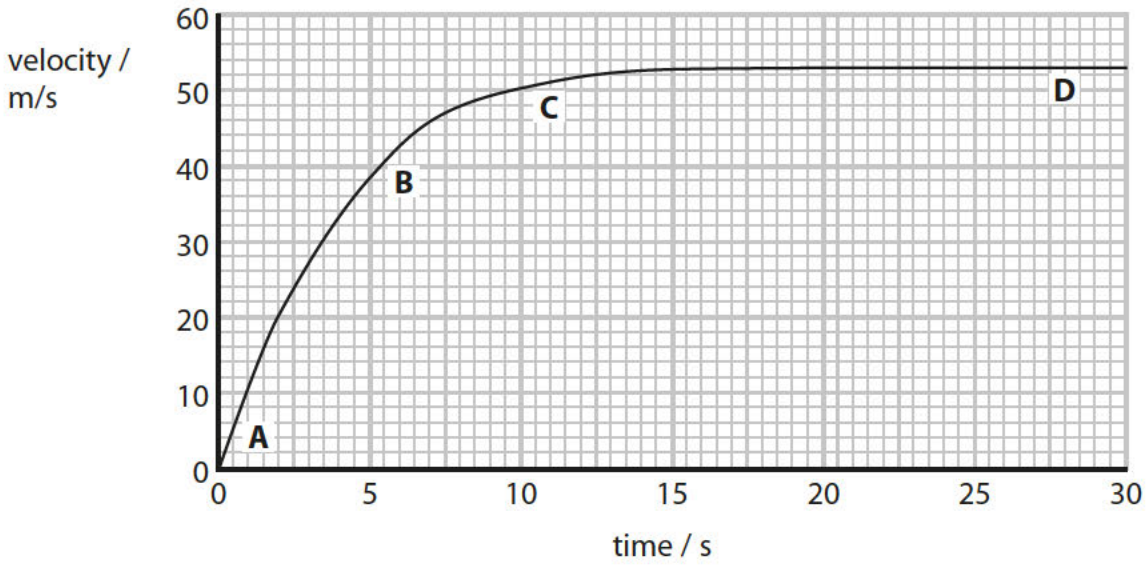
(Total for Question = 8 marks)

Parachuting

3 Christine is a free-fall parachutist.



This is a velocity–time graph for her jump.



(a) Complete the sentence by putting a cross (☒) in a box next to your answer.

On the graph, the greatest acceleration is at

(1)

☐ **A**

☐ **B**

☐ **C**

☐ **D**

(b) Estimate how far

(3)

Christine falls = ... m

(c) Explain the difference between velocity and speed.

(2)

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*(d) The graph shows how Christine's velocity changes from the time she leaves the plane until she reaches terminal velocity.

Explain, in terms of forces, why her velocity changes as shown in the graph.

(6)

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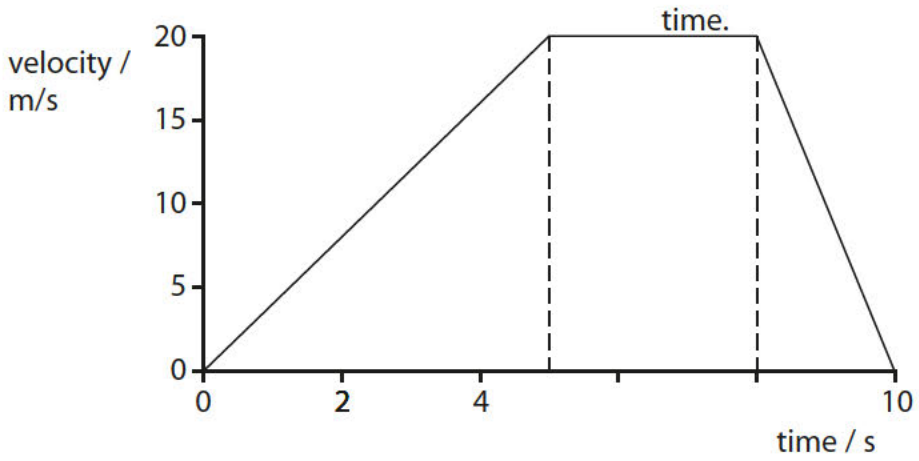
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(Total for Question = 12 marks)

4 The graph shows how the velocity of a small car changes with time.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The resultant force on the car will be zero when the car is

(1)

- ☐ **A** accelerating
- ☐ **B** decelerating
- ☐ **C** changing velocity
- ☐ **D** moving at a constant velocity

(b) (i) Use the graph to estimate the velocity of the car at three seconds.

(1)

velocity ..... m/s

(ii) Calculate the acceleration of the car when it is speeding up.

(2)

acceleration = ... m/s^2

(iii) Explain why the units of acceleration are m/s^2.

(2)

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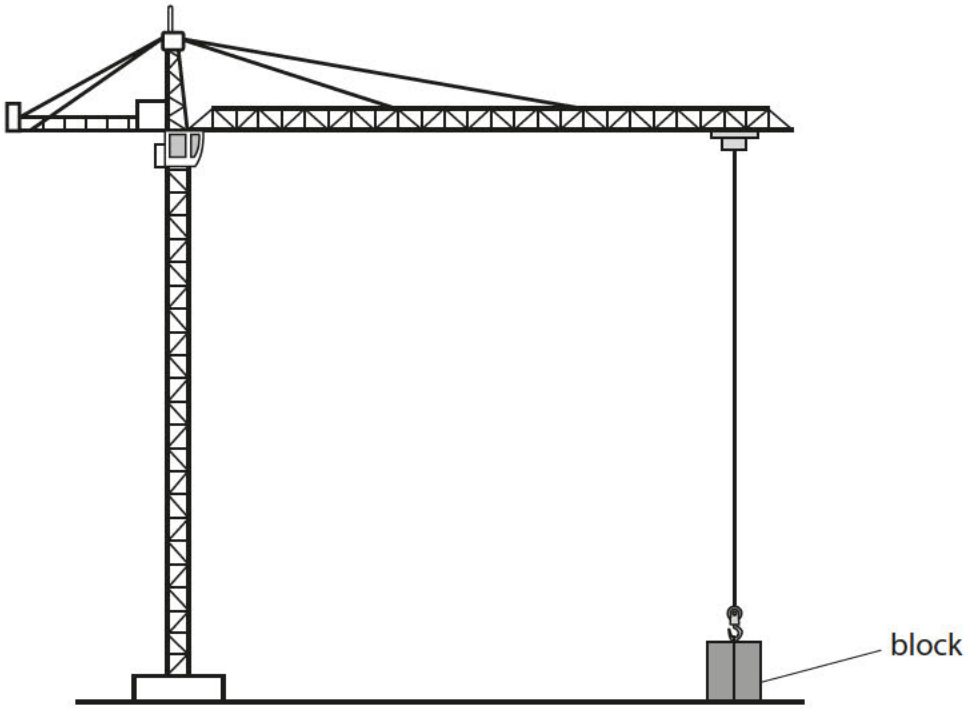
(iv) Show that the car travels further at a constant velocity than it does when it is slowing down.

(3)

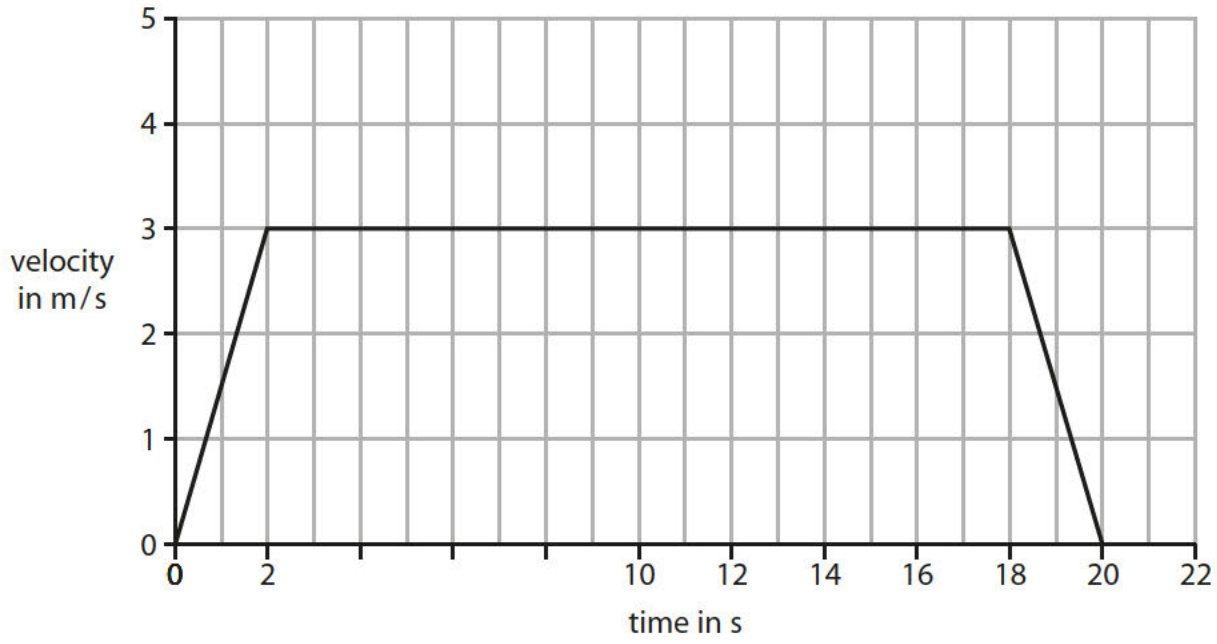
(Total for Question = 9 marks)

Motion and forces

5 (a) A crane is lifting a heavy block from the ground to the top of a building.



This is the velocity/time graph for the block as it travels upwards.

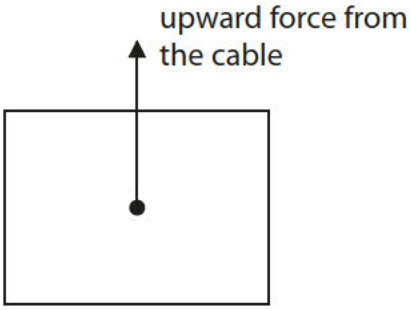


(i) For how many seconds is the block moving at a constant velocity?

(1)

number of seconds = ...

This diagram shows one of the forces acting on the block.



(ii) Draw an arrow on the diagram to represent the weight of the block.

(1)

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

When the block is moving upwards at a constant velocity, the resultant force on the block is

(1)

☐ **A** upwards and equal to its weight

☐ **B** downwards and equal to its weight

☐ **C** upwards and more than its weight

☐ **D** zero

(iv) Use the velocity/time graph to calculate the acceleration of the block during the first 2 s.
State the unit.

(3)

acceleration = ... unit .....

(v) Explain why ater
than the upward force for the next 4 s.

(2)

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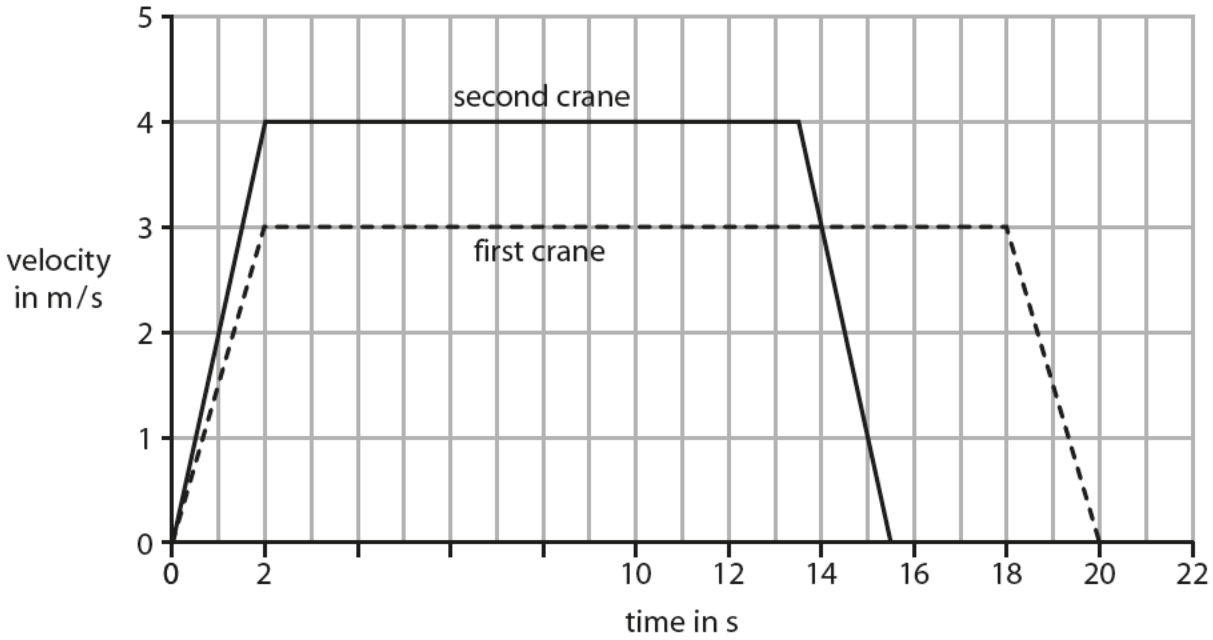
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(b) A second crane lifts an identical block to the same height.

This is the velocity/time graph for the second crane.

The graph for the first crane is shown as a dotted line.



The second crane has a larger power than the first crane.

Explain how the graph shows that the second crane has the larger power.

(2)

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(Total for Question = 10 marks)