1 Fig. 12.1 shows a cyclist.

Fig. 12.1

(a) The cyclist starts from rest and accelerates with constant acceleration.

The cyclist reaches 12 m / s after 20 seconds.

He then continues at this constant speed for 15 seconds.

(i) On Fig. 12.2, plot a speed–time graph for the cyclist.

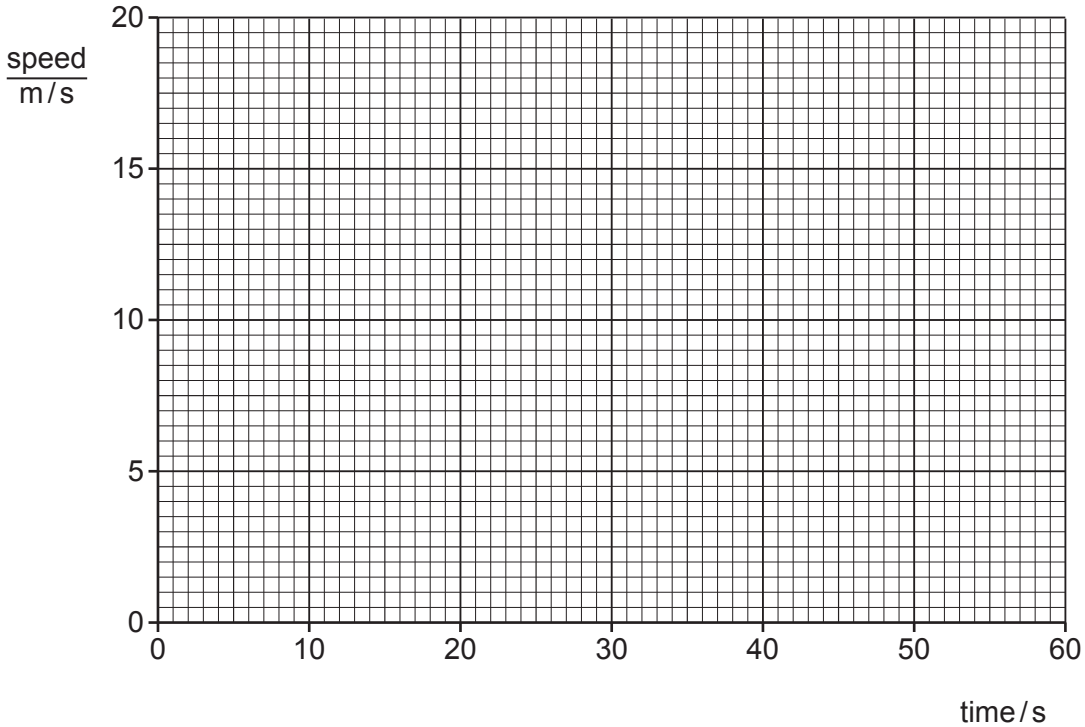


Fig. 12.2

[2]

(ii) Calculate the acceleration of the cyclist during the first 20 seconds.

State the unit for your answer.

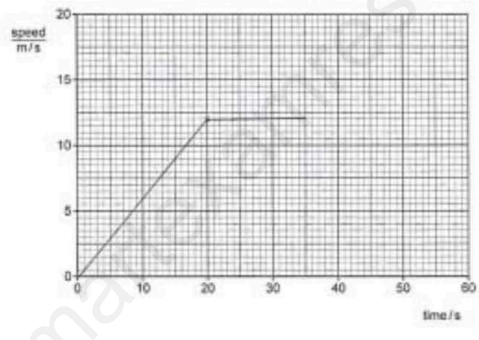
acceleration = ... unit ..... [3]

(iii) Describe how to calculate the distance travelled by the cyclist using the speed–time graph.

.....

..... [1]

MARK SCHEME:

Question	Answer	Marks
(a)(i)	 ;;	2
(a)(ii)	(a =) Δv / t / 12 / 20 ; 0.6 ; m / s^2 ;	3
(a)(iii)	area under the graph ;	1
(b)	velocity has a direction ORA ; both measure, rate of change of distance or displacement / same units ;	2
(c)(i)	460 (N) ;	1
(c)(ii)	air resistance / friction / drag ;	1

2 **(a)** A sprinter runs a 200 m race in 25 seconds.

(i) Calculate the average speed of the sprinter.

average speed = ... m/s [2]

MARK SCHEME:

(a)(i)	(speed =) d / t **or** 200 / 25 ; 8 (m / s) ;	**2**

3 Fig. 6.1 shows a cheetah.

Cheetahs are the fastest land animal and have a top speed of 30 m / s.

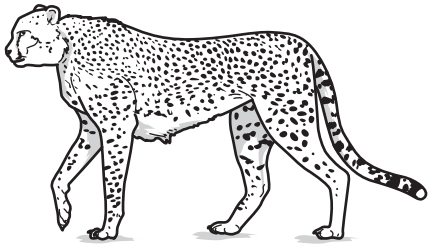


Fig. 6.1

(a) State the difference between speed and velocity.

.....

..... [1]

(b) Fig. 6.2 shows a speed–time graph for a cheetah's journey.

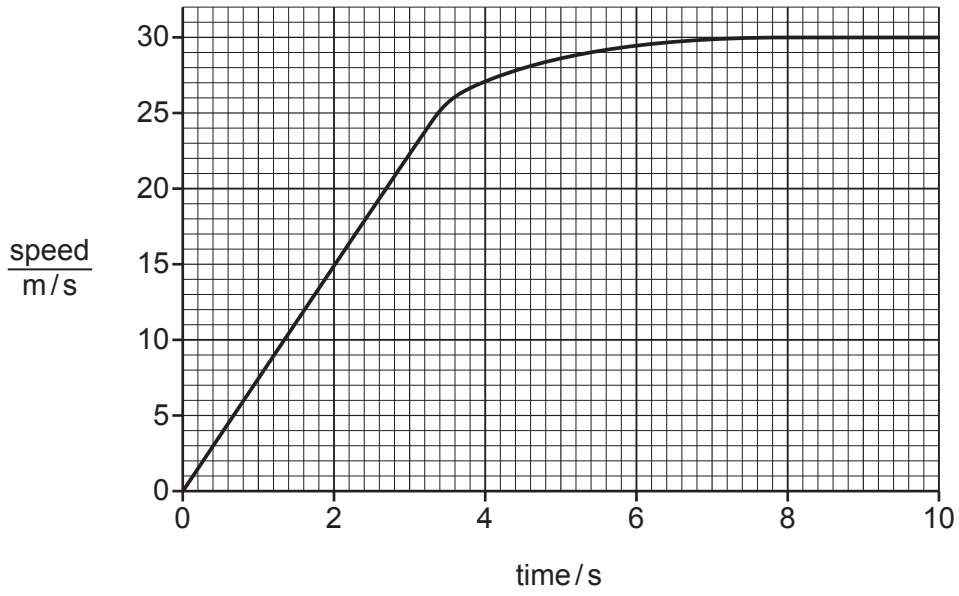


Fig. 6.2

Describe the motion of the cheetah shown in Fig. 6.2.

.....

.....

.....

.....

.....

..... [3]

MARK SCHEME:

Question	Answer	Marks
(a)	velocity has direction / ORA ;	1
(b)	acceleration ; constant followed by non-constant ; constant speed / zero acceleration ;	3

4 Fig. 3.2 shows a speed–time graph for the start of the cycle ride.

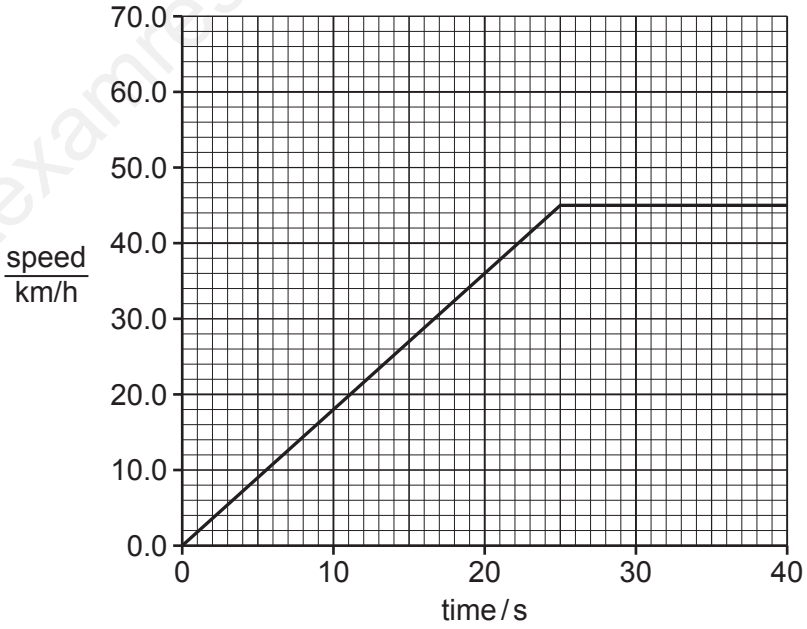


Fig. 3.2

(i) Show that the maximum speed of the athlete during the first 40 seconds of the cycle ride is 12.5 m / s.

[1]

(ii) Calculate the acceleration of the athlete during the first 25 seconds of the cycle ride.

Give your answer in m/s^2.

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

(iii) Calculate the distance covered by the athlete during the first 35 seconds of the cycle ride.

distance = ... m [2]

MARK SCHEME:

(b)(i)	45000 / 3600 (=12.5 m / s) ;	**1**
(b)(ii)	(a =) Δv / t / 12.5 / 25 ; (a =) 0.5 (m / s^2) ;	**2**
(b)(iii)	(0.5 × 25 × 12.5) + (12.5 × 10) ; 281.25 (m) ;	**2**

5 Fig. 3.1 shows an insect called a pond skater.

Pond skaters spread their weight over their 6 legs so that they can move over the surface of water.

Fig. 3.1

(a) The pond skater has a mass of 0.25 g and is stationary on the surface of the water.

(i) Use the values in the list to complete the sentences about the pond skater.

The gravitational field strength, *g*, is 10 N / kg.

You can use each value once, more than once or not at all.

0 N **0.0025 kg** **0.0025 N** **0.25 g** **0.25 kg** **2.5 N**

The weight of the pond skater is ..... .

The force acting upwards on the pond skater by the water is ..... .

The resultant force acting on the pond skater is ..... .

[2]

(ii) The pond skater stands on all 6 legs, with the foot of each leg making contact with the surface of the water.

The area of each foot is $1.2 \times 10^{-7}\,m^2$.

Calculate the pressure exerted by each foot on the surface of the water.

pressure = ... Pa [2]

(b) The pond skater moves across the surface of a pond.

Fig. 3.2 shows a speed–time graph for part of the pond skater's journey.

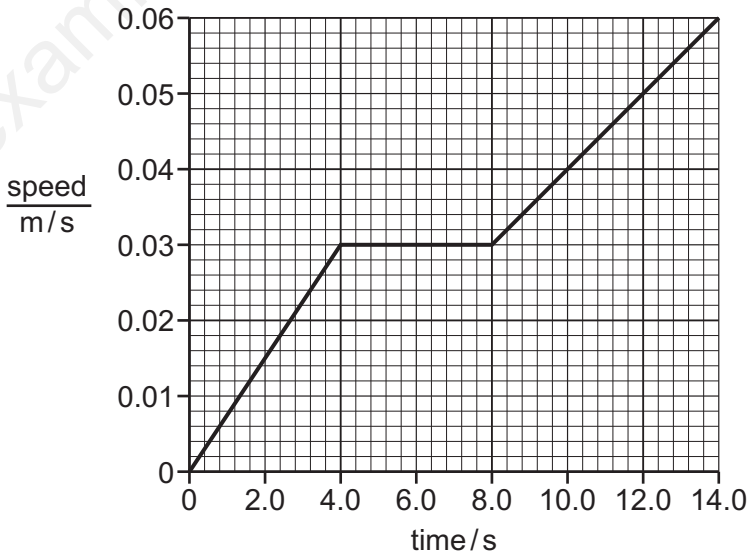


Fig. 3.2

(i) Place an **X** on Fig. 3.2 to show a time at which the pond skater is travelling at a constant speed. [1]

(ii) Use Fig. 3.2 to calculate the maximum acceleration of the pond skater.

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

MARK SCHEME:

(b)(i)	X placed between 4.0 and 8.0 s ;	**1**
(b)(ii)	(a =) $\Delta v / \Delta t$ **or** 0.03 / 4.0 ; (a =) 0.0075 (m / s^2) ;	**2**