1 Fig. 6.2 shows a speed-time graph for the rollercoaster car's journey between positions **D** and **E**.

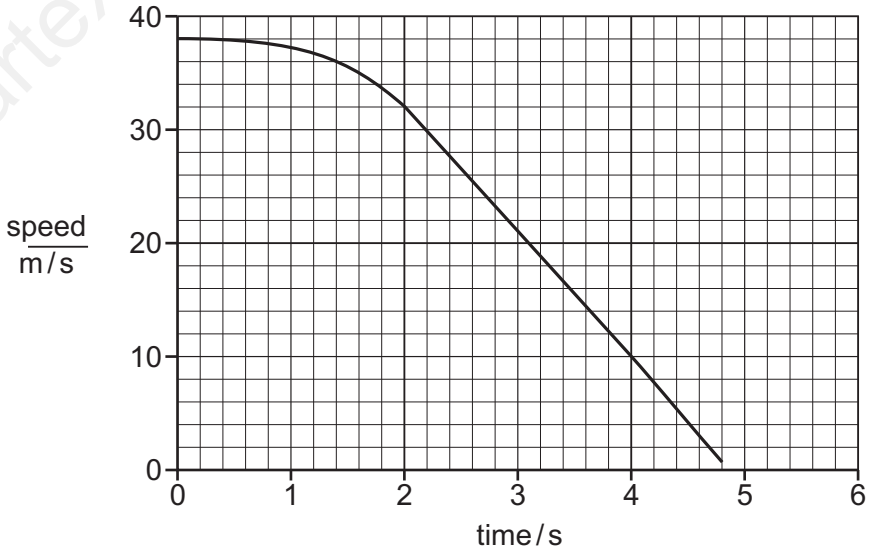


Fig. 6.2

(i) Use Fig. 6.2 to determine the change in speed of the rollercoaster car between t = 2 s and t = 4 s.

change in speed = ... m/s [1]

(ii) Calculate the acceleration of the rollercoaster car between t = 2 s and t = 4 s.

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

(iii) Use Fig. 6.2 to describe the motion of the rollercoaster car between t = 0 s and t = 5 s.

.....

.....

.....

.....

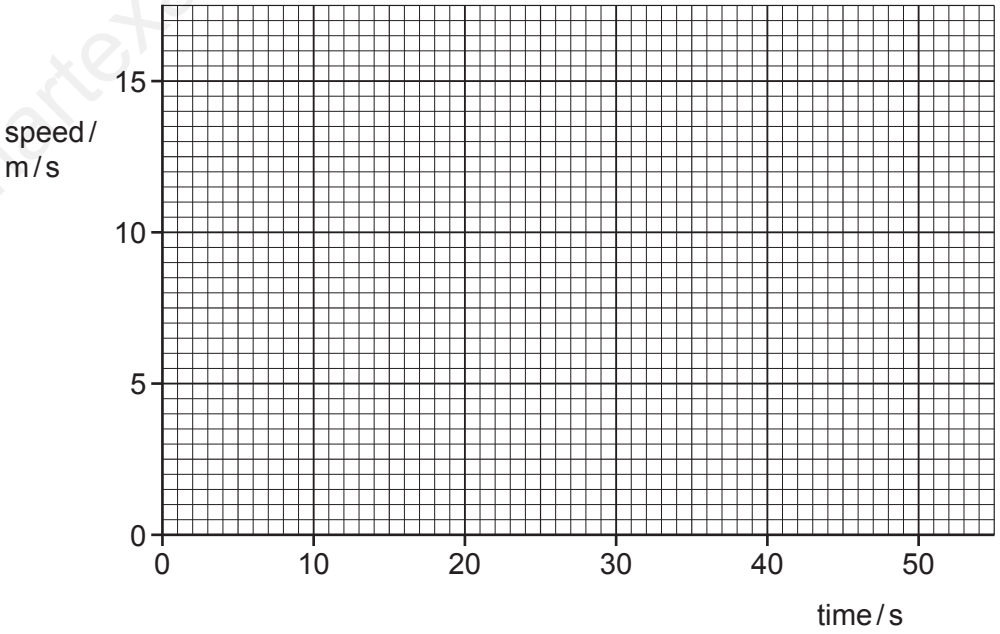
..... [3]

MARK SCHEME:

(i)	(–)22 (m / s) ;	1
(ii)	a = Δv / t **or** (–)22 / 2 ; (–)11 (m / s^2) ;	2
(iii)	decelerating / negative acceleration / slowing down ; non-constant (deceleration), at start / before 2 s ; constant (deceleration), at end / after 2 s ;	3

2 **(a)** A car travels at 12 m/s for 15 seconds. The driver applies the brakes which brings the car to rest after 25 seconds of braking. The deceleration is constant.

(i) On the grid, draw a speed/time graph for this car's journey.



[2]

Fig. 9.1

(ii) Show that the deceleration of the car during the braking period is 0.48 m/s^2.

[1]

(iii) The mass of the car is 1200 kg.
Calculate the size of the braking force.

force = ... N [2]

(iv) The braking distance of the car is 150 m.
Using your answer from **9(a)(iii)** calculate the work done by the brakes.

work done = ... J [2]

(b) Describe the main energy transfer that happens when the car brakes.

from ..... energy to ..... energy

[2]

MARK SCHEME:

Question	Answer	Marks
(a)(i)	horizontal line drawn at 12 m/s for 15 s ; straight line drawn from 12 m/s to 0 m/s taking 25 s ;	2
(a)(ii)	(a =) 12 / 25 (= 0.48 m/s^2) ;	1
(a)(iii)	(F =) ma **or** 1200 × 0.48 ; 576 (N) ;	2
(a)(iv)	(W =) f × d **or** 576 × 150 ; 86 400 (J) ;	2
(b)	kinetic; thermal ;	2

3 Fig. 3.1 shows a man transporting some luggage in a small boat.

Fig. 3.1

(a) Fig. 3.2 shows a distance–time graph for part of the journey.

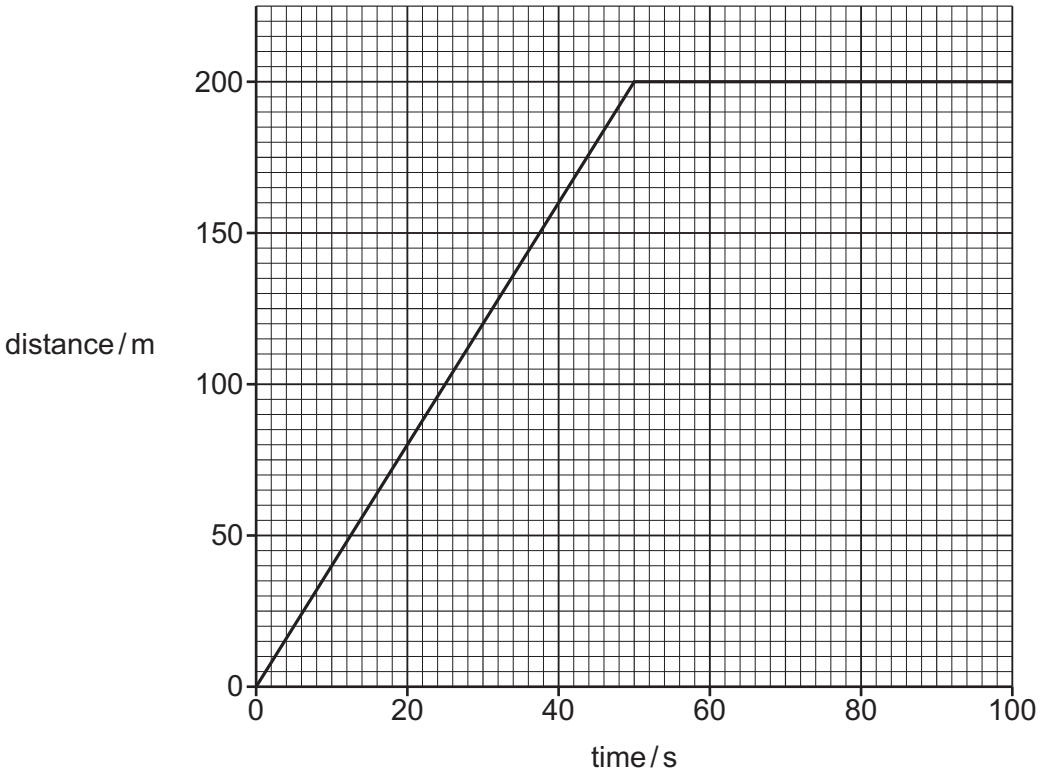


Fig. 3.2

(i) Using data from the graph, describe the journey shown in Fig. 3.2.

.....

.....

..... [3]

(ii) Show that the speed of the boat, 20 seconds after the start of the journey, is 4.0 m / s.

..... [1]

(iii) The combined mass of the man, his luggage and the small boat is 100 kg.

Calculate the total kinetic energy of the man, his luggage and the small boat when their speed reaches 4.0 m / s.

kinetic energy = ... J [2]

(b) The man lifts the boat off the water and attaches it to a trolley.

The man exerts a downwards force **F** which keeps the boat in equilibrium as shown in Fig. 3.3.

The wheels of the trolley act as a pivot.

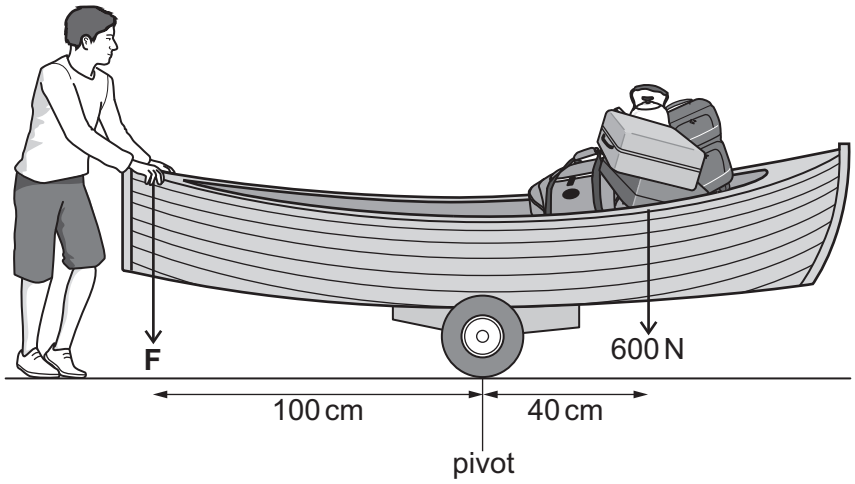


Fig. 3.3

Use the principle of moments to calculate the size of the force **F**.

force = ... N [3]

[Total: 9]

MARK SCHEME:

Question	Answer	Marks
(a)(i)	constant speed ; stationary ; use of data to identify change at 50 s or 200 m ;	3
(a)(ii)	(v =) 200 / 50 **or** 80 / 20 = (4 m / s) ;	1
(a)(iii)	(KE =) ½ mv^2 **or** ½ × 100 × 4^2 ; (KE =) 800 (J) ;	2
(b)	(M =) f × d **or** 600 × 40 **or** 24000 (Ncm) ; (F =) 24000 / 100 ; (F =) 240 (N) ;	3

4 After hearing the sound, the zebra runs across the enclosure in 7.5 s. The average speed of the zebra is 16 m / s.

Calculate the distance the zebra runs.

distance = ... m [2]

MARK SCHEME:

	(d =) v × t **or** 16×7.5 ; (d =) 120 (m) ;	**2**

5 Fig. 3.1 shows a man in a canoe on a lake.

The combined mass of the man and the canoe is 120 kg.

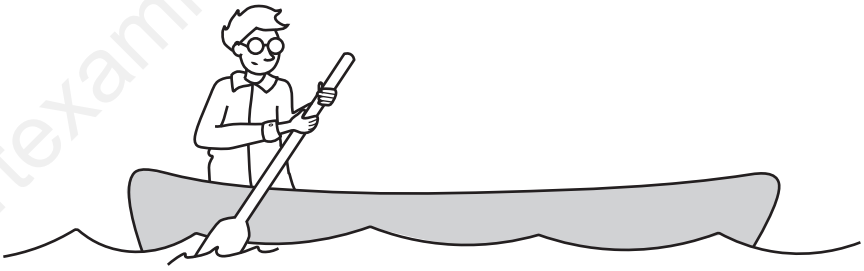


Fig. 3.1

(a) The canoe moves at a speed of 4.0 m/s.

(i) Calculate the kinetic energy of the man and the canoe.

kinetic energy = ... J [2]

(ii) The canoe takes 5.0 s to slow down to a speed of 0.5 m/s.

Calculate the constant deceleration of the canoe.

deceleration = ... m/s^2 [3]

(iii) On Fig. 3.2 draw a speed–time graph to show the canoe's deceleration.

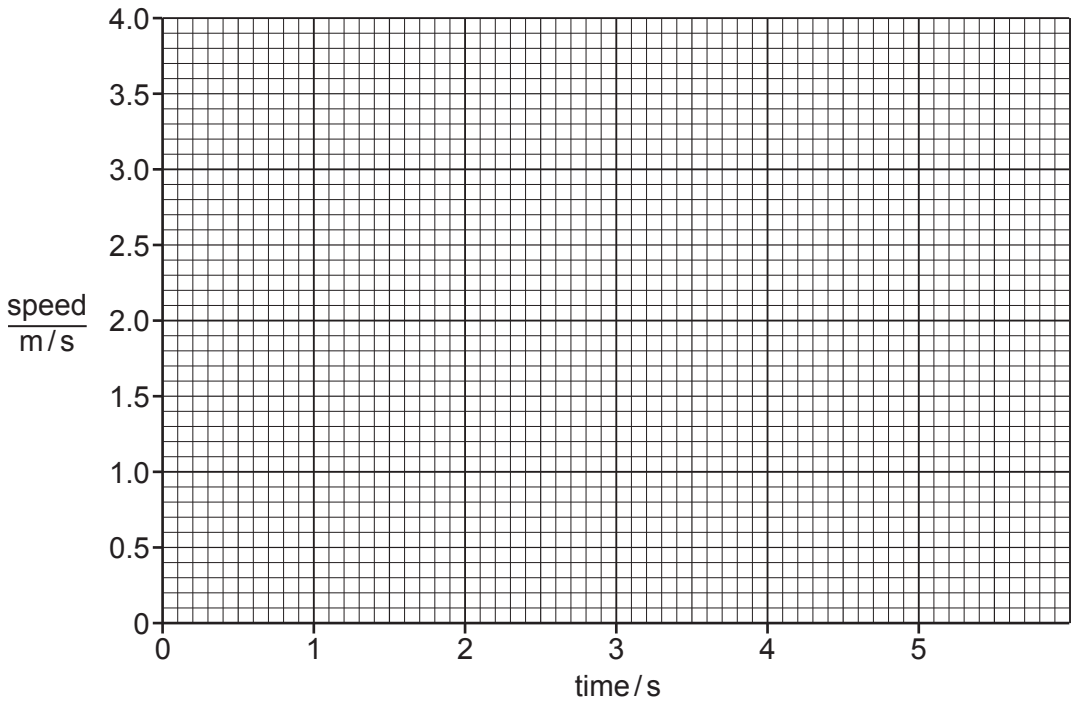
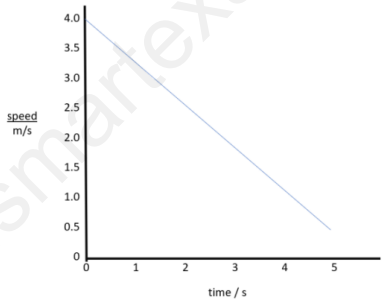


Fig. 3.2

[1]

MARK SCHEME:

estion	Answer	Marks
(a)(i)	(KE =) ½ mv^2 or ½ × 120 × 4^2 ; 960 (J) ;	2
(a)(ii)	(Δv =) 3.5 (m / s) ; (a =) Δv / t or 3.5 / 5.0 ; 0.7 (m / s^2) ;	3
(a)(iii)	 ;	1