O Level Combined Physics Structured

Kinematics Test 1.0

Q1

Fig 2.1 shows a stone being thrown upwards at **A** from a cliff. It reaches the maximum height at B and falls to the bottom of the cliff at **C**.

Fig 2.2 shows how the speed of the stone changes from **A** to **C**.

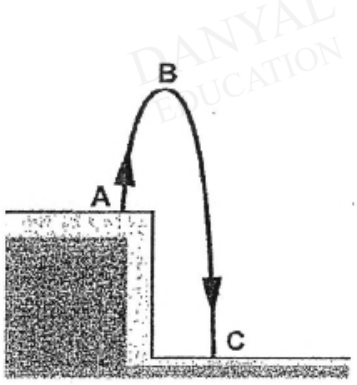


Fig 2.1

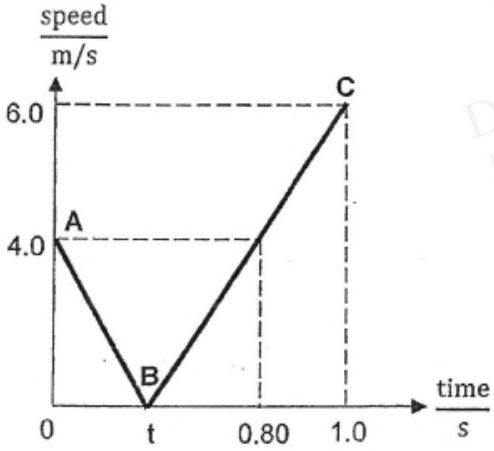


Fig 2.2

(a) The stone undergoes constant deceleration of 10 m/s^2 from **A** to **B**.

(i) Explain the term "*constant deceleration*".

.....

..... [1]

(ii) Explain in terms of forces why the stone has a constant deceleration of 10 m/s^2 from **A** to **B**.

.....

.....

.....

..... [2]

(b) Hence, or otherwise, calculate time t, the time taken for the stone to go from **A** to **B**.

time t = ...s [1]

(c) Calculate distance **BC** and hence determine the height of the cliff.

distance BC = ... m

height of cliff = ... m [2]

(d) Calculate the average speed from **B** to **C**.

average speed = ... m/s [1]

Q2

I A cyclist starts from rest. He accelerates and then travels at a constant speed. Photographs are taken of the cyclist at 4.0 s intervals. Fig. 1.1 shows the results.

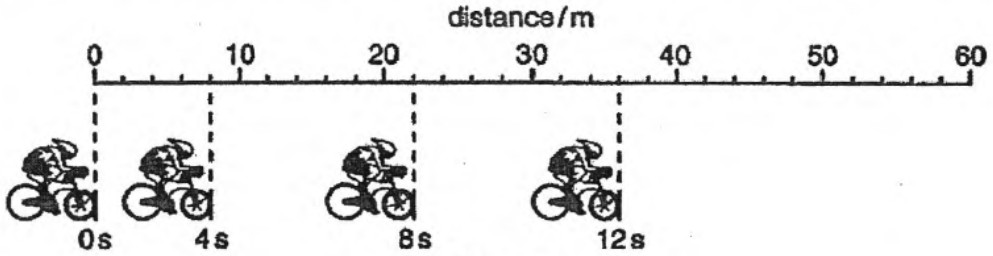


Fig. 1.1

(a) On Fig. 1.1, draw a possible position of the front wheel of the cycle at 16 s. [1]

(b) On Fig. 1.2, plot a distance-time graph of the cyclist for the first 12 s. [2]

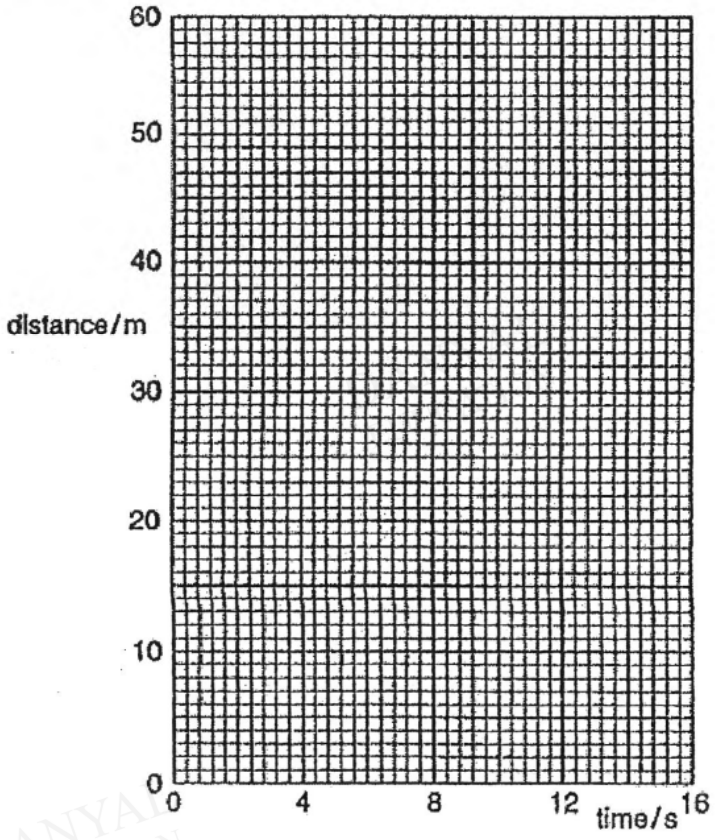


Fig. 1.2

(c) Calculate the average speed of the cyclist during the first 12 s.

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

Q3

Fig. 1.1 shows how the speed of two cars changes as they move from rest along a straight road.

car A	
time / s	speed / (m/s)
0	0
5.0	20
10.0	40
15.0	60
20.0	60
25.0	60
30.0	60

car B	
time / s	speed / (m/s)
0	0
5.0	10
10.0	20
15.0	30
20.0	40
25.0	50
30.0	60

Fig. 1.1

(a) Plot the speed-time graphs in Fig. 1.2 for both cars **A** and **B**. Label your graphs clearly.

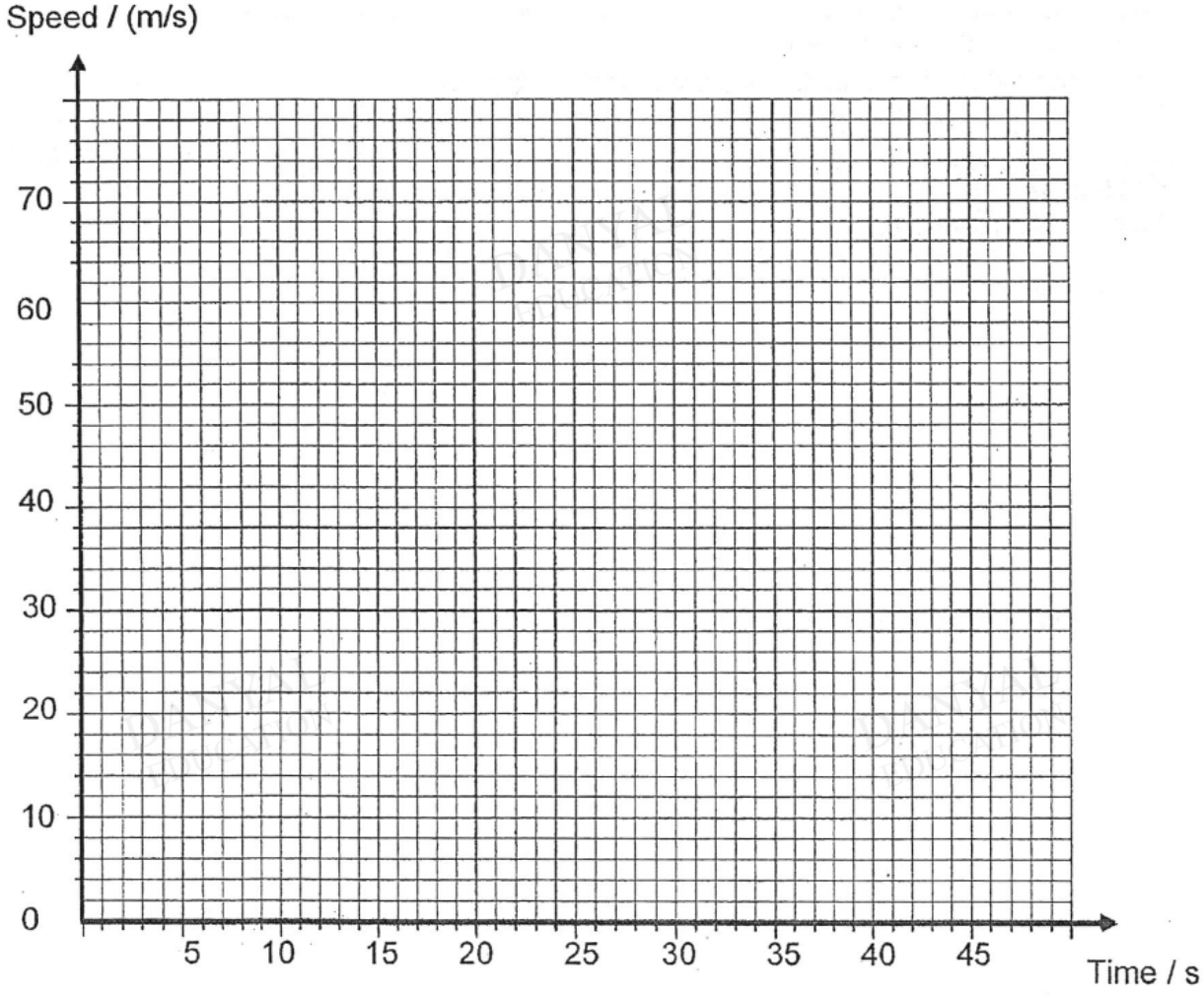


Fig. 1.2

[2]

(b) At the end of 30.0 s, calculate the distance between the two cars.

distance = ... m [2]

(c) If the mass of the car **B** is 500 kg, calculate the net force acting on it.

net force = ... N [2]

Q4

A motorcycle accelerates along a straight section of a track from a speed of 40 m/s to maximum speed. Fig. 1.1 is the speed-time graph for the motorcycle along the straight section of the track

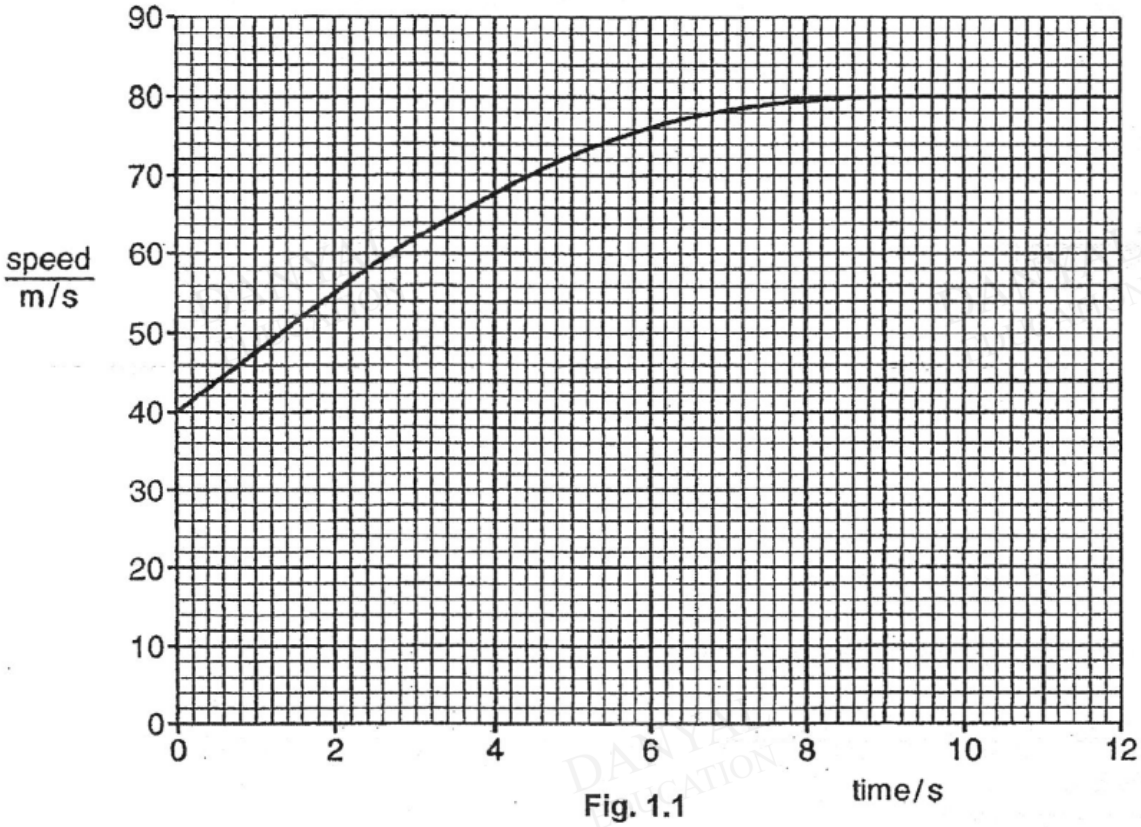


Fig. 1.1

(a) For the time 0 s to 2.0 s, determine the acceleration of the motorcycle.

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

(b) Calculate the distance travelled by the motorcycle at constant speed.

distance = ...m [1]

Q5

Fig. 1.1 shows the speed-time graph of a motorcyclist.

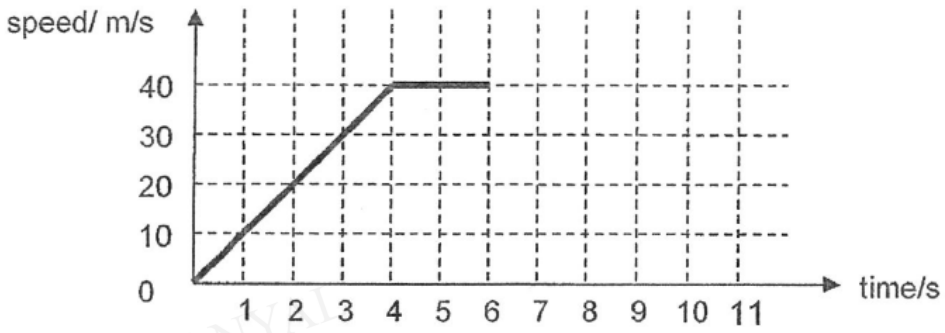


Fig. 1.1

(a) Describe the motion of the motorcyclist for the first 6.0 seconds.

_____

_____

_____ [2]

(b) The motorcyclist decelerates uniformly at 20 ms^{-2} from t = 6.0 s until he comes to a stop before the traffic light. Sketch this part of the motion in Fig. 1.1 above. [2]

(c) Calculate the total distance travelled by the motorcyclist from t = 0 s till the time he stopped at the traffic light.

total distance travelled = _____ m [2]

(d) Hence, calculate the average speed of the motorcyclist in this whole journey.

average speed = _____ m/s [1]

Answers

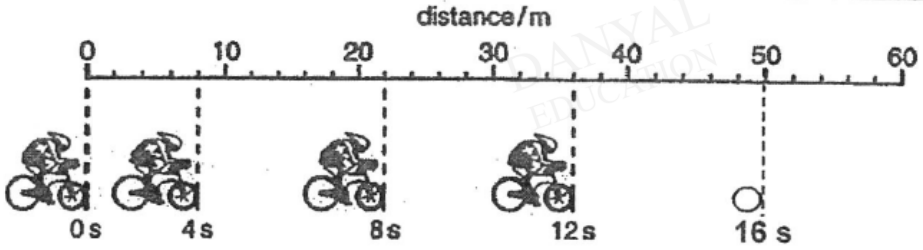
Kinematics Test 1.0

Q1

2ai)	Constant decrease in velocity per unit time	1
ii)	Deceleration as net force (weight) is downwards while motion is upwards (or opposes motion) Deceleration is constant as net force = weight = constant	1 1
b)	Gradient = - 10 -4.0/t = -10 t = 0,40 s	1
c)	Distance BC = area under v-t graph = ½ (1-0.40)(6) = 1.8 m Height of cliff = BC – AB = 1.8 – ½ (0.40)(4.0) = 1.0 m	1 1
d)	Average speed = 1.8 /0.6 = 3.0 m/s	1

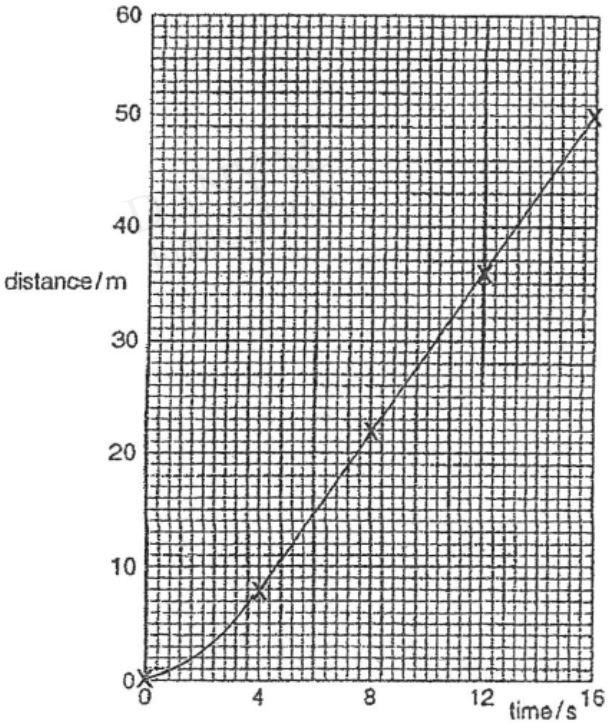
Q2

(a)



[1]

(b)

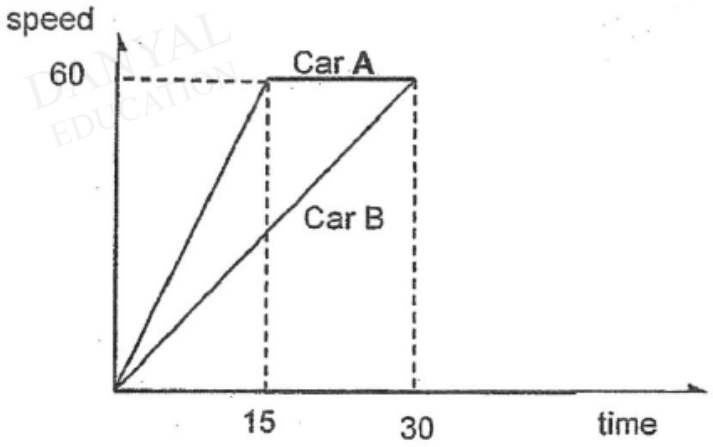


Correct Points plotted [1]

Best fit line [1]

(c)	Average speed = $\frac{total\_distance}{total\_time} = \frac{36}{12}$	[1]
	= 3.0 m/s	[1]

Q3

(a)		2 (1m for each graph
(b)	Distance between the cars = (½ x 15 x 60 + 15 x 60) – (½ x 30 x 60) = 450 m	1 1
(c)	$Acceleration = \frac{60-0}{30}$ $= 2.0\ m/s^2$	1
	Net force = 500 x 2.0 = 1000 N	1

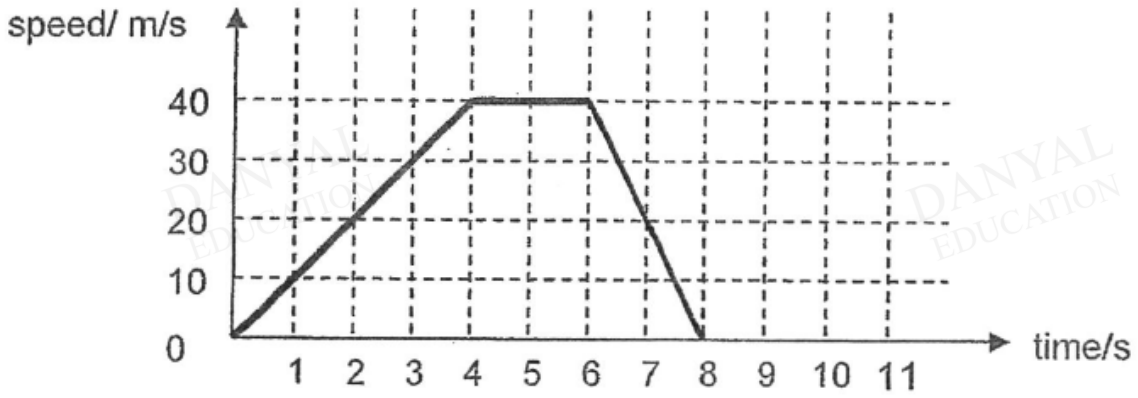
Q4

(a)	$a = \frac{55-40}{2}$ = 7.5 ms^{-2}	[M1] [A1]
(b)	d = 4x80 = 320 m	[A1]

Q5

(a) The motorcyclist was travelling at constant acceleration from t = 0 s to 4.0 s. He then travels at a constant speed of 40 m/s from t = 4.0 s to 6.0 s. [1] [1]

(b)



[1] for the line
[1] for correct time

(c) total distance = ½(2+8)(40)
= 200 m [1] [1]

(d) average speed = 200/8
= 25 m/s [1]