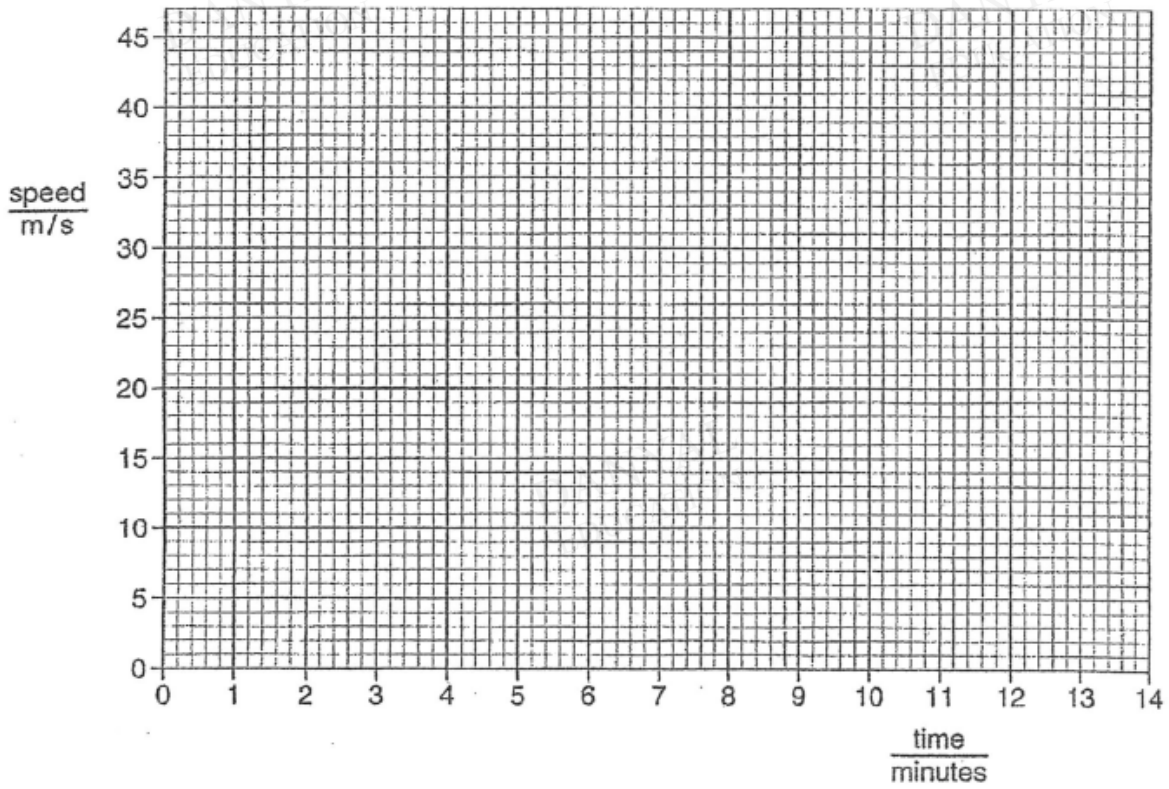
O Level Combined Physics Structured

Kinematics Test 2.0

Q1

A car travels at 15 ms^{-1} for 2.0 minutes. It then accelerates uniformly to a speed of 40 ms^{-1} in 1.5 minutes. It travels at a uniform speed of 40 ms^{-1} for a further 7.0 minutes before decelerating non-uniformly to rest in 2.5 minutes.

(i) In the figure, plot a graph to show the variation with time of the speed of the car. [2]



(ii) Calculate the distance moved by the car before it decelerated.

distance = ...[2]

Q2

Fig. 11.1 shows the speed-time graph of an object falling through the air from rest until it hits the ground. The mass of the object is 0.8 kg.

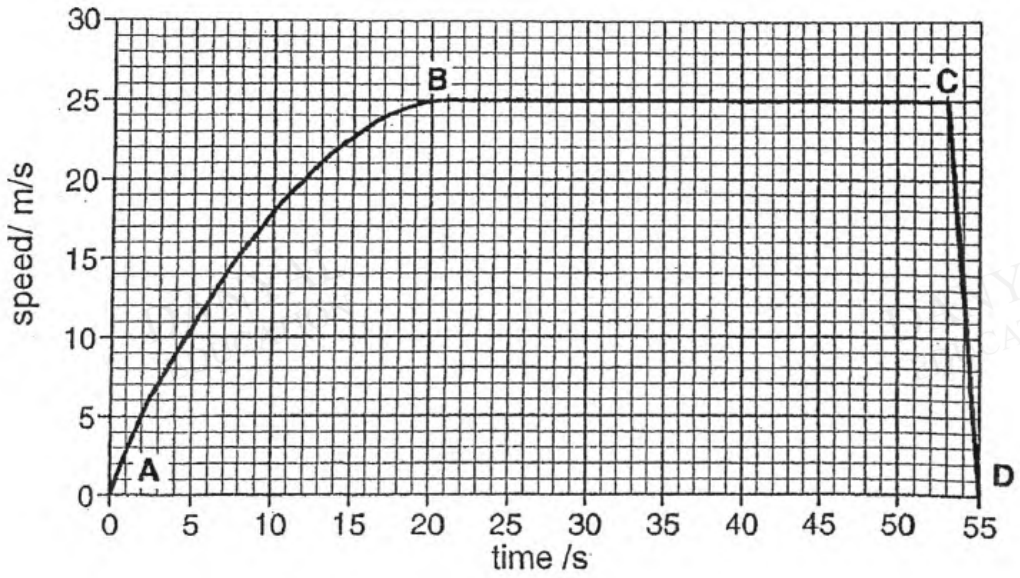


Fig. 11.1

a) State the magnitude of the acceleration of the object between points B & C.

acceleration = ... ms^{-2} [1]

b) Describe the motion of the object between points A and B.

.....

..... [1]

c) Use the weight of the object and the air resistance to explain the motion of the object between points A and B.

.....

.....

.....

.....

.....

..... [3]

d) State the magnitude of the air resistance experienced by the object between points B and C. (Assume g = 10 N/kg)

air resistance = ... N [1]

e) What is the distance moved by the object from 20 s to 55 s?

distance = ... m [2]

f) What is the acceleration of the object between points C and D?

acceleration = ... ms^{-2} [2]

Q3

A trolley was attached to a ticker tape as shown below. It was moving at a speed of 4 cm/s along a flat road in Fig. 1a. The ticker timer creates dots on the ticker tape as shown in Fig. 1b at a frequency of 2 Hz to indicate the movement of the trolley.

(a) What is meant by moving at a speed of 4 cm/s? [1]

.....

.....

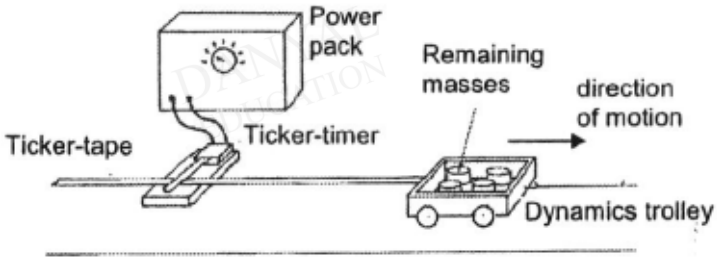


Fig. 1a

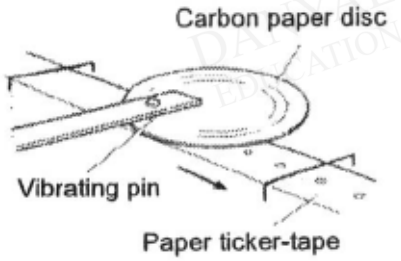


Fig 1b

(b) In Fig. 1c below, draw to scale how the dots will be arranged after the trolley travelled for 3 s? Mark the dots with a cross. The first dot has been drawn for you. [2]

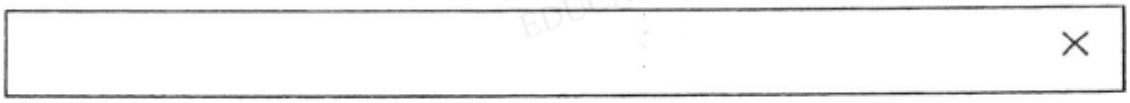


Fig. 1c

(c) In Fig. 1d below, draw additional 4 crosses to show how the ticker tape will look like if the trolley was accelerating. The first dot has been drawn for you. [2]

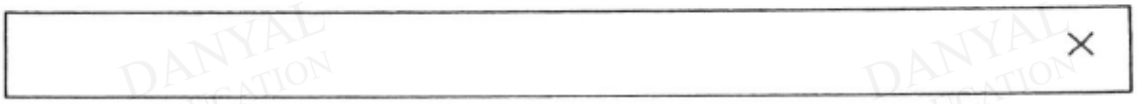


Fig. 1d

Q4

A car travels at 15 m/s for 2 minutes. It then accelerates uniformly to a speed of 30 m/s in 1 minute. It travels at a uniform speed of 30 m/s for a further 7 minutes before decelerating non-uniformly to rest in 1.5 minutes

(a) On the grid of Fig. 1.1, plot the graph to show the variation with time of the speed of the car. [3]

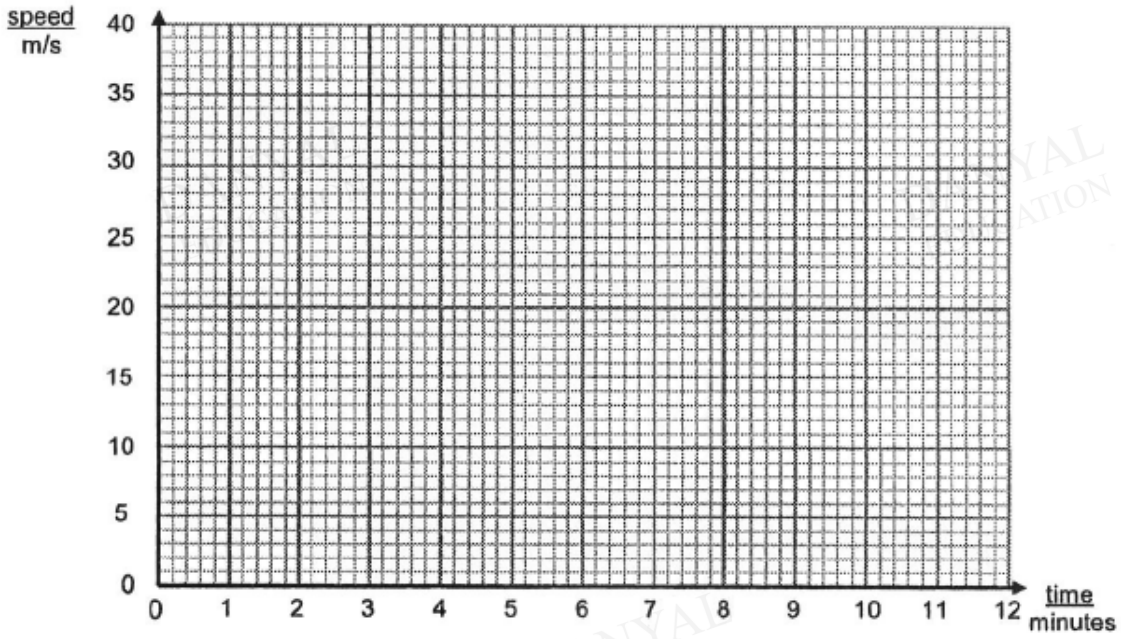


Fig. 1.1

(b) Calculate the acceleration of the car as it increases its speed from 15 m/s to 30 m/s.

acceleration = ...[2]

(c) Calculate the distance moved by the car between the 2nd and the 3rd minute.

distance = ...[3]

Q5

Fig. 2.1 shows the velocity-time graph of a car moving from rest.

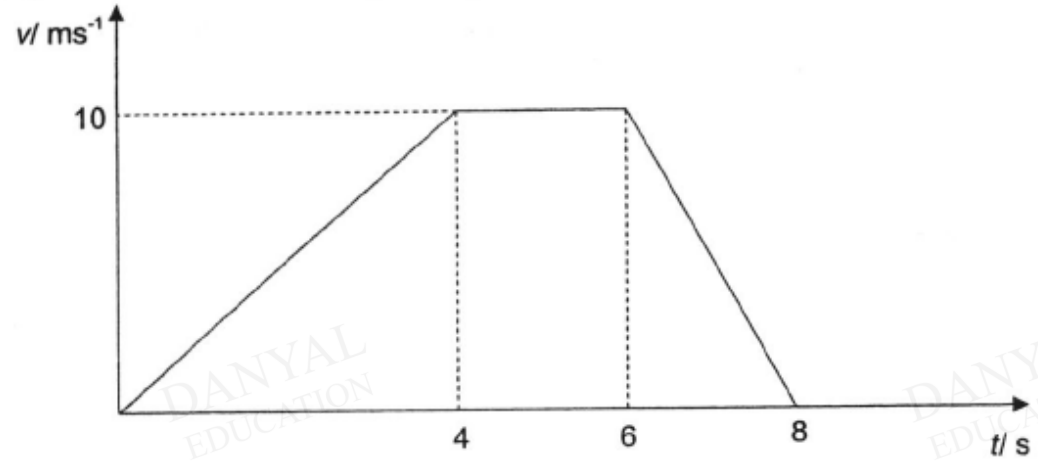


Fig 2.1

(a) Calculate the initial acceleration of the car from 0 to 4 s. [2]

Initial acceleration = _____ m/s^2

(b) Calculate the total distance travelled by the car. [2]

Total distance= _____ m

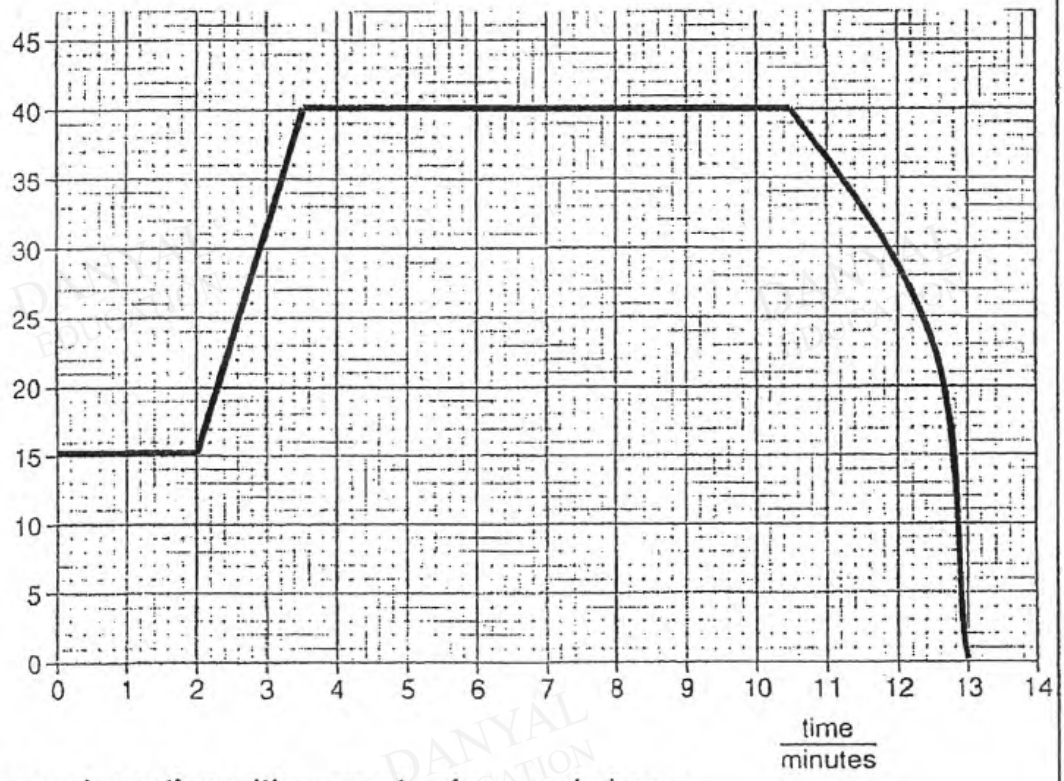
(c) Hence, calculate the average speed of the car over its whole motion. [2]

Average Speed= _____ m/s

Answers

Kinematics Test 2.0

Q1

(a)	 ½ m for each section with correct values and shape. Accept decreasing curve.	2
(b)	Distance moved by the car before it decelerated= 15 x3.5(60) + ½ (1.5)60x25 +(40x7x60) =3150+1125+16800=21075 m	2

Q2

a	0 ms^{-2}	A1
b	The object is falling with decreasing acceleration.	A1
c	As speed increases, air resistance also increases but weight remains unchanged. The resultant force decreases. Using F = ma, the acceleration also decreases.	A1 A1 A1
d	8 N	A1
e	Distance = area under the graph = 0.5 x (35+33) x 25 = 850 m	M1 A1
f	a = (v-u) /t = (0 – 25) / (55 – 53) = -12.5 ms^{-2}	M1 A1

Q3

A trolley was attached to a ticker tape as shown below. It was moving at a speed of 4 cm/s along a flat road in Fig. 1a. The ticker timer creates dots on the ticker tape as shown in Fig. 1b at a frequency of 2 Hz to indicate the movement of the trolley.

(a) What is meant by moving at a speed of 4 cm/s? [1]
The trolley was moving at a distance of 4 cm in every second.

.....

.....

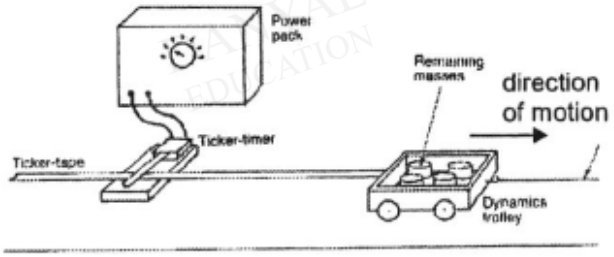


Fig. 1a

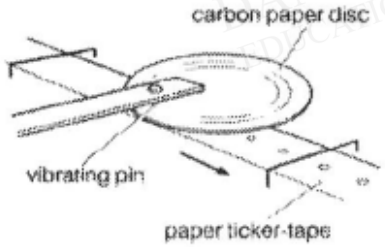
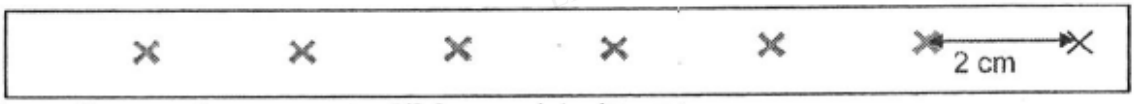


Fig 1b

(b) In Fig. 1c below, draw to scale how the dots will be arranged after the trolley travelled for 3 s? Mark the dots with a cross. The first dot has been drawn for you. [2]



[1] equally spaced crosses [1] 6 more dots drawn

Fig. 1c

(c) In Fig. 1d below, draw additional 4 crosses to show how the ticker tape will look like if the trolley was accelerating. The first dot has been drawn for you. [2]

[1] increasing spaced crosses [1] 4 more dots drawn

Fig. 1d

Q4

(a) On the grid of Fig. 1.1, plot the graph to show the variation with time of the speed of the car. [3]

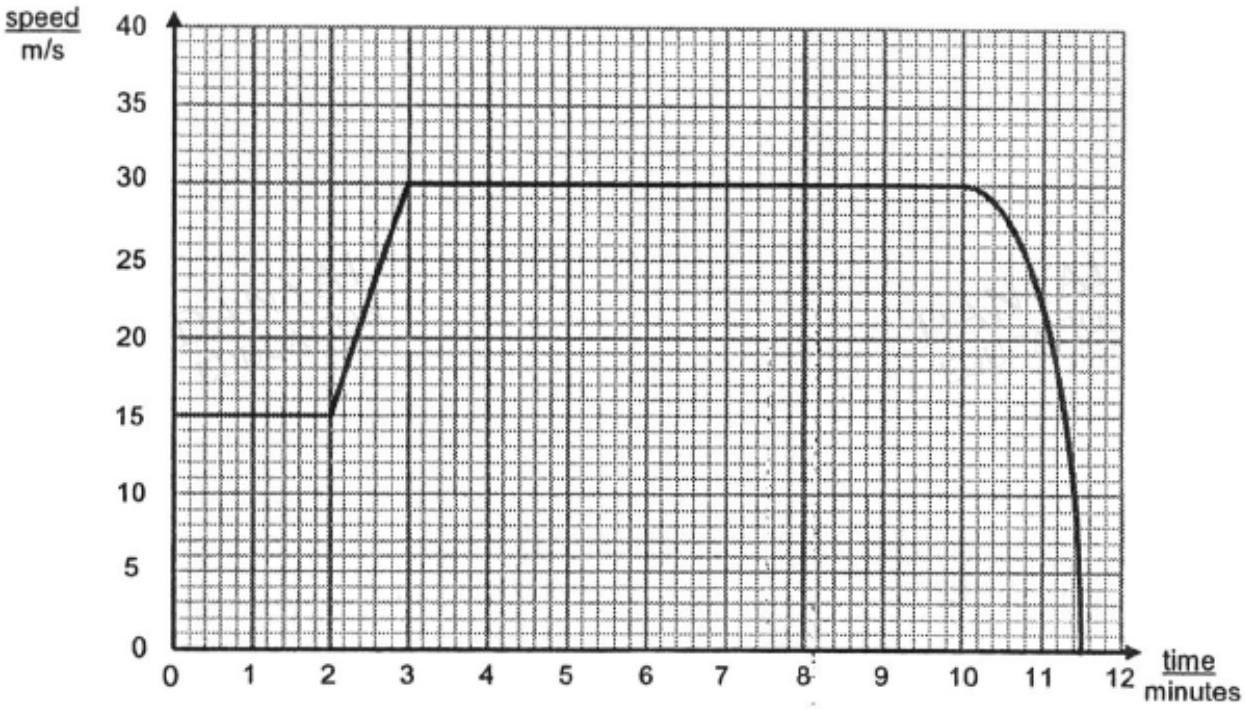


Fig. 1.1

(b) Calculate the acceleration of the car as it increases its speed from 15 m/s to 30 m/s.

$a = (v - u) / t$
$= (30 - 15) / 60$
$= 0.25\ m/s^2$

acceleration = ... [2]

(c) Calculate the distance moved by the car between the 2nd and the 3rd minute.

distance = area under graph
= ½ x (15+30) x 60
= 1350 m

distance = ... [3]

Q5

(a) Calculate the initial acceleration of the car from 0 to 4 s. [2]

Acceleration = gradient from 0 to 4s [1]
$= \frac{10-0}{4}$
$=2.5\ m/s^2$ [1]

Initial acceleration = _____ m/s^2

(b) Calculate the total distance travelled by the car. [2]

Distance = area under graph [1]
=1/2 * 10 * (2+8)
= 50 m [1]

Total distance= _____ m

(c) Hence, calculate the average speed of the car over its whole motion. [2]

Average speed = $\frac{total\ distance}{total\ time}$ [1]

$= \frac{50\ m}{8\ s}$

= 6.25 m/s [1]

Average Speed= _____ m/s