EXAM-STYLE QUESTIONS

Multiple choice questions

1 The following are three quantities used to describe the motion of a body:

i Displacement

ii Velocity

iii Acceleration

Which of the following correctly describes the vector nature of the quantities?

A i only

B i and ii only

C ii and iii only

D i, ii and iii

2 The following are three statements about the motion of a body:

i A body moving with constant speed cannot be accelerating.

ii A body moving always in the same direction could be accelerating.

iii A body moving with a changing direction must be accelerating.

Which of the following is/are true?

A i only

B ii only

C iii only

D i and iii

3 Which of the following statements about the motion of a body is **false**?

A It is not possible to travel at a constant speed for 1 minute and have a displacement of zero.

B It is not possible to travel at a constant velocity for 1 minute and have a displacement that is zero.

C A body travelling for 1 minute with a changing velocity can have a final displacement of zero.

D A body travelling with a constant velocity for 1 minute must have a non-zero displacement.

4 A man walks eastwards a distance of 4.0 km and then moves northwards a distance of 3.0 km. 13

Which of the following statements correctly describes the overall displacement of the man?

A 7 km in a direction that is 53° north of eastwards

B 7 km in a direction that is 37° north of eastwards

C 5 km in a direction that is 37° north of eastwards

D 5 km in a direction that is 53° north of eastwards

5 A racing car accelerates from rest at 4 ms^{-2} until it has travelled a distance of 50 m. The final speed of the car is:

A 10 ms^{-1}

B 12.5 ms^{-1}

C 20 ms^{-1}

D 25 ms^{-1}

14

6 In 1969 Neil Armstrong dropped a spanner whilst standing on the surface of the Moon, where acceleration due to gravity is $\frac{1}{6}$ of the Earth's. The time it took to fall to the Moon's surface was:

A $\frac{1}{6}$ of the time it would have taken on the Earth

B $\sqrt{\frac{1}{6}}$ times the time it would have taken on the Earth

C 6 times the time it would have taken on the Earth

D $\sqrt{6}$ times the time it would have taken on the Earth

7 Figure 1.9 shows four different journeys on the same velocity–time axes.

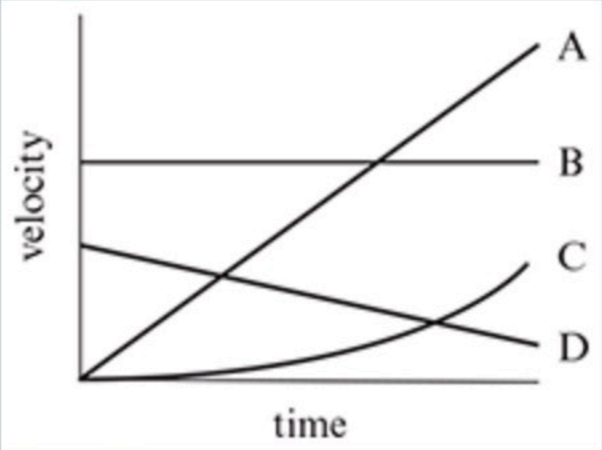

Figure 1.9

Which of the journeys shows an increasing acceleration?

8 The area under an acceleration–time graph is:

A Distance travelled

B Displacement

C Average velocity

D Change of velocity

Short answer questions

9 When a golfer hits a golf ball, the club head makes contact with the golf ball for a time of 0.4 ms. During this time, the speed of the golf ball increases from rest to 80 ms^{-1}.

a Determine the average acceleration of the golf ball whilst in contact with the club head. **[1]**

b Determine the distance that the golf ball travels during this time. **[2]**

c High-speed photography has shown that during the contact between the club head and the ball, the ball squashes rather than remaining rigid. Suggest a reason why your answer to part **b** is supported by this observation. **[1]**

10 Learning to drive a car usually involves understanding how far a car will travel when a driver applies the brakes in order to stop. This distance i 15
the stopping distance. It is made up of two components: the thinking distance and the braking distance.

thinking distance = initial speed × driver reaction time

braking distance = distance travelled whilst coming to a stop

A typical healthy driver has a reaction time of about 0.5 s and a typical family car can decelerate at about 5 ms^{-2}.

a Complete Table 1.3. Some of the values have been calculated for you. **[2]**

Initial speed / ms^{-1}	Thinking distance / m	Braking distance / m	Stopping distance / m
0	0	0	0
5	2.5	2.5	5
10		10	
15			30
20	10		

Table 1.3

b Use the data in your completed table to construct a graph of *stopping distance* against *initial speed*. **[2]**

c Use your graph to estimate the initial speed of a car that requires 40 m of stopping distance. **[1]**

11 Figure 1.10 shows the velocity–time graph for a ball thrown vertically into the air and then caught by the thrower.

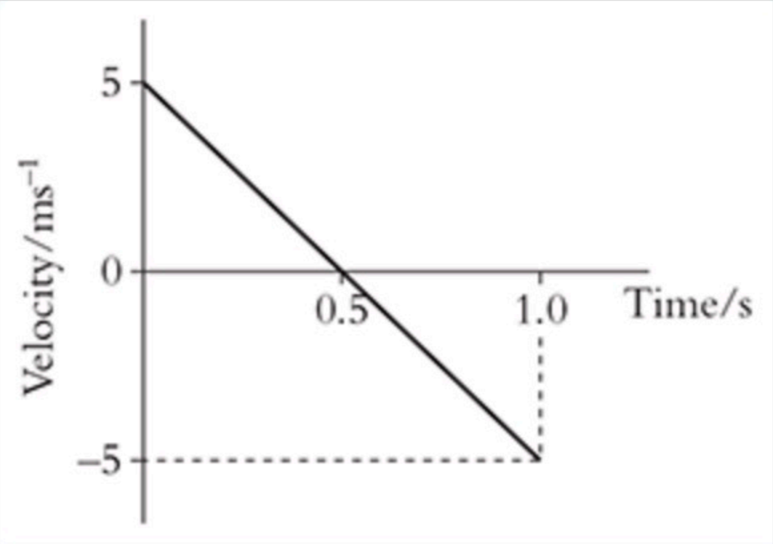

Figure 1.10

a Show on the graph where the ball has reached its highest point. **[1]**

b Use the graph to determine how high the ball reaches. **[2]**

c Explain how the graph shows that the overall displacement of the ball is zero. **[2]**

16

12 A firework rocket shoots vertically from the ground with a constant acceleration of 20 ms^{-2} for 3.0 s, after which the rocket stops burning its fuel. The rocket continues upwards until it reaches its maximum height and then falls back to the ground. Assume there are no effects due to air friction and use g = 9.81 ms^{-2}.

a Sketch a velocity–time graph for the rocket's journey. (It is not necessary to include any values on the axes of your graph; only the shape is required.) **[1]**

b Calculate the maximum height reached by the rocket. **[2]**

c Calculate the total flght time of the rocket. **[2]**

13 A projectile is launched horizontally at a speed of 40 ms^{-1} from the top of a hill, 50 m above the ground. Ignoring the effects of air friction, and using g = 9.81 ms^{-2}, calculate the:

a time it takes for the projectile to hit the ground, **[1]**

b horizontal distance from the hill that the projectile travels, **[1]**

c **total** velocity vector of the projectile **just before** it hits the ground. **[3]**

14 Figure 1.11 shows a velocity–time graph for a moving object.

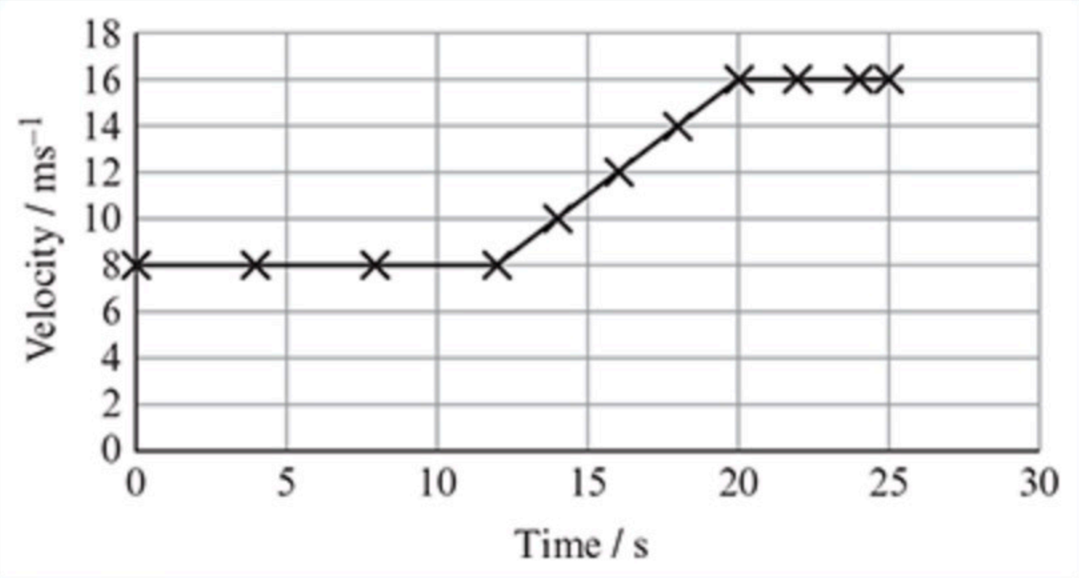

Figure 1.11

a Determine the acceleration of the object between t = 12 s and t = 20 s **[1]**

b Determine the total displacement of the object during its 25 s journey. **[2]**

c Use your answer to part **b** to determine the average velocity of the object. **[1]**

15 Figure 1.12 shows how the displacement of an object varies with time.

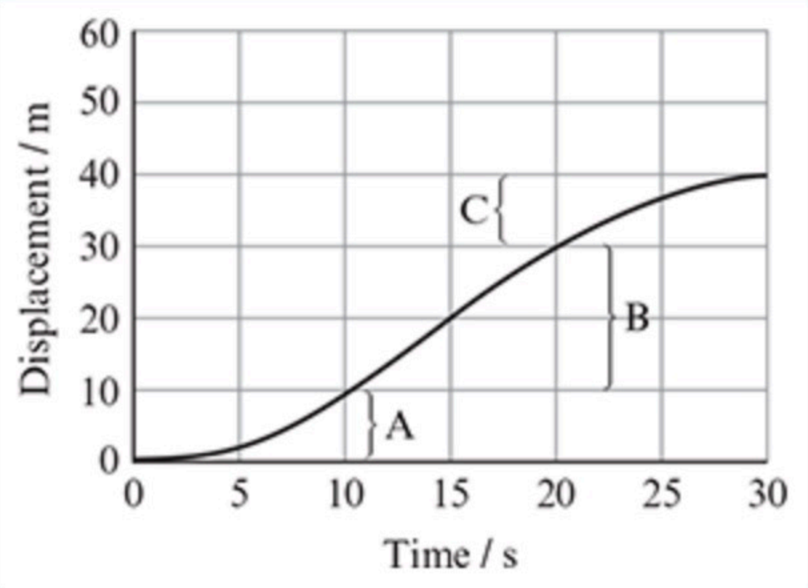

Figure 1.12

a Describe how the velocity of the object is varying during each of the labelled sections of the graph, A, B and C. **[3]**

b Estimate the velocity of the object during the section of the graph labelled B. **[1]**

c Calculate the average velocity of the object during its 30 s journey. **[1]**

16 Figure 1.13 shows how the velocity of a wandering wild elephant varies with time.

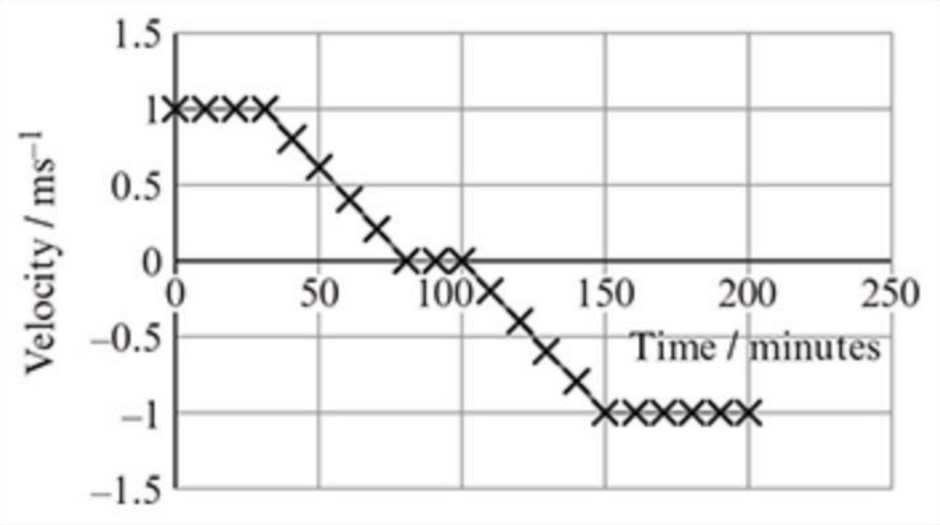

Figure 1.13

Use the graph to:

a Estimate the acceleration (in ms^{-2}) of the elephant during the period 30 minutes to 80 minutes. **[2]**

b Determine the total displacement (in metres) of the elephant during the 200 minute journey. **[2]**

c Determine the average velocity (in ms^{-1}) of the elephant for the whole journey. **[1]**

17 Figure 1.14 shows how the acceleration of an initially stationary object varies with time.

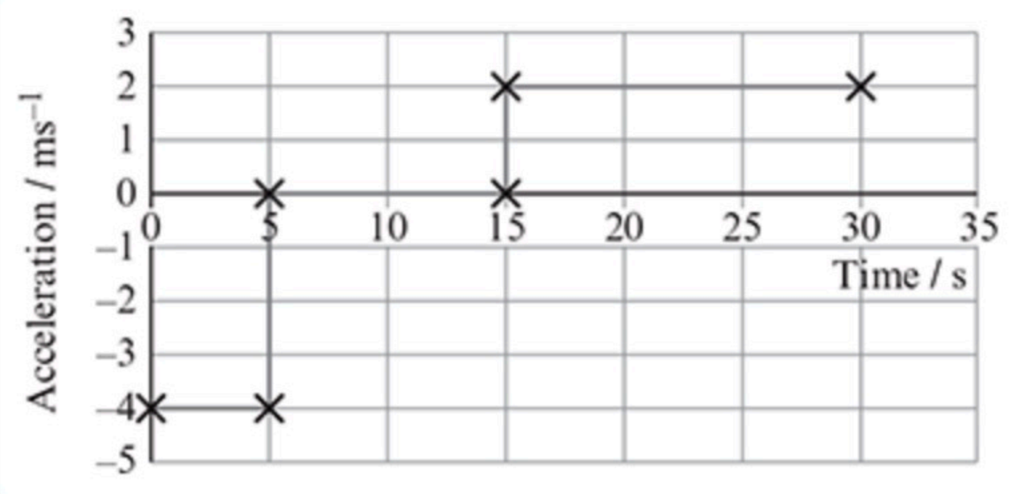

Figure 1.14

a Calculate how far the object moved in the first 5 s. **[1]**

b Draw a graph of *velocity of the object* against *time*. **[2]**

c Use your graph to determine the total displacement of the object during the 30 s journey. **[2]**

18 Figure 1.15 shows the graph of velocity against time for a moving object.

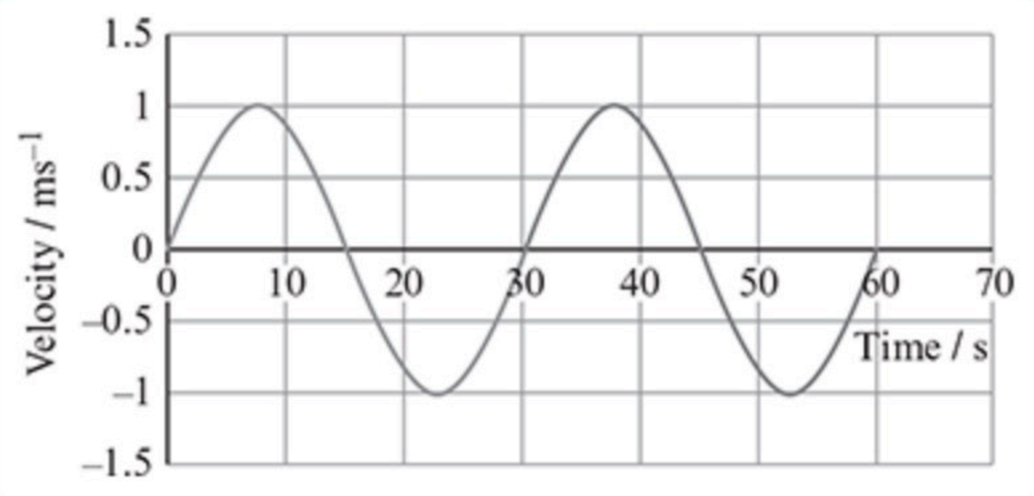

Figure 1.15

a Estimate the maximum acceleration of the object. **[2]**

b State the total displacement of the object during the 60 s period. **[1]**

c Describe the way in which the object is moving. **[1]**