Motion and Kinematic Quantities (MCQ Only)

Q1.

Which of the following quantities is a vector?

☒ **A** charge

☒ **B** mass

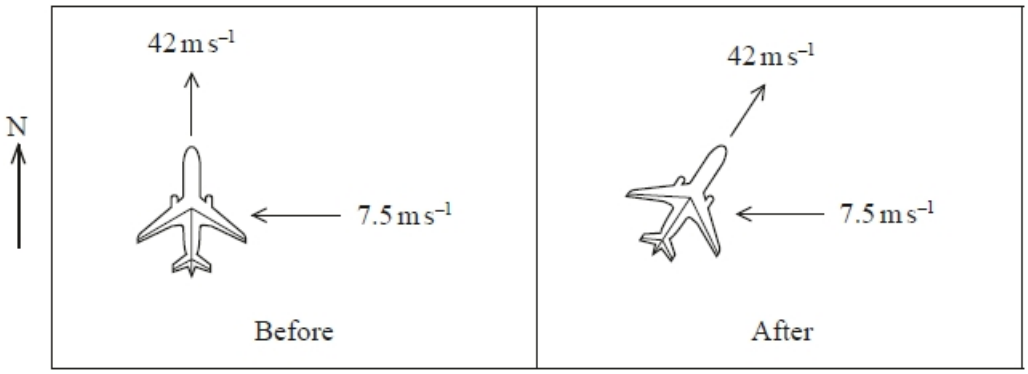
☒ **C** momentum

☒ **D** time

(Total for question = 1 mark)

Q2.

A plane is travelling north at 42 m s^{-1}. It enters a region with a wind blowing from the east at 7.5 m s^{-1}. To keep travelling north, the plane turns towards the east, without changing the thrust, as shown.



Which of the following could be used to calculate the angle through which the plane turns?

☒ **A** $\cos^{-1}\left(\frac{42}{7.5}\right)$

☒ **B** $\sin^{-1}\left(\frac{7.5}{42}\right)$

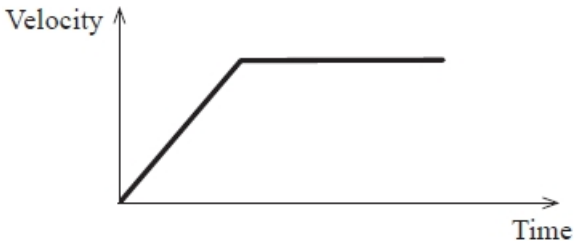
☒ **C** $\tan^{-1}\left(\frac{7.5}{42}\right)$

☒ **D** $\tan^{-1}\left(\frac{42}{7.5}\right)$

(Total for question = 1 mark)

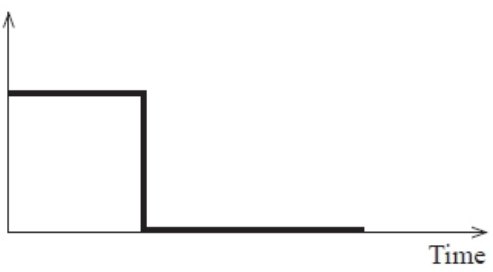
Q3.

The graph shows how the velocity varies with time for an object.

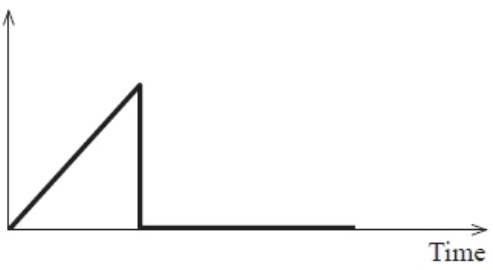


Which of the following graphs shows how the displacement varies with time for this object?

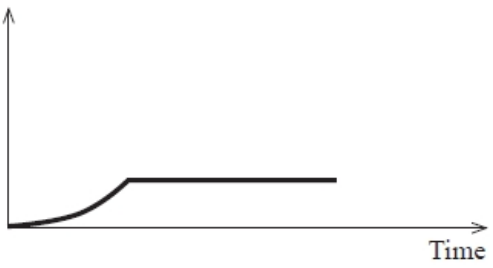
☒ **A**



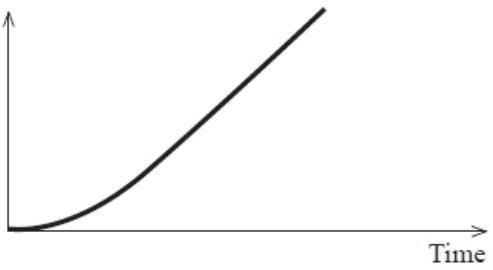
☒ **B**



☒ **C**



☒ **D**



(Total for question = 1 mark)

Q4.

A ball is kicked, giving it an initial velocity *v* at an angle of 35° to the vertical. The ball remains in the air for a time *t*.

Which of the following gives the distance travelled over the ground?

(1)

☒ **A** $vt\cos 35°$

☒ **B** $\frac{v\cos 35°}{t}$

☒ **C** $vt\sin 35°$

☒ **D** $\frac{v\sin 35°}{t}$

(Total for question = 1 mark)

Q5.

Which of the following is a scalar quantity?

☒ **A** displacement

☒ **B** force

☒ **C** weight

☒ **D** work

(Total for question = 1 mark)

Q6.

A ball is thrown with an initial horizontal component of velocity *u* and an initial vertical component of velocity *v*. The effects of air resistance are negligible.

Which of the following statements about the motion of the ball is **not** correct?

☒ **A** The magnitude of the acceleration in the vertical plane is *g*.

☒ **B** The horizontal component of velocity is constant.

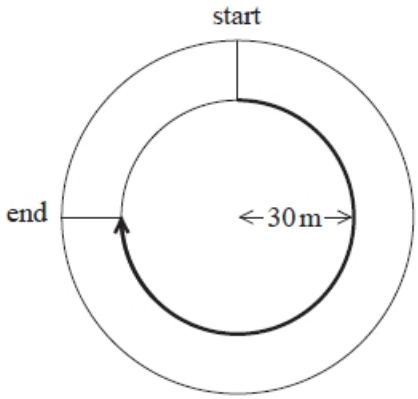
☒ **C** The time taken for the ball to reach its maximum height is equal to $\frac{v}{g}$.

☒ **D** The maximum height of the ball depends on the values of *u* and *v*.

(Total for question = 1 mark)

Q7.

An athlete runs a race around three quarters of a circular track of radius 30 m using the inside lane.



What is the magnitude of the displacement of the athlete at the end of the race?

- ☒ **A** 141 m
- ☒ **B** 47 m
- ☒ **C** 42 m
- ☒ **D** 30 m

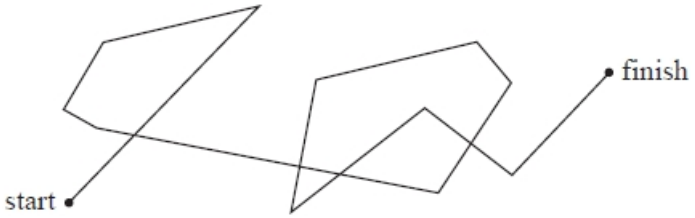
(Total for question = 1 mark)

Q8.

The diagram shows the path of a pollen particle on the surface of water as it is hit by water molecules.

Scale

1 cm : 0.5 mm



Which of the following is the magnitude of the displacement of the pollen particle in mm?

- ☒ **A** 260
- ☒ **B** 80
- ☒ **C** 13
- ☒ **D** 4

(Total for question = 1 mark)

Q9.

Which of the following can be used to determine the magnitude of velocity?

(1)

☒ **A** area under an acceleration-time graph

☒ **B** area under a velocity-time graph

☒ **C** gradient of an acceleration-time graph

☒ **D** gradient of a velocity-time graph

(Total for question = 1 mark)

Q10.

A student carried out an experiment to measure the acceleration of free fall *g*.

The student recorded the time taken for an object to fall from rest through a measured height.

Which equation would enable the student to obtain a value for g without any additional measurements or calculations?

☒ **A** $a = \frac{v - u}{t}$

☒ **B** $s = ut + \frac{1}{2}at^2$

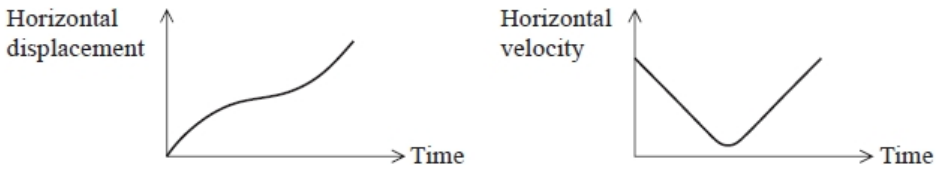
☒ **C** $s = \frac{(v + u)t}{2}$

☒ **D** $v^2 = u^2 + 2as$

(Total for question = 1 mark)

Q11.

The graphs shown represent the displacement-time and velocity-time graphs for the horizontal component of the motion of a ball.



Which of the following situations could produce this motion of the ball?

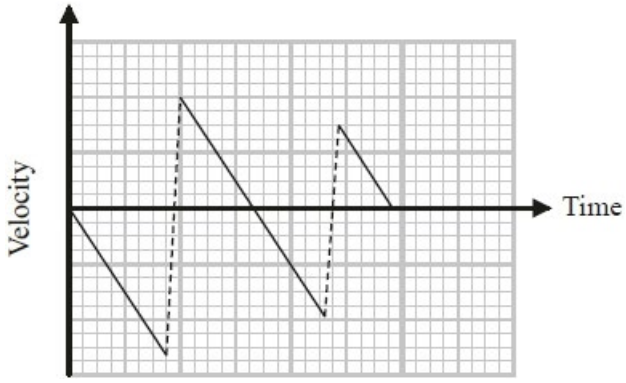
(1)

☒ **A** Rolling down one ramp and then rolling up a second ramp.
☒ **B** Rolling down a ramp then along the floor.
☒ **C** Rolling up one ramp and down a second ramp.
☒ **D** Rolling up a ramp and rolling back down the same ramp.

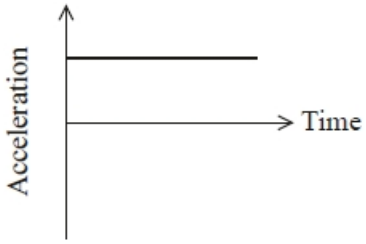
(Total for question = 1 mark)

Q12.

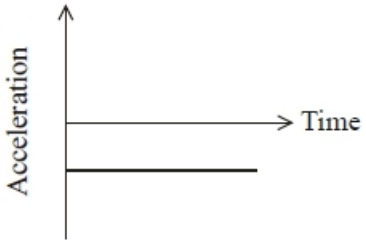
A ball is dropped vertically onto a horizontal surface and bounces twice before being caught. The graph shows how the velocity of the ball varies with time for the motion of the ball.



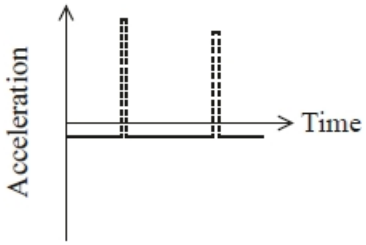
Which of the following is the acceleration-time graph for the motion of the ball?



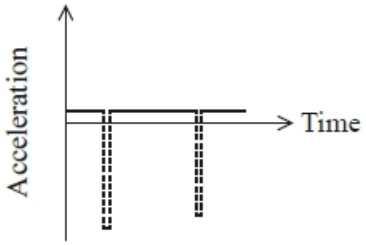
☐ **A**



☐ **B**



☐ **C**



☐ **D**

(Total for question = 1 mark)

Q13.

Which of the following is an example of a scalar quantity?

- ☒ **A** displacement
- ☒ **B** energy
- ☒ **C** momentum
- ☒ **D** velocity

(Total for question = 1 mark)

Q14.

The winner of a 400m race must have the greatest

(1)

- ☒ **A** acceleration.
- ☒ **B** average speed.
- ☒ **C** instantaneous speed.
- ☒ **D** maximum speed.

(Total for question = 1 mark)

Q15.

Which of the following is a vector quantity?

- ☒ **A** kinetic energy
- ☒ **B** momentum
- ☒ **C** time
- ☒ **D** work done

(Total for question = 1 mark)

Q16.

Which of the following is **not** a vector quantity?

(1)

- ☒ **A** acceleration
- ☒ **B** distance
- ☒ **C** momentum
- ☒ **D** velocity

(Total for question = 1 mark)

Q17.

A pilot wishes to fly due east. A wind is blowing in a northerly direction.

The direction of north is as shown.

Which of the following correctly shows the direction the plane should point?

(1)

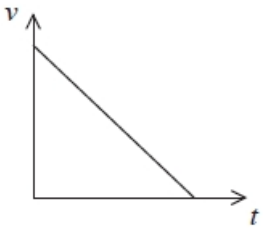
☒ **A** ☒ **B** ☒ **C** ☒ **D**

(Total for question = 1 mark)

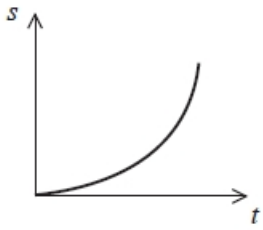
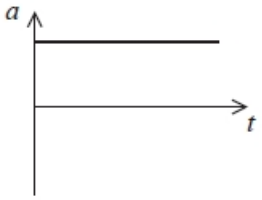
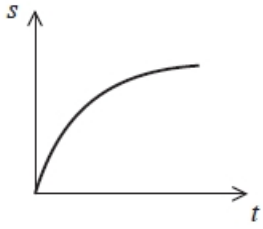
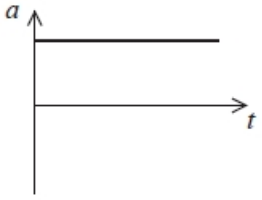
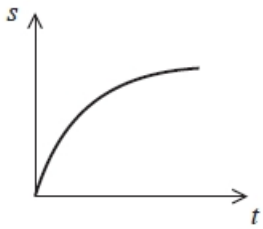
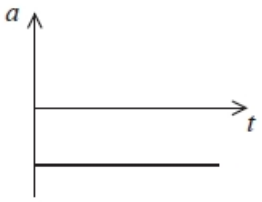
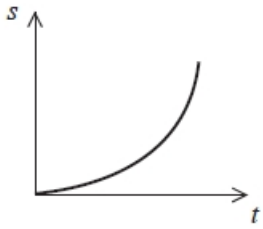
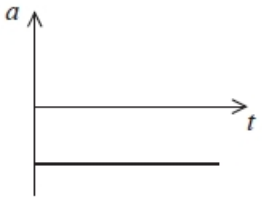
Q18.

A ball is rolled along a horizontal surface. Frictional forces slow the ball to rest.

The velocity-time graph for the ball is shown.



Select the row of the table that correctly gives the corresponding displacement-time and acceleration-time graphs for the ball.

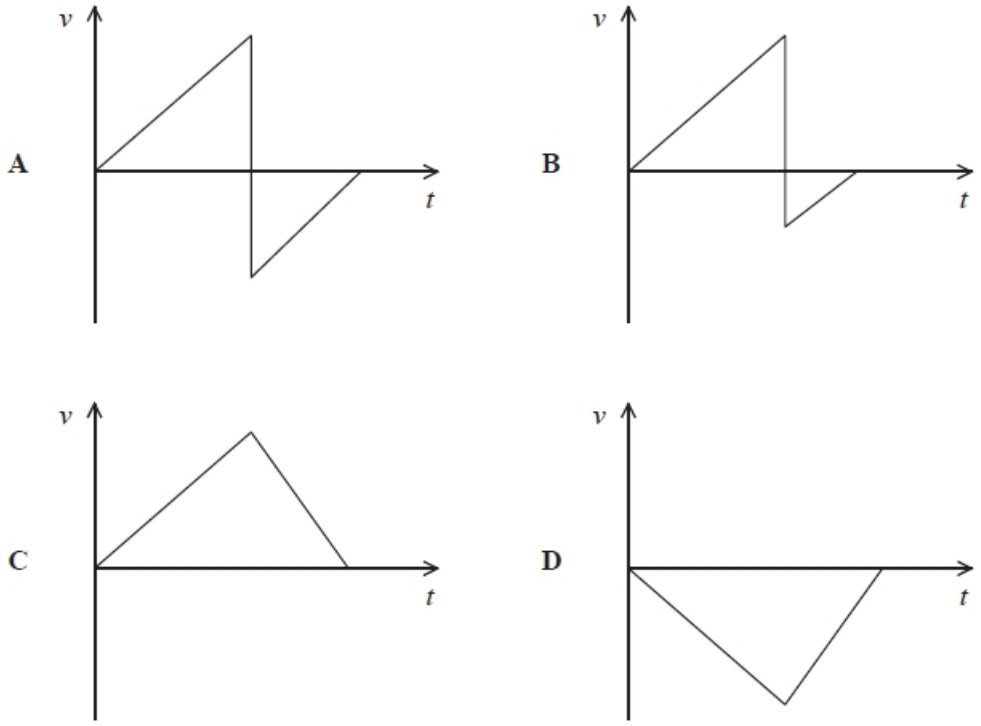
	Displacement-time graph	Acceleration-time graph
☐ A		
☐ B		
☐ C		
☐ D		

(Total for question = 1 mark)

Q19.

A ball was dropped from rest, from a height above the ground. The ball bounced back up to about half its initial height.

Which graph shows how the velocity *v* of the ball varied with time *t* ?



☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Mark Scheme – Motion and Kinematic Quantities

Q1.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is C *A is not correct because charge is a scalar quantity* *B is not correct because mass is a scalar quantity* *D is not correct because time is a scalar quantity*		**1**

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
	B		**1**

Q3.

Question Number	Answer	Mark
	D	**1**
	Incorrect Answers: **A** – both sections of graph incorrect **B** – both sections of graph incorrect **C** – second section of graph incorrect	

Q4.

Question Number	Answer	Mark
	C $vt \sin 35°$	**1**
	Incorrect Answers: A – correct formula but initial vertical velocity and not horizontal velocity used B – incorrect formula used with initial vertical velocity D – incorrect formula used with initial horizontal velocity	

Q5.

Question Number	Acceptable Answer	Additional Guidance	Mark
	D		**1**

Q6.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is D *A is not correct because the acceleration in the vertical plane is g* *B is not correct because the horizontal component of velocity is constant* *C is not correct because of $v = 0 - at$ gives $t = v / g$*		**1**

Q7.

Question Number	Answer	Mark
	C 42 m	**1**
	Incorrect Answers: A – 141 m is ¾ of the internal circumference of the track ($¾ \times 2 \times \pi \times 30 =$ 141 m) B – 141 m is ¼ of the internal circumference of the track ($¼ \times 2 \times \pi \times 30 =$ 47 m) D – 30 m (the radius) is the displacement travelled in one direction (downwards from the start position)	

Q8.

Question Number	Answer	Mark
	D 4 mm	**1**
	Incorrect Answers: A – distance has been measured and has not been scaled. B – the displacement has not been scaled C – distance has been used	

Q9.

Question Number	Answer	Mark
	A area under an acceleration-time graph	**1**
	Incorrect Answers: B – this is equivalent to the displacement C – this is equivalent to the rate of change of acceleration D – this is equivalent to the acceleration	

Q10.

Question Number	Answers	Additional Guidance	Mark
	B	$s = ut + \frac{1}{2}at^2$	**(1)**

Q11.

Question Number	Acceptable Answer	Additional Guidance	Mark
	C Rolling up one ramp and down a second ramp.		**1**

Q12.

Question Number	Acceptable answers	Additional guidance	Mark
	C		**1**

Q13.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is B **energy**	A,C,D are vectors	**1**

Q14.

Question Number	Acceptable Answer	Additional Guidance	Mark
	B Average speed		**1**

Q15.

Question Number	Answer	Mark
	B momentum	**1**
	Incorrect Answers: **A** – scalar quantity **C** – scalar quantity **D** – scalar quantity	

Q16.

Question Number	Answer	Mark
	B distance	**1**
	Incorrect Answers: A – acceleration is a vector quantity C – momentum is a vector quantity D – velocity is a vector quantity	

Q17.

Question Number	Acceptable Answer	Additional Guidance	Mark
	D		**1**

Q18.

Question Number	Answer	Mark
	C	**1**

Q19.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is A B is not correct as the rebound velocity wil be about $0.7 \times v_{\text{initial}}$ C is not correct as the velocity must switch sign on rebound D is not correct as the velocity must switch sign on rebound		**1**