EDITION # 07

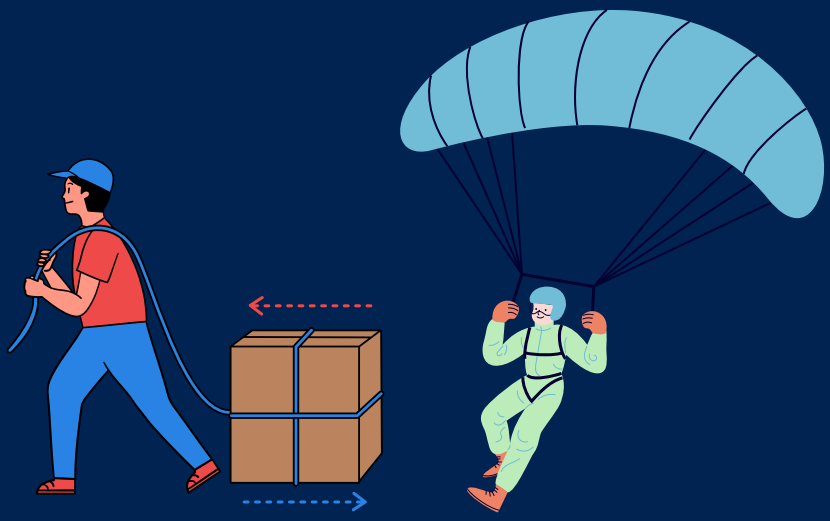
MAY 2025

EDEXCEL IAL PHYSICS

UNIT 1 - MECHANICS

Topical Past Paper MCQs

(compiled by Sir Muhammad Abdullah Shah)



WHAT'S INSIDE

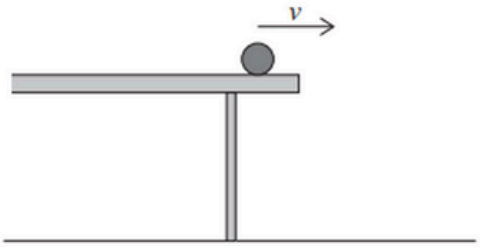
- 6 Years of Past Papers: The complete collection (2019–2025).
- Sorted by Topic: Don't just practice—master one concept at a time
- Sample Assessment Papers: Includes the "hidden" questions often missed in standard revision.
- Exam-Ready: 140+ carefully curated questions to boost your grade.

EXAM PREP ARENA
HUB OF EXAM PREPARATION

1.3.1 (Equations for uniformly accelerated motion)

1. **May 2025, Q3**

The diagram shows a ball of mass m moving at speed v along a horizontal table.



The ball leaves the table. The time taken between the ball leaving the table and landing on the floor is t.
A second ball of mass 2m moves at speed 2v along the table.
Which of the following gives the time taken between the second ball leaving the table and landing on the floor?

- ☒ **A** $2t$
- ☒ **B** t
- ☒ **C** $\frac{t}{2}$
- ☒ **D** $\frac{t}{4}$

(Total for Question 3 = 1 mark)

2. **May 2023, Q7**

A car travels with a velocity of $3ms^{-1}$. The car accelerates uniformly in a straight line for a distance of 15m. The final velocity of the car is $5ms^{-1}$.

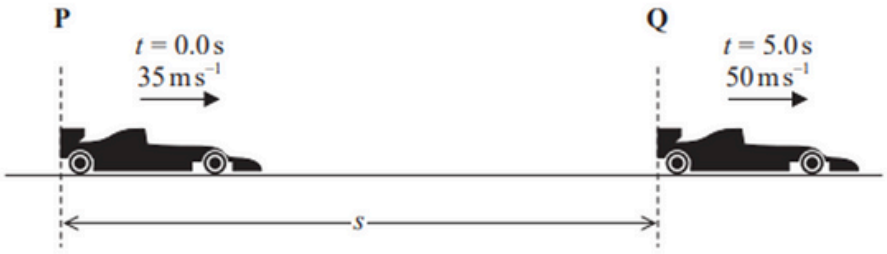
Which of the following expressions gives the acceleration of the car in ms^{-2}?

- ☒ **A** $\frac{5-3}{15}$
- ☒ **B** $\frac{5-3}{2\times 15}$
- ☒ **C** $\frac{5^2-3^2}{15}$
- ☒ **D** $\frac{5^2-3^2}{2\times 15}$

(Total for Question 7 = 1 mark)

3. **Jan 2023, Q5**

A racing car passes point P at a speed of $35ms^{-1}$.
The car accelerates uniformly and after 5.0s passes point Q at a speed of $50ms^{-1}$, as shown.



Which of the following expressions gives the distance s, in metres, between the two points?

- ☒ **A** $\frac{50^2-35^2}{2\times 5}$
- ☒ **B** $(35 \times 5) + (0.5 \times 9.81 \times 5^2)$
- ☒ **C** $0.5 \times (35 + 50) \times 5$
- ☒ **D** $35 + (9.81 \times 5)$

(Total for Question 5 = 1 mark)

4. **Jan 2022, Q5**

An object on the Moon falls a vertical distance of 0.32m, from rest, in a time of 0.63 s.
Which of the following expressions gives the acceleration due to gravity on the Moon in ms^{-2}?

- ☒ **A** $\frac{0.32}{2\times0.63}$
- ☒ **B** $\frac{0.32}{2\times0.63^2}$
- ☒ **C** $\frac{2\times0.32}{0.63^2}$
- ☒ **D** $\frac{2\times0.32}{0.63}$

(Total for Question 5 = 1 mark)

5. **Oct 2021, Q7**

A ball bearing falls vertically from rest through a distance of 50cm in a time of 0.32s.

Which expression gives the acceleration of the ball bearing in ms^{-2}?

- ☒ **A** $1 \div 0.32^2$
- ☒ **B** $0.5 \div 0.3^2$
- ☒ **C** $100 \div 0.32^2$
- ☒ **D** $50 \div 0.32$

(Total for Question 7 = 1 mark)

6. **Jan 2021, Q1**

A car is moving towards a stop sign at a speed of $25ms^{-1}$. The driver applies the brakes 20m before the sign and decelerates uniformly to rest just before the sign.

Which of the following gives the magnitude of the car's deceleration in ms^{-2}?

- ☒ A $\frac{25}{40}$
- ☒ B $\frac{25}{20}$
- ☒ C $\frac{25^2}{40}$
- ☒ D $\frac{25^2}{20}$

(Total for Question 1 = 1 mark)

7. **Jan 2020, Q6**

A ball is travelling horizontally at a speed of $7.0ms^{-1}$. The ball hits a vertical wall and rebounds along its initial path at a speed of $5.0ms^{-1}$.
The ball has an acceleration of $300ms^{-2}$ while in contact with the wall.
Which of the following expressions gives the time of contact t between the ball and the wall?

- ☒ A $t = \frac{-5-7}{-300}$
- ☒ B $t = \frac{5-7}{-300}$
- ☒ C $t = \frac{-5-7}{300}$
- ☒ D $t = \frac{5-7}{300}$

(Total for Question 6 = 1 mark)

8. **Oct 2019, Q9**

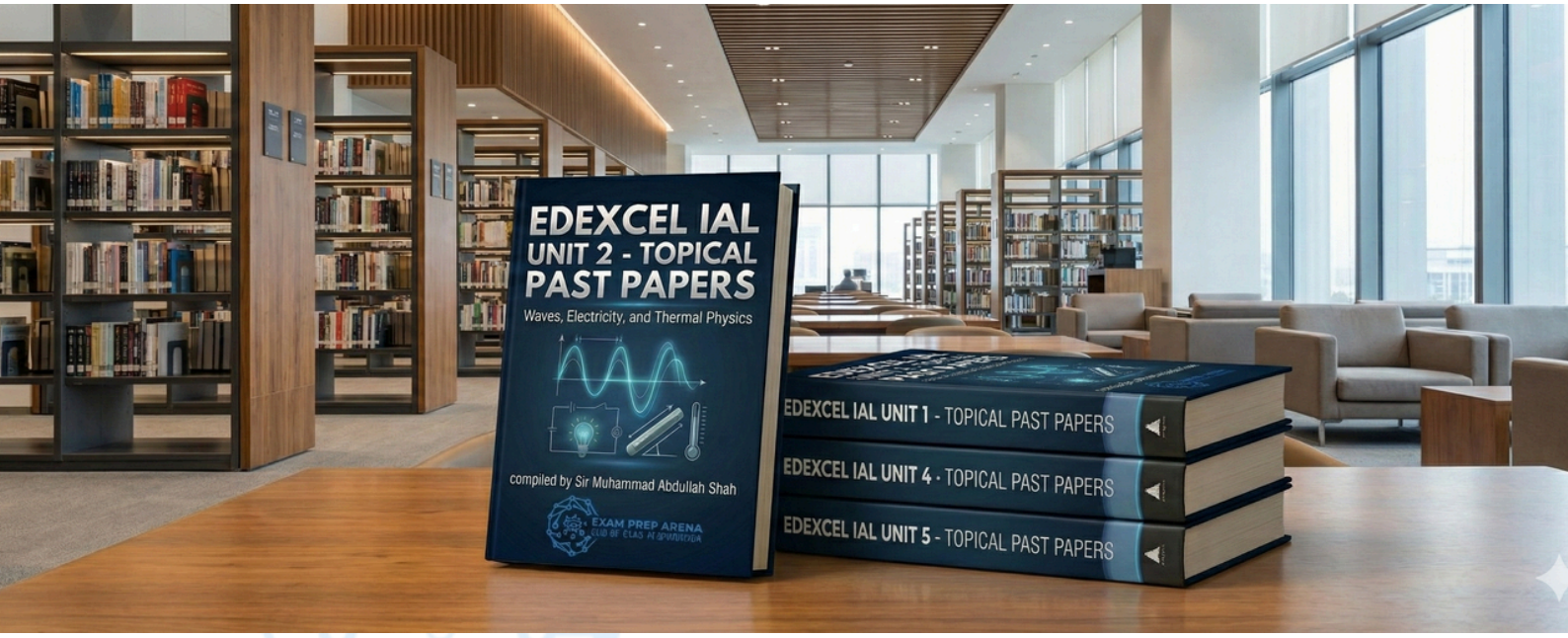
A student used a falling sphere to determine the acceleration of free fall.
A camera produced images of the sphere at constant time intervals as it fell.
The positions of the sphere in the first two images are shown. Image 1 shows the sphere's position at the instant it was released.

- Image 1
- Image 2
- P
- Q
- R
- S

Which of the positions P, Q, R or S will the sphere be at in Image 3?

- **A** P
- **B** Q
- **C** R
- **D** S

(Total for Question 9 = 1 mark)



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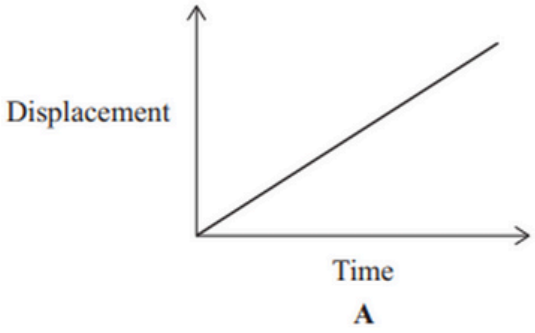
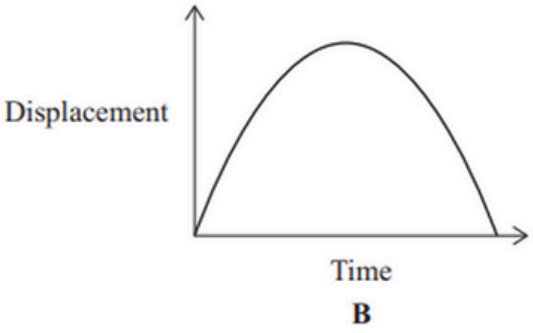
1.3.2 (Drawing and interpreting motion graphs)

10. **May 2025, Q6**

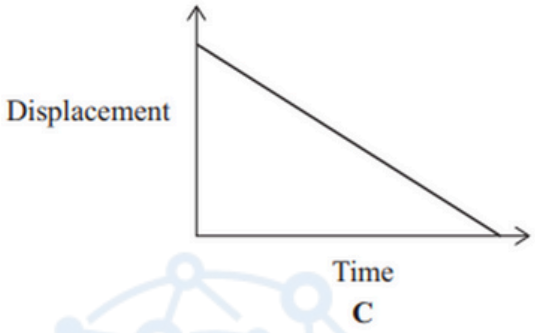
An object has a constant non-zero acceleration.
Which of the following displacement-time graphs could represent the motion of the object?



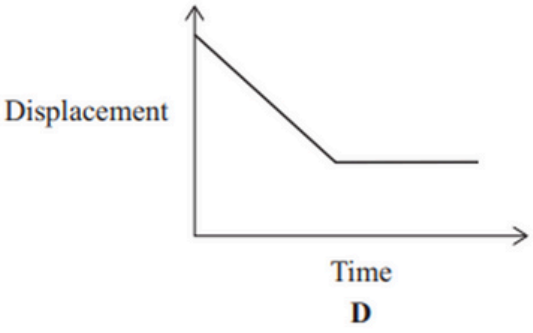
A



B



C



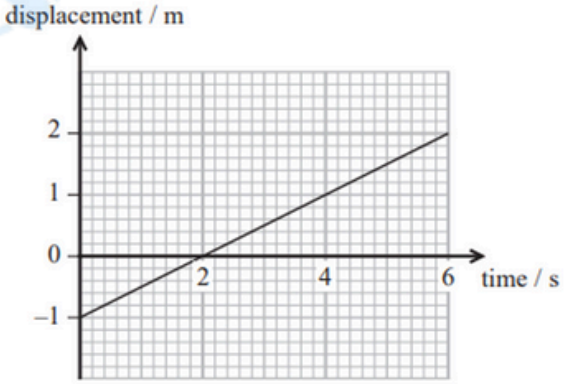
D

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 6 = 1 mark)

11. **Jan 2022, Q1**

A student walks for 6 seconds. The displacement-time graph for the student is shown.



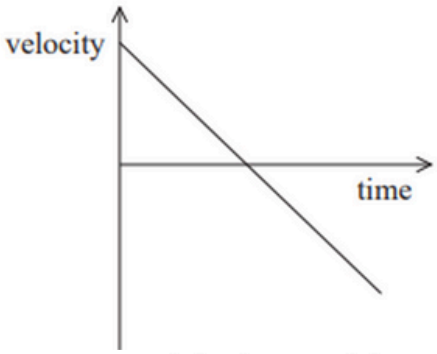
Which row of the table shows the final displacement and velocity of the student?

	Displacement / m	Velocity / m s^{-1}
☐ **A**	2.0	0.5
☐ **B**	3.0	0.5
☐ **C**	5.0	2.0
☐ **D**	3.0	2.0

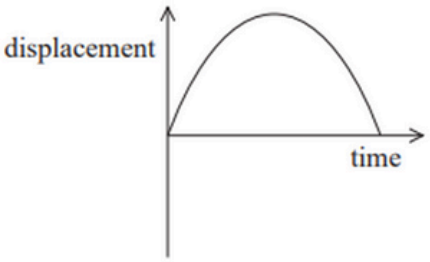
(Total for Question 1 = 1 mark)

12. **Jan 2022, Q3**

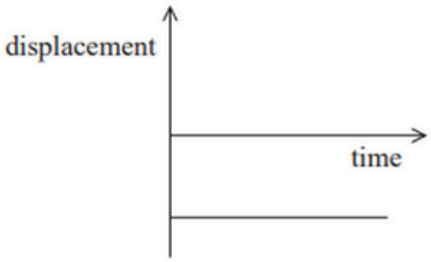
The velocity-time graph for a particle is shown.



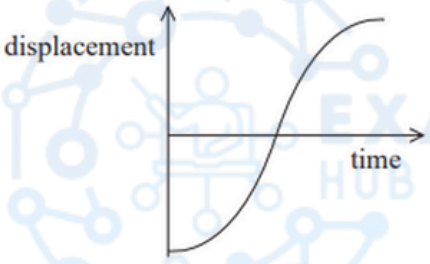
Which of the following is the displacement-time graph for this particle?



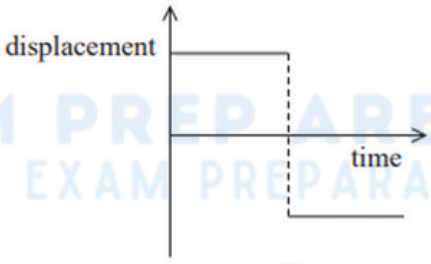
A



B



C



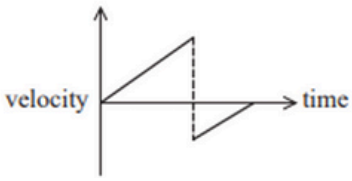
D

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 3 = 1 mark)

Questions 13 and 14 refer to the information below.

The velocity-time graph for the motion of a ball is shown.



13. **Oct 2020 (May), Q9**

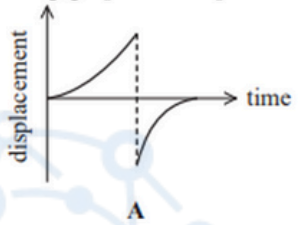
Which of the following correctly describes the motion of the ball?

- ☐ **A** The ball is dropped and rebounds to its original position.
- ☐ **B** The ball is dropped and rebounds to a lower position.
- ☐ **C** The ball is thrown upwards and is caught at its original position.
- ☐ **D** The ball is thrown upwards and is caught at a higher position.

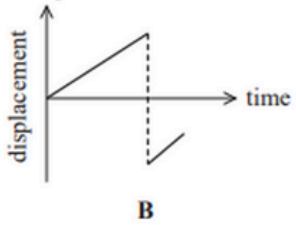
(Total for Question 9 = 1 mark)

14. **Oct 2020 (May), Q10**

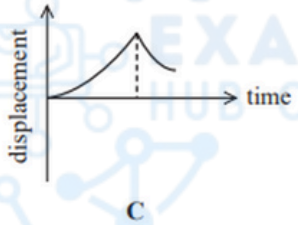
Which of the following graphs of displacement against time could represent the motion of the ball?



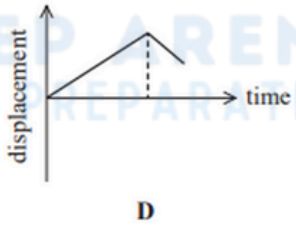
A



B



C



D

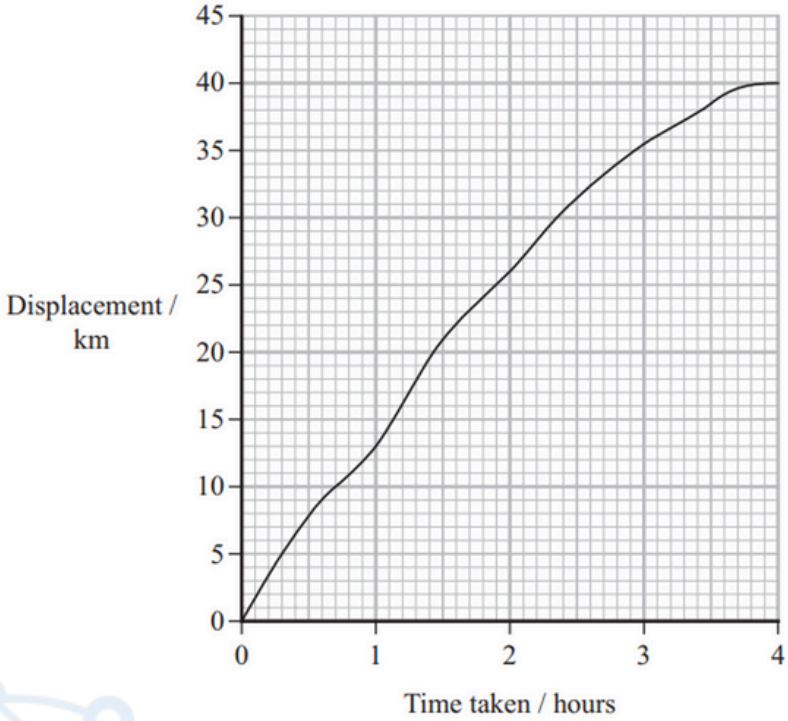
- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

(Total for Question 10 = 1 mark)

1.3.3 (Quantities from slopes and areas of motion graphs)

15. **Oct 2024, Q3**

The displacement-time graph for a person running a race is shown



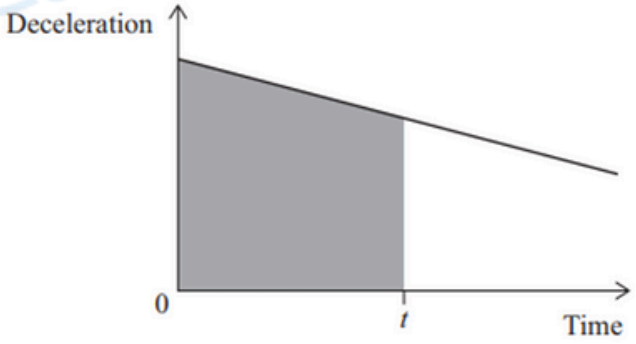
Which of the following gives the average velocity of the person?

- ☒ **A** area between the curve and the x-axis from 0 hours to 4 hours
- ☒ **B** gradient of a tangent to the curve at 4 hours
- ☒ **C** gradient of a tangent to the curve at 2 hours
- ☒ **D** displacement at 4 hours divided by a time of 4 hours

(Total for Question 3 = 1 mark)

16. **Jan 2025, Q5**

An aeroplane lands on a runway at time 0 and then decelerates.
The graph shows how the deceleration of the aeroplane varies with time.



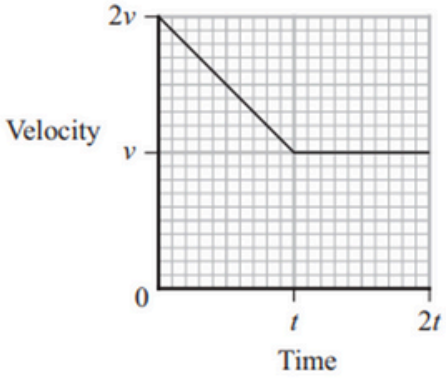
Which of the following does the shaded area on the graph represent?

- ☒ **A** The displacement of the aeroplane at time t.
- ☒ **B** The change in displacement of the aeroplane during time t.
- ☒ **C** The velocity of the aeroplane at time t.
- ☒ **D** The change in velocity of the aeroplane during time t.

(Total for Question 5 = 1 mark)

17. **Jan 2025, Q8**

The velocity-time graph for a train journey is shown.



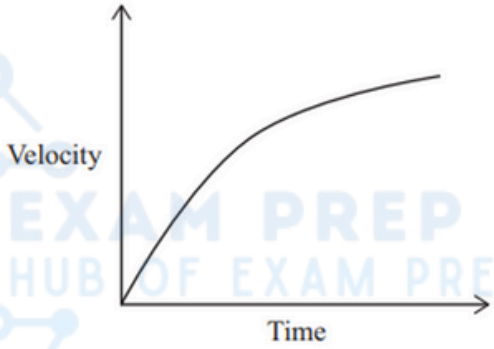
Which of the following expressions gives the distance travelled by the train in time 2t ?

☒ **A** $4vt$
☒ **B** $5vt$
☒ **C** $\frac{3vt}{2}$
☒ **D** $\frac{5vt}{2}$

(Total for Ouestion 8 = 1 mark)

18. **MAY 2024, Q2**

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



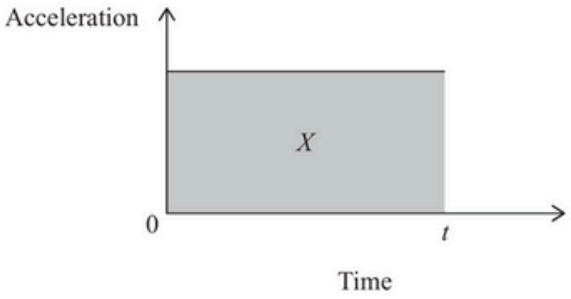
Which of the following describes the motion of the object?

☒ **A** constant acceleration
☒ **B** constant displacement
☒ **C** decreasing acceleration
☒ **D** decreasing displacement

(Total for Question 2 = 1 mark)

19. **Jan 2024, Q10**

An object moves from rest with uniform acceleration for time t.
The acceleration-time graph for the object is shown.
X is the area under the graph between time 0 and time t.



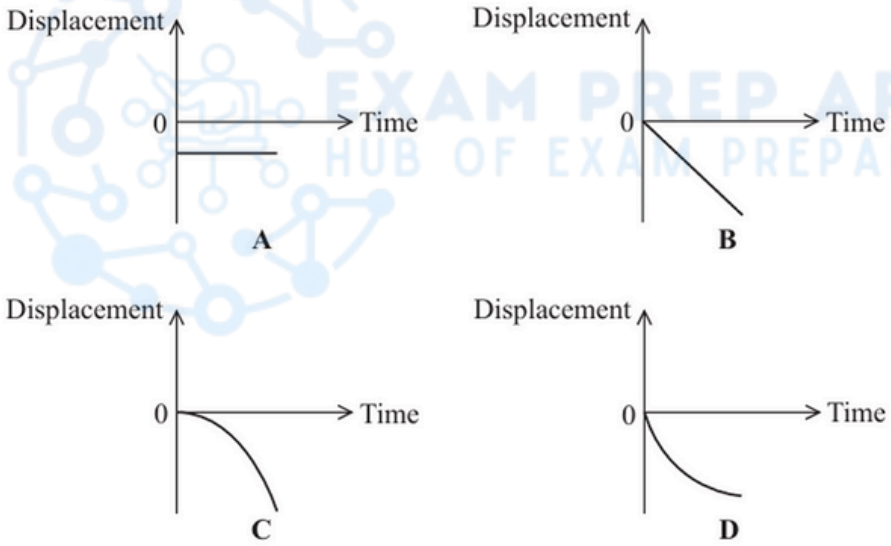
Which of the following expressions gives the distance moved by the object?

- ☒ **A** X
- ☒ **B** $\frac{X}{2}$
- ☒ **C** Xt
- ☒ **D** $\frac{Xt}{2}$

(Total for Question 10 = 1 mark)

20. **Oct 2023, Q4**

A ball falls through air from rest.
Which of the following shows the graph of displacement against time for the ball?



- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 4 = 1 mark)

21. **Oct 2022, Q1**

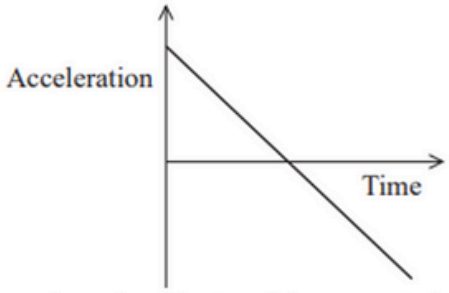
Which of the following quantities is given by the area under a velocity-time graph?

- ☒ **A** acceleration
- ☒ **B** displacement
- ☒ **C** speed
- ☒ **D** time taken

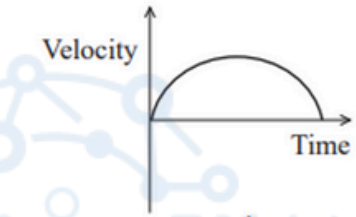
(Total for Question 1 = 1 mark)

22. **Oct 2022, Q4**

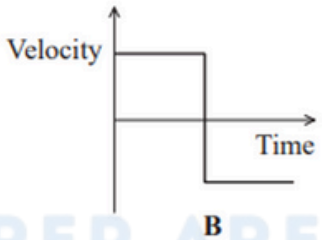
A car accelerated along a straight road. The graph shows how the acceleration of the car varied with time.



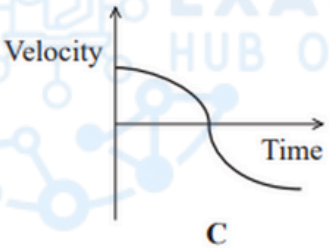
Which of the following graphs shows how the velocity of the car varied with time over the same time interval?



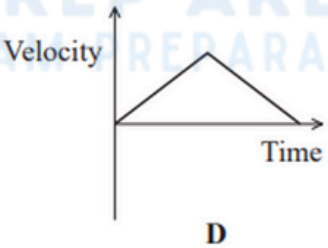
A



B



C



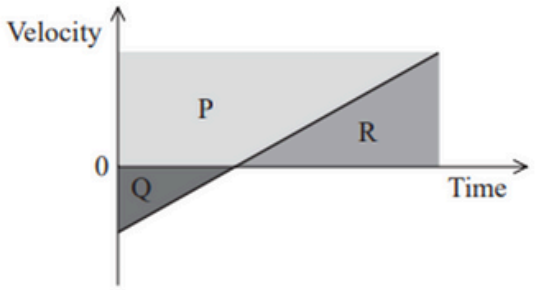
D

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

(Total for Question 4 = 1 mark)

23. **May 2022, Q8**

The velocity-time graph shows the motion of a particle with a constant acceleration. P, Q and R represent the magnitudes of each area shown.



Which of the following expressions gives the total displacement of the particle?

☒ **A** P + Q

☒ **B** P + Q – R

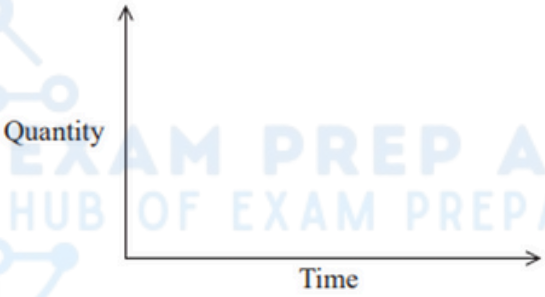
☒ **C** R + Q

☒ **D** R – Q

(Total for Question 8 = 1 mark)

24. **Oct 2021, Q1**

Graphs can be used to represent the motion of an object.



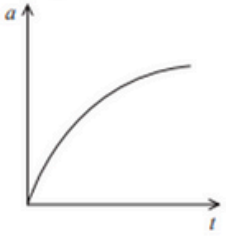
Which row in the table gives a quantity plotted on the y-axis and the corresponding quantity represented by the gradient of the graph?

		Quantity plotted on *y*-axis	Gradient of graph
☒	**A**	displacement	acceleration
☒	**B**	velocity	acceleration
☒	**C**	acceleration	velocity
☒	**D**	acceleration	displacement

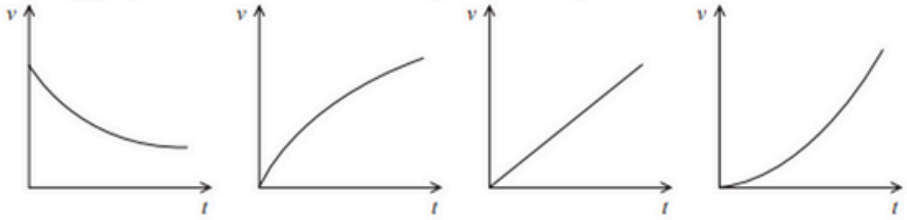
(Total for Question 1 = 1 mark)

25. **Jan 2021, Q3**

The graph shows how the acceleration a of an object varies with time t.



Which of the following graphs shows how the velocity v of the object varies with t?

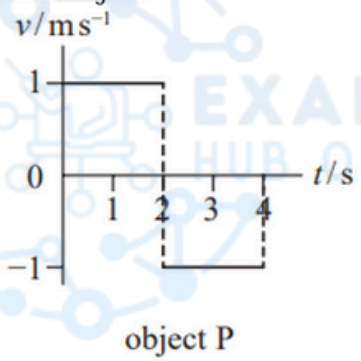


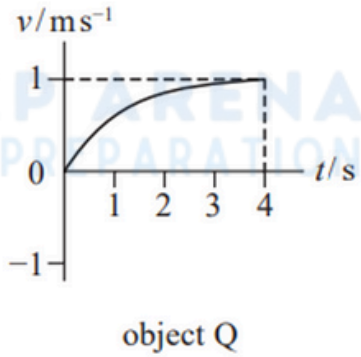
- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

(Total for Question 3 = 1 mark)

26. **Jan 2020, Q5**

Two objects P and Q are at the same position at time t = 0s. The graphs show how the velocity v varies with time t for each object.





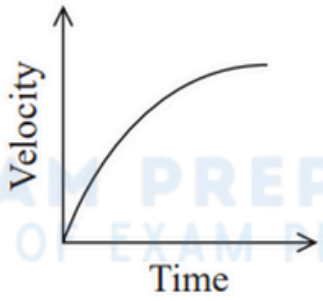
Which of the following statements describes the positions of P and Q at t = 4s?

- ☐ **A** P and Q are both at the initial position.
- ☐ **B** P and Q are the same distance from the initial position.
- ☐ **C** P is further from the initial position than Q.
- ☐ **D** Q is further from the initial position than P.

(Total for Question 5 = 1 mark)

27. **Jan 2020, Q10**

Some students were shown a velocity-time graph for the motion of an object falling through a liquid.



The students suggested possible explanations for the decrease in gradient of the graph.
Which explanation could be a reason for the gradient of the graph decreasing?

- **A** The drag force increases.
- **B** The gravitational force increases.
- **C** The temperature of the liquid increases.
- **D** The upthrust on the object decreases.

(Total for Question 10 = 1 mark)

1.3.4 (Scalar and vector quantities)

28. **Oct 2024, Q2**

Which row of the table gives two vector quantities?

☐	**A**	acceleration	weight
☐	**B**	displacement	kinetic energy
☐	**C**	strain	velocity
☐	**D**	Young modulus	mass

(Total for Question 2 = 1 mark)

29. **Jan 2025, Q3**

A physical quantity can be either a scalar or a vector.
Which row of the table is correct for acceleration and work done?

		Acceleration	**Work done**
☐	**A**	scalar	scalar
☐	**B**	scalar	vector
☐	**C**	vector	scalar
☐	**D**	vector	vector

(Total for Question 3 = 1 mark)

30. **MAY 2024, Q4**

Which of the following expressions gives a vector quantity?

☐ **A** density × volume

☐ **B** force × distance moved in direction of force

☐ **C** mass × velocity

☐ **D** power × time

(Total for Question 4 = 1 mark)

31. **Jan 2024, Q2**

Which row of the table only contains vector quantities?

☒	**A**	acceleration	momentum	weight
☒	**B**	density	time	work done
☒	**C**	displacement	mass	velocity
☒	**D**	force	kinetic energy	temperature

(Total for Question 2 = 1 mark)

32. **Oct 2023, Q1**

A quantity is either a scalar or a vector.

Which row of the table is correct?

	Scalar	Vector
☒ **A**	energy	momentum
☒ **B**	displacement	acceleration
☒ **C**	time	mass
☒ **D**	velocity	force

(Total for Question 1 = 1 mark)

33. **May 2023, Q1**

Which of the following is a vector quantity?

- ☒ **A** efficiency
- ☒ **B** kinetic energy
- ☒ **C** power
- ☒ **D** weight

(Total for Question 1 = 1 mark)

34. **Jan 2023, Q1**

Which of the following is a scalar quantity?

- ☒ **A** displacement
- ☒ **B** moment of a force
- ☒ **C** power
- ☒ **D** weight

(Total for Question 1 = 1 mark)

35. **Oct 2022, Q2**

Which of the following quantities is a vector?

- ☒ **A** energy
- ☒ **B** mass
- ☒ **C** momentum
- ☒ **D** power

(Total for Question 2 = 1 mark)

36. **May 2022, Q3**

Which of the following is a scalar quantity?

- ☒ **A** force
- ☒ **B** momentum
- ☒ **C** velocity
- ☒ **D** work

(Total for Question 3 = 1 mark)

37. **Jan 2022, Q2**

Physical quantities may be vectors or scalars.
Which row of the table is correct?

	Force	Mass	Acceleration
☐ **A**	scalar	vector	scalar
☐ **B**	scalar	scalar	vector
☐ **C**	vector	vector	scalar
☐ **D**	vector	scalar	vector

(Total for Question 2 = 1 mark)

38. **May 2021, Q1**

Which of the following is a scalar quantity?

☐ **A** weight
☐ **B** momentum
☐ **C** terminal velocity
☐ **D** kinetic energy

(Total for Question 1 = 1 mark)

39. **Jan 2021, Q8**

A car is moving towards a stop sign at a speed of $25 ms^{-1}$. The driver applies the brakes 20m before the sign and decelerates uniformly to rest just before the sign.
Which of the following gives the magnitude of the car's deceleration in ms^{-2}?

☐ A $\frac{25}{40}$
☐ B $\frac{25}{20}$
☐ C $\frac{25^2}{40}$
☐ D $\frac{25^2}{20}$

(Total for Question 1 = 1 mark)

40. **Oct 2020 (May), Q1**

Which of the following units is only used with vector quantities?

☐ **A** J
☐ **B** m
☐ **C** N
☐ **D** W

(Total for Question 1 = 1 mark)

41. **Oct 2020 (May), Q4**

A car travels north with a velocity of $+50 ms^{-1}$. While still travelling north, the car slows to a velocity of $+20 ms^{-1}$.
Which of the following is the change of velocity of the car?

☐ **A** $+30 ms^{-1}$
☐ **B** $-30 ms^{-1}$
☐ **C** $+70 ms^{-1}$
☐ **D** $-70 ms^{-1}$

(Total for Question 4 = 1 mark)

42. **May 2019, Q1**

Quantities in physics are classified as either vectors or scalars.
Which of the following units could only be used for a scalar quantity?

☐ **A** ms^{-1}
☐ **B** ms^{-2}
☐ **C** $kg\ ms^{-2}$
☐ **D** $kg\ m^{-3}$

(Total for Question 1 = 1 mark)

43. **Jan 2019, Q1**

Which of the following is a vector quantity?

- ☐ **A** work done
- ☐ **B** time
- ☐ **C** temperature
- ☐ **D** displacement

(Total for Question 1 = 1 mark)

44. **Sample Assess., Q1**

Quantities can be scalar or vector.

Select the row of the table that correctly states a scalar quantity and a vector quantity.

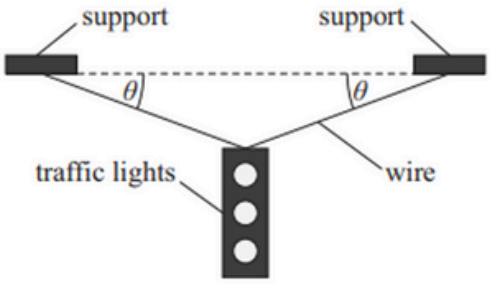
	Scalar quantity	Vector quantity
☐ **A**	mass	momentum
☐ **B**	momentum	weight
☐ **C**	speed	mass
☐ **D**	weight	speed

(Total for Question 1 = 1 mark)

1.3.5 (Resolve a vector into two components)

45. **Jan 2025, Q10**

Traffic lights of weight W are suspended from a wire.
The wire is held at an angle θ to the horizontal by two supports, as shown.



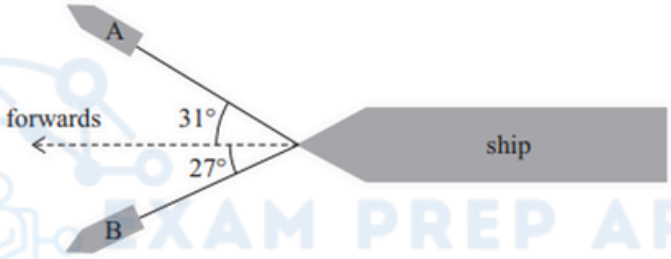
Which of the following expressions gives the tension in the wire?

- ☒ **A** $2W \sin\theta$
- ☒ **B** $\frac{W}{2\sin\theta}$
- ☒ **C** $2W \cos\theta$
- ☒ **D** $\frac{W}{2\cos\theta}$

(Total for Question 10 = 1 mark)

46. **Oct 2024, Q9**

Two boats, A and B, are pulling a ship. Each boat is attached to the ship by a rope, as shown.



The force from boat A on the ship is F_A.

The force from boat B on the ship is F_B.

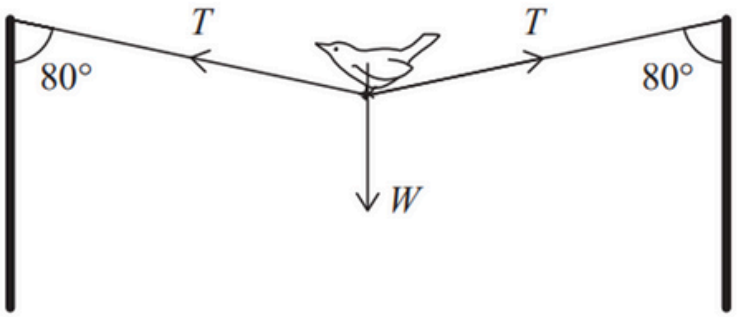
Which of the following expressions gives the forwards component of the total force of the boats on the ship?

- ☒ **A** $F_A \sin(31°) + F_B \cos(27°)$
- ☒ **B** $F_A \sin(31°) + F_B \sin(27°)$
- ☒ **C** $F_A \cos(31°) + F_B \cos(27°)$
- ☒ **D** $F_A \cos(31°) + F_B \sin(27°)$

(Total for Question 9 = 1 mark)

47. **Jan 2024, Q6**

A length of string is attached between two vertical posts. A bird of weight W stands on the middle of the string causing tension T in the string. The string makes an angle of 80° with each post, as shown.



Which of the following expressions is correct?

☒ **A** $T = \frac{W}{2 \sin 80°}$

☒ **B** $T = W \times 2 \sin 80°$

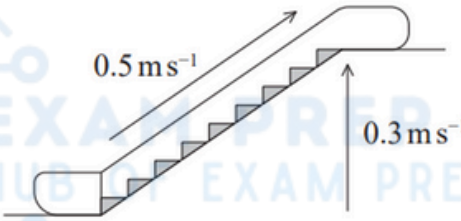
☒ **C** $T = \frac{W}{2 \cos 80°}$

☒ **D** $T = W \times 2 \cos 80°$

(Total for Question 6 = 1 mark)

48. **Oct 2019, Q5**

The steps on an escalator move with a speed of 0.5 ms^{-1}. The vertical component of their velocity is 0.3 ms^{-1} upwards



Which of the following is the horizontal component of velocity for the escalator steps?

☒ **A** $0.2\ ms^{-1}$

☒ **B** $0.4\ ms^{-1}$

☒ **C** $0.5ms^{-1}$

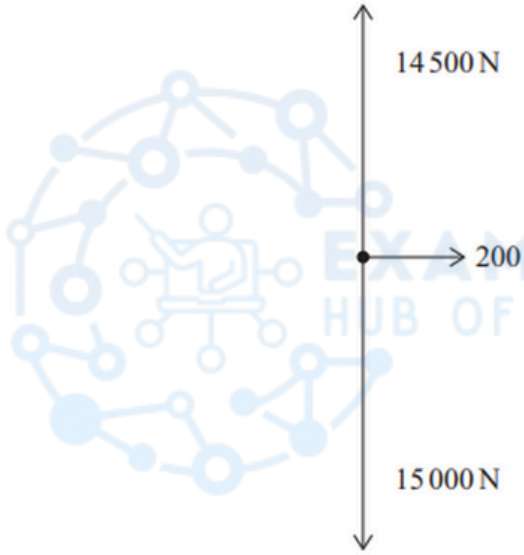
☒ **D** $0.8\ ms^{-1}$

(Total for Question 5 = 1 mark)

1.3.6 (Find the resultant of two coplanar vectors)

49. **May 2025, Q7**

The forces acting on a helicopter are shown. The helicopter is represented by the dot.



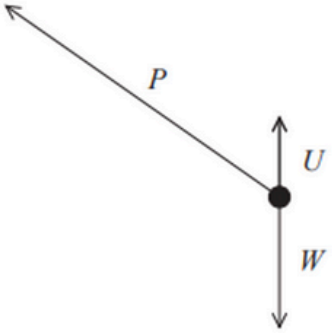
Which of the following expressions gives the magnitude of the resultant force, in newtons, on the helicopter?

- ☒ **A** $(15000^2 - 14500^2) + 200^2$
- ☒ **B** $\sqrt{(15000^2 - 14500^2) + 200^2}$
- ☒ **C** $(15000 - 14500)^2 + 200^2$
- ☒ **D** $\sqrt{(15000 - 14500)^2 + 200^2}$

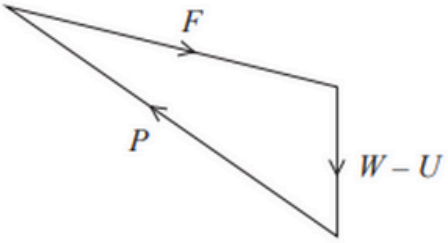
(Total for Question 7 = 1 mark)

50. **Jan 2023, Q6**

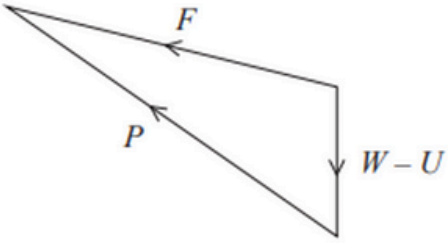
A soap bubble is being blown by the wind. The free-body force diagram shows the forces acting on the bubble. P is the force of the wind, W is the weight of the bubble and U is the upthrust acting on the bubble.



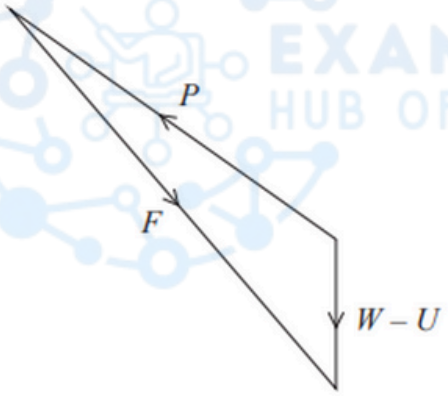
Which of the following vector diagrams shows the resultant force F acting on the bubble?



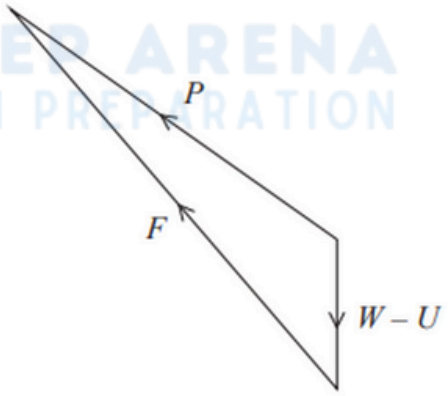
A



B



C



D

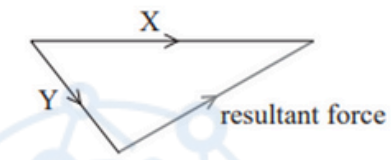
- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 6 = 1 mark)

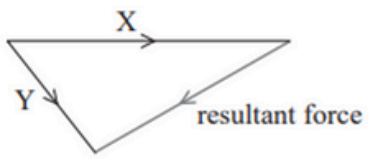
51. **Oct 2022, Q7**

Two forces, X and Y, act at a point.

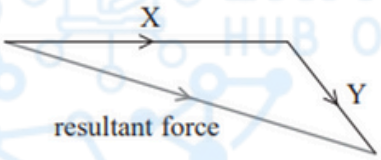
Which of the following vector diagrams shows the magnitude and direction of the resultant of the two forces?



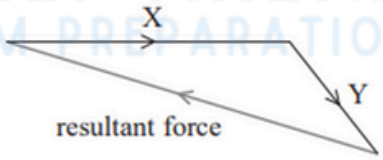
A



B



C



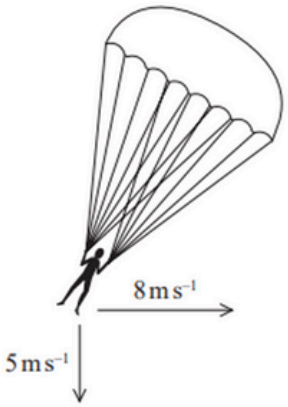
D

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 7 = 1 mark)

52. **Jan 2022, Q4**

The diagram shows a student during a parachute jump on a windy day. The vertical component of her velocity is $5.0 ms^{-1}$. The horizontal component of her velocity is $8.0 ms^{-1}$. She descends at an angle θ to th vertical.



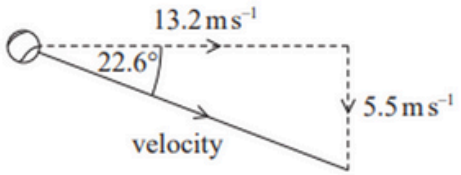
Which row of the table gives expressions for the magnitude and angle of the student's resultant velocity?

	Magnitude / $m s^{-1}$	θ / °
☒ A	$\sqrt{8^2 - 5^2}$	$\tan^{-1}\frac{8}{5}$
☒ B	$\sqrt{8^2 - 5^2}$	$\sin^{-1}\frac{5}{8}$
☒ C	$\sqrt{8^2 + 5^2}$	$\tan^{-1}\frac{8}{5}$
☒ D	$\sqrt{8^2 + 5^2}$	$\sin^{-1}\frac{5}{8}$

(Total for Question 4 = 1 mark)

53. **Oct 2021, Q4**

A tennis ball is moving through the air. The diagram shows the horizontal and vertical components of its velocity.



Which of the following expressions gives the magnitude of the velocity in ms^{-1}?

☒ **A** $\frac{132}{\sin 22.6°}$

☒ **B** $13.2 \times \sin 22.6°$

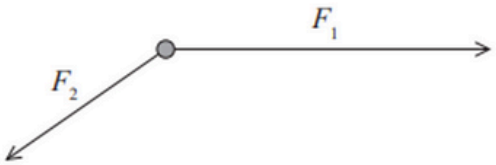
☒ **C** $\frac{55}{\sin 22.6°}$

☒ **D** $5.5 \times \sin 22.6°$

(Total for Question 4 = 1 mark)

54. **May 2021, Q10**

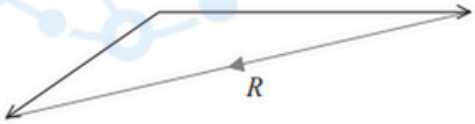
Two forces F_1 and F_2 act on an object, as shown.



Which of the following is a correctly drawn scaled vector diagram for the resultant R of the forces F_1 and F_2?

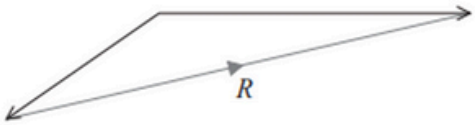
☒ **A**

☒ **B**



☒ **C**

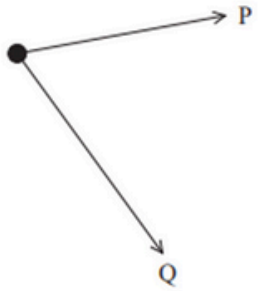
☒ **D**



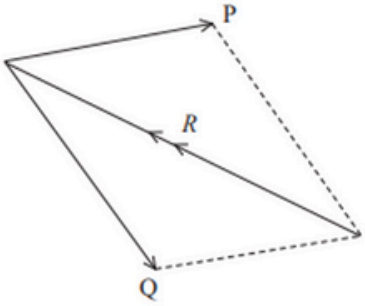
(Total for Question 10 = 1 mark)

55. **Oct 2020 (May), Q5**

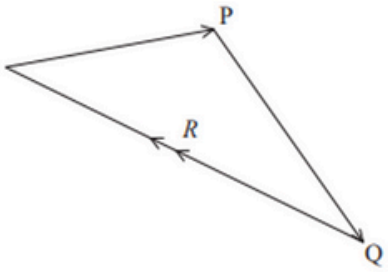
Two forces P and Q act on an object as shown.



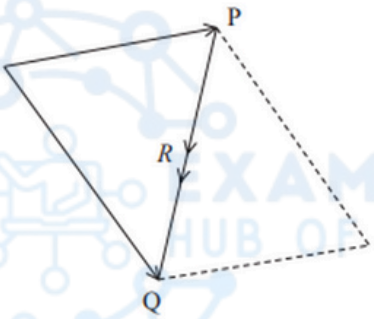
Which of the following is a correctly drawn, scaled, vector diagram for the resultant R of forces P and Q?



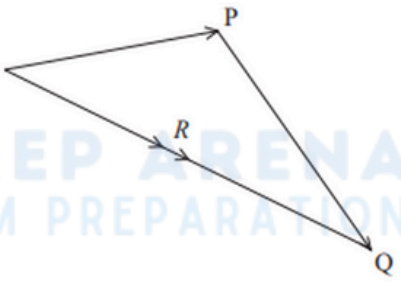
A



B



C



D

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

(Total for Question 5 = 1 mark)

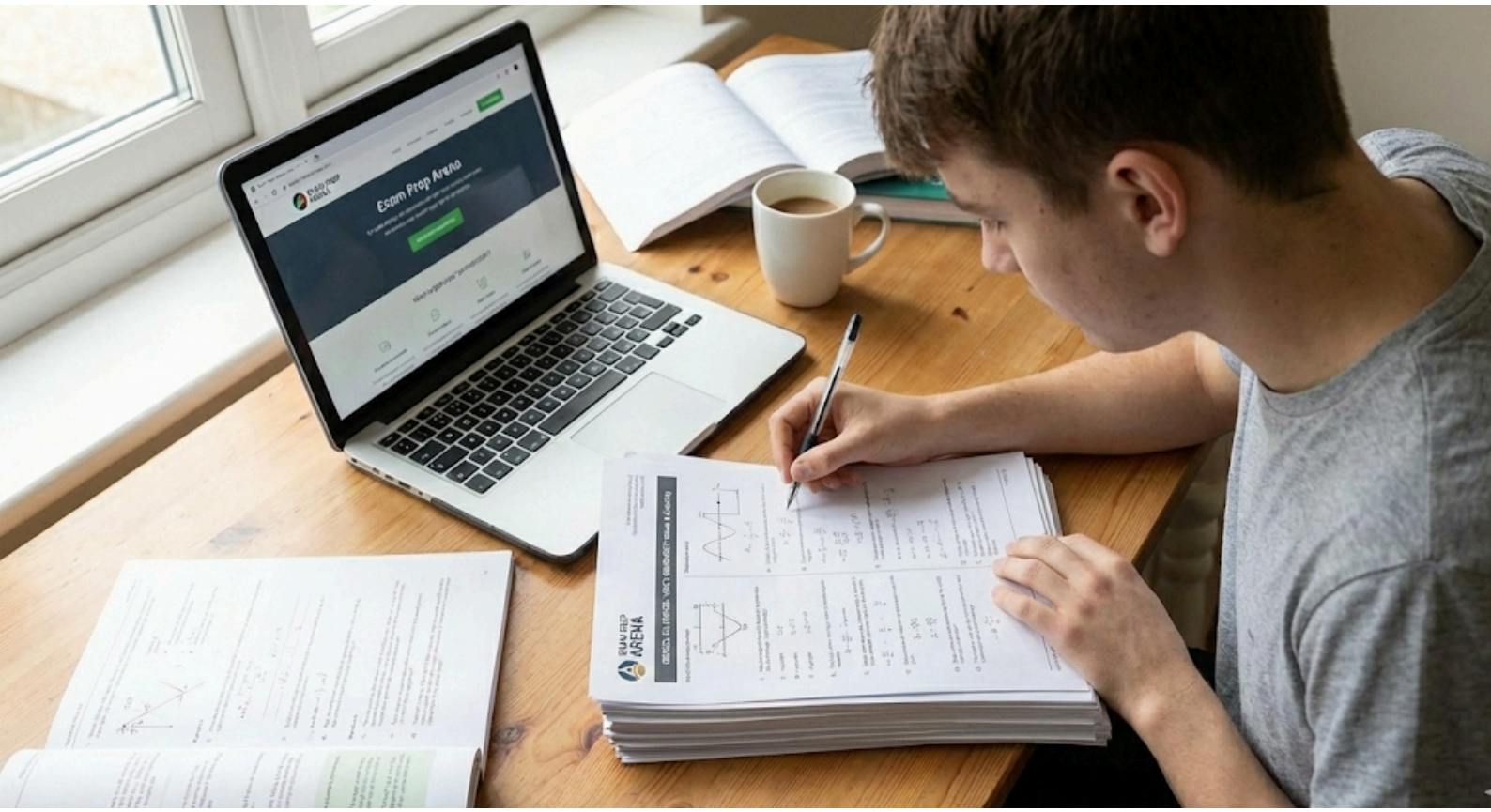
56. **Jan 2020, Q3**

The diagrams below show the velocity of an object before and after a force is applied.
The magnitude of the velocity did not change.

Which of the following arrows represents the direction of the change in velocity?

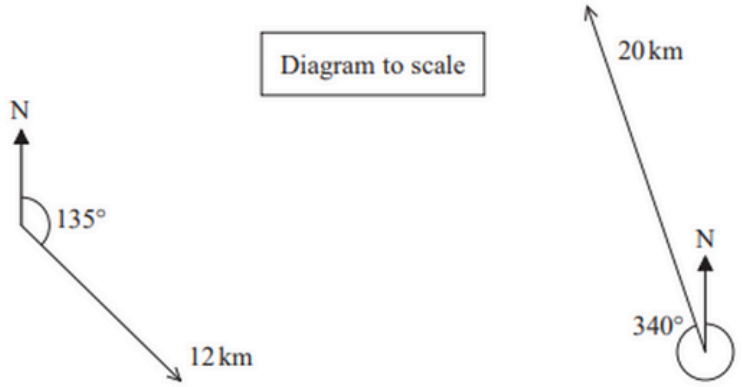
- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

(Total for Question 3 = 1 mark)

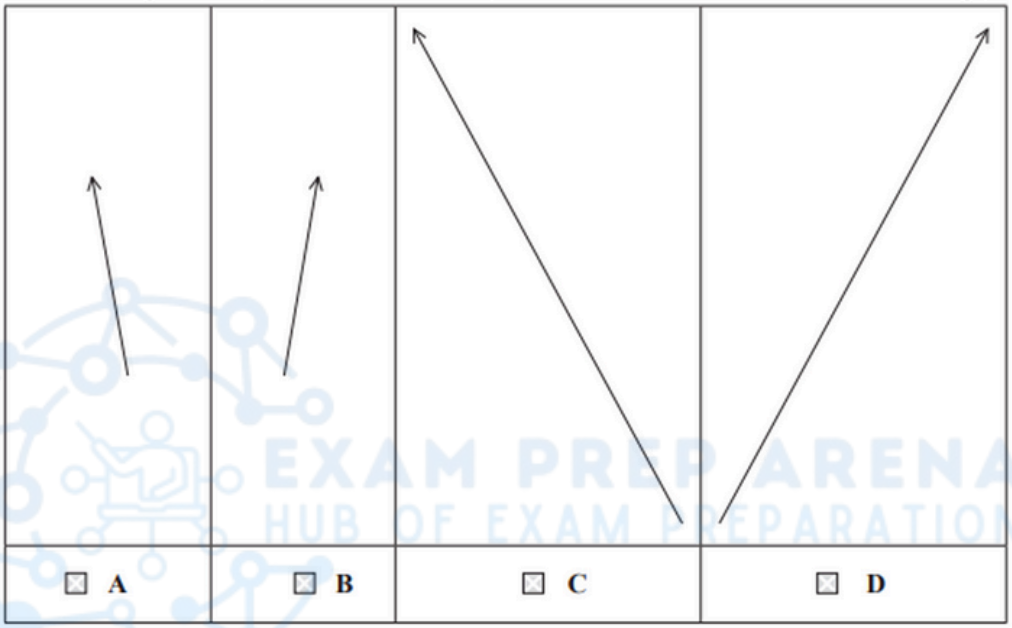


57. **May 2019, Q9**

A student walked 1 2 km on a bearing of 1350 and then walked 20km on a bearing of 3400 as shown.



Which of the following could represent the final displacement of the student from his starting point?



(Total for Question 9 = 1 mark)

1.3.7 (Independence of vertical and horizontal motion)

58. **Jan 2025, Q2**

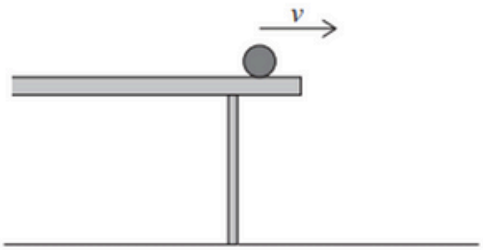
A coin and a feather are dropped from the same height, through air.
Which row of the table is correct as the coin and feather fall to the ground?

	Initial acceleration	Time taken to reach the ground
☐ **A**	Greater for coin	Less for coin
☐ **B**	Greater for coin	Same for coin and feather
☐ **C**	Same for coin and feather	Less for coin
☐ **D**	Same for coin and feather	Same for coin and feather

(Total for Question 2 = 1 mark)

59. **May 2025, Q3**

The diagram shows a ball of mass m moving at speed v along a horizontal table.



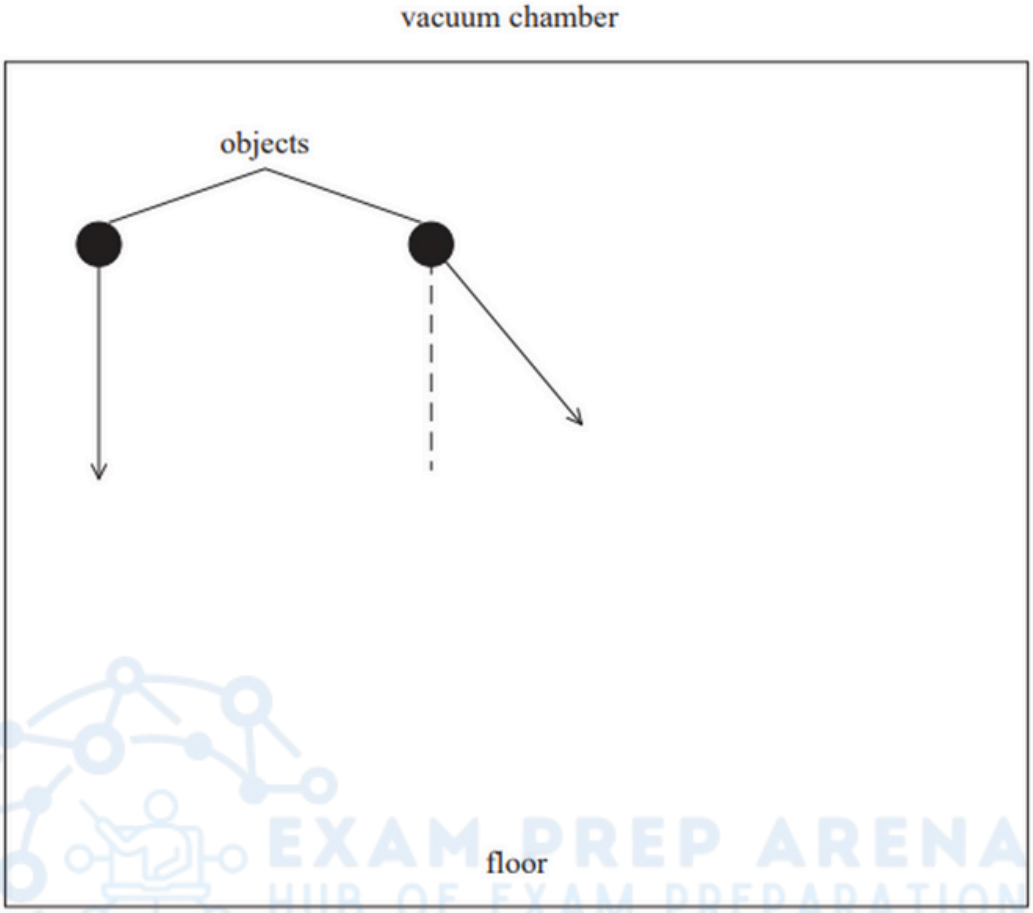
The ball leaves the table. The time taken between the ball leaving the table and landing on the floor is t.
A second ball of mass 2m moves at speed 2v along the table.
Which of the following gives the time taken between the second ball leaving the table and landing on the floor?

☐ **A** $2t$
☐ **B** t
☐ **C** $\frac{t}{2}$
☐ **D** $\frac{t}{4}$

(Total for Question 3 = 1 mark)

60. **May 2021, Q7**

Two objects with the same initial speed fall from the same height in a vacuum chamber, as shown. The arrows in the diagram show initial directions of travel of the objects.



Which of the following quantities are not the same for both objects?

☒ **A** The accelerations of the objects during the fall.

☒ **B** The velocities of the objects as they reach the floor.

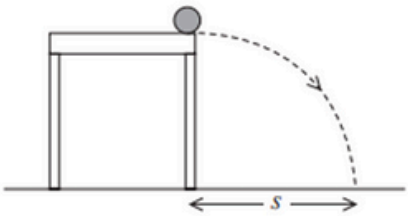
☒ **C** The increase in the speeds of the objects during the fall.

☒ **D** The kinetic energies of the objects as they reach the floor.

(Total for Question 7 = 1 mark)

61. **May 2019, Q4**

A ball rolls Offa table with a horizontal velocity of $1.2\ ms^{-1}$.The ball takes 0.9 s to reach the ground and landsa distance s from the table as shown.



Which of the following expressions could be used to determine the value of s in metres?

☒ **A** $\frac{1.2^2}{2\times9.81}$

☒ **B** 1.2×0.9

☒ **C** $\frac{1}{2} \times 9.81 \times 0.9^2$

☒ **D** $(1.2 \times 0.9) + \left(\frac{1}{2} \times 9.81 \times 0.9^2\right)$

(Total for Question 4 = 1 mark)

62. **Jan 2019, Q6**

A ball is thrown vertically upwards.

Which row of the table correctly describes the magnitude of the initial acceleration of the ball and the magnitude of the acceleration when it is at its maximum height?

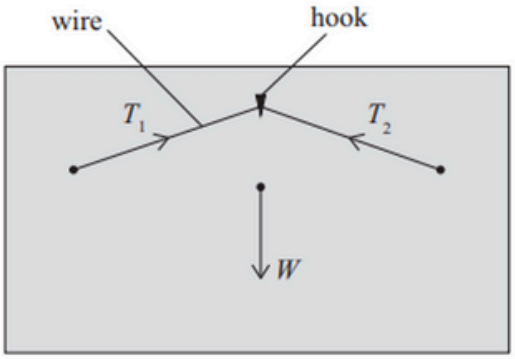
	Initial acceleration	Acceleration at maximum height
☐ **A**	0	$9.81\,ms^{-2}$
☐ **B**	$9.81\,ms^{-2}$	0
☐ **C**	$9.81\,ms^{-2}$	$9.81\,ms^{-2}$
☐ **D**	0	0

(Total for Question 6 = 1 mark)

1.3.8 (Draw and interpret free-body force diagrams... centre of gravity)

63. **May 2025, Q5**

A wire is used to hang a picture from a hook on a wall.
The wire exerts forces T1 and T2 on the picture. The picture has weight W, as shown.



Not to scale

Which of the following describes the relationship between the forces when the picture is hanging on the wall?

- ☒ **A** $\vec{W} = \vec{T_1} + \vec{T_2}$
- ☒ **B** $\vec{W} + \vec{T_1} + \vec{T_2} = 0$
- ☒ **C** $\vec{W} = \vec{T_1} - \vec{T_2}$
- ☒ **D** $\vec{W} + \vec{T_1} - \vec{T_2} = 0$

(Total for Question 5 = 1 mark)

64. **MAY 2024, Q7**

Which of the following describes the centre of gravity of an object?

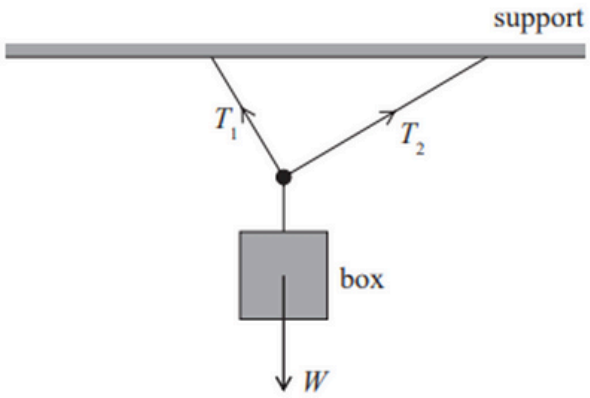
- ☒ **A** the point where the mass of the object is located
- ☒ **B** the point where the mass of the object is concentrated
- ☒ **C** the point where the weight of the object is located
- ☒ **D** the point where the weight of the object may be considered to act

(Total for Question 7 = 1 mark)

65. **Oct 2023, Q9**

A box of weight W is suspended, in equilibrium, from a support by two ropes.

The tensions in the two ropes are T_1 and T_2



Which of the following is a vector expression relating the forces acting on the box?

☒ **A** $\overrightarrow{W} + \overrightarrow{T_1} = \overrightarrow{T_2}$

☒ **B** $\overrightarrow{W} + \overrightarrow{T_2} = \overrightarrow{T_1}$

☒ **C** $\overrightarrow{W} = \overrightarrow{T_1} + \overrightarrow{T_2}$

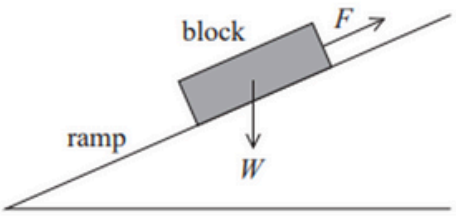
☒ **D** $\overrightarrow{W} + \overrightarrow{T_1} + \overrightarrow{T_2} = 0$

(Total for Question 9 = 1 mark)

66. **Oct 2021, Q6**

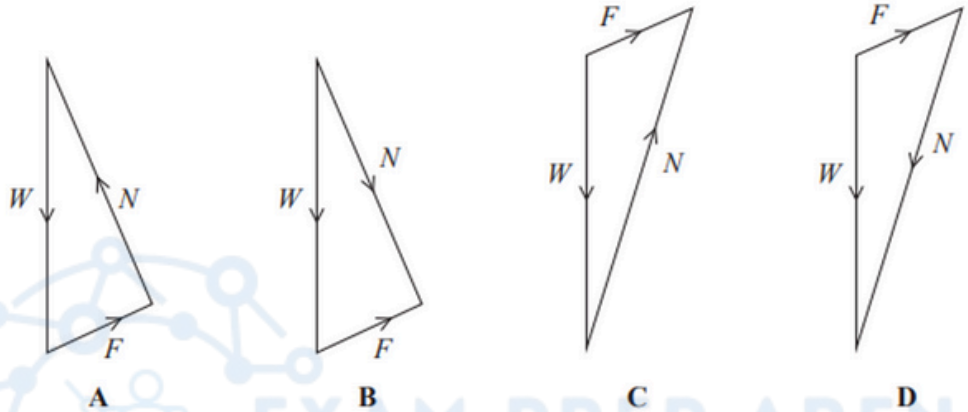
A block of wood is stationary on a frictionless ramp as shown.

The block is held in place by a string. The weight of the block is W. The force applied to the block by the string is F.



A triangle of forces can be used to determine the magnitude and direction of the normal contact force N acting on the block.

Which of the following triangles is correct?



- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

(Total for Question 6 = 1 mark)

67. **Jan 2020, Q4**

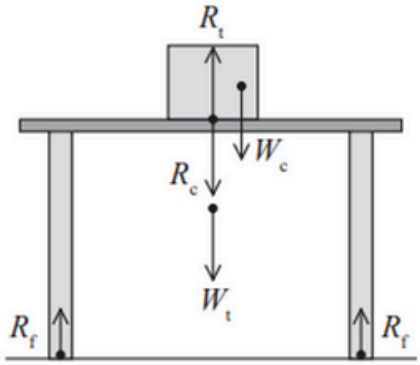
A ball of mass m is projected vertically upwards. An air resistance F acts on the ball at all times.
Which of the following equations would apply to the ball as it is travelling upwards?

- ☐ **A** $mg - F = 0$
- ☐ **B** $mg + F = 0$
- ☐ **C** $mg - F = ma$
- ☐ **D** $mg + F = ma$

(Total for Question 4 = 1 mark)

68. **Oct 2019, Q6**

A uniform solid cube is placed on a table. The diagram shows the forces acting on the table and on the cube.



R_c = reaction force of cube on table
R_f = reaction force of floor on table
R_t = reaction force of table on cube
W_c = weight of cube
W_t = weight of table

The dot at the start of every arrowed line indicates the point at which the force can be considered to act.
Which of the following forces has been drawn in the wrong position?

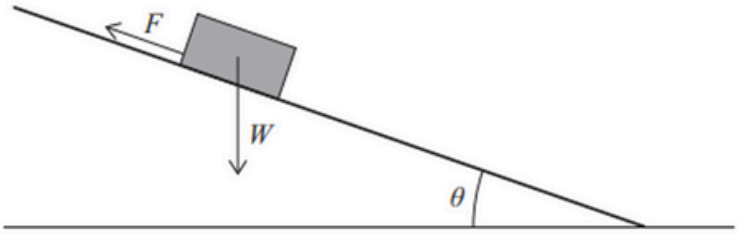
- **A** R_c
- **B** R_t
- **C** W_c
- **D** W_t

(Total for Question 6 = 1 mark)

1.3.9 (Use the equation $\Sigma F = ma$)

69. **May 2025, Q8**

A box of weight W slides down a ramp. The ramp is at an angle θ to the horizontal.
A frictional force F acts on the box, as shown.



Which of the following is correct when the box moves at a constant speed?

- ☒ **A** $F = W\cos\theta$
- ☒ **B** $F < W\cos\theta$
- ☒ **C** $F = W\sin\theta$
- ☒ **D** $F < W\sin\theta$

(Total for Question 8 = 1 mark)

70. **Oct 2024, Q5**

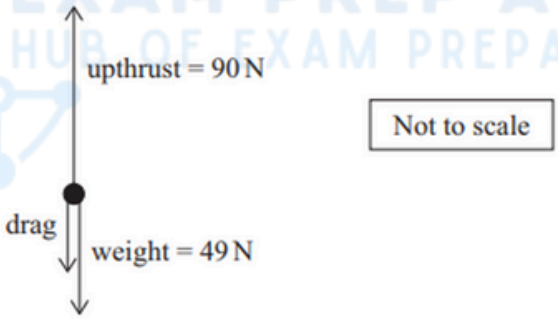
A box slides down a slope at a constant speed. Weight and resistive forces both act on the box.
Which of the following is a reason why the speed of the box is constant?

- ☒ **A** The component of the weight parallel to the slope is equal to the sum of the resistive forces.
- ☒ **B** The component of the weight parallel to the slope is greater than the sum of the resistive forces.
- ☒ **C** The component of the weight perpendicular to the slope is equal to the sum of the resistive forces.
- ☒ **D** The component of the weight perpendicular to the slope is greater than the sum of the resistive forces.

(Total for Question 5 = 1 mark)

71. **Jan 2025, Q9**

A free-body force diagram for an object moving through a fluid is shown.



The mass of the object is 5 kg.
The object is accelerating upwards at $4 ms^{-2}$.
Which of the following gives the magnitude of the drag force in newtons?

- ☒ **A** 5×4
- ☒ **B** $90 - 49$
- ☒ **C** $90 - 49 - (5 \times 4)$
- ☒ **D** $90 - 49 + (5 \times 4)$

(Total for Question 9 = 1 mark)

72. **MAY 2024, Q10**

A ship has a mass of 1.2×10^7 kg and has an acceleration of 0.03 m s^{-2}. The force produced by the ship's engine is 8.0×10^5 N.
Which of the following expressions gives the magnitude of the drag force, in N, on the ship?

- ☒ **A** $8.0 \times 10^5 - (0.03 \times 1.2 \times 10^7)$
- ☒ **B** $8.0 \times 10^5 + (0.03 \times 1.2 \times 10^7)$
- ☒ **C** $8.0 \times 10^5 \div (0.03 \times 1.2 \times 10^7)$
- ☒ **D** $8.0 \times 10^5 \times (0.03 \times 1.2 \times 10^7)$

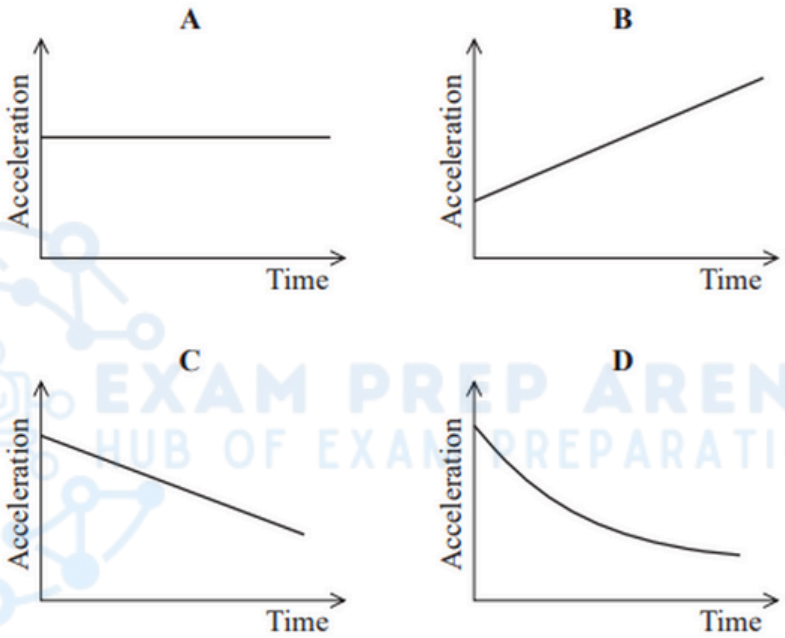
(Total for Question 10 = 1 mark)

73. **May 2022, Q6**

A rocket is accelerating horizontally due to a constant resultant force.

The mass of the rocket decreases steadily as it uses up its fuel.

Which graph shows how the acceleration of the rocket could change?



- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 6 = 1 mark)

74. **Oct 2021, Q10**

The diagram shows a rocket of mass *m* accelerating upwards with acceleration a.

The diagram represents the forces acting on the rocket.

Diagram not to scale

Which of the following equations gives the value of D?

- **A** D = T +m (g – a)
- **B** D = T +m (a + g)
- **C** D = T – m (g – a)
- **D** D = T – m (g + a)

(Total for Question 10 = 1 mark)

75. **May 2021, Q3**

A van travels along a straight, horizontal road at a constant velocity.
Which of the following statements is correct?

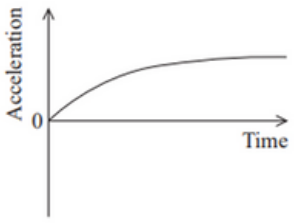
- **A** The frictional force of the road on the tyres can be ignored.
- **B** The frictional force of the road on the tyres is equal to the resultant force on the van.
- **C** The frictional force of the road on the tyres is in the direction of motion of the van.
- **D** The frictional force of the road on the tyres is in the opposite direction to the motion of the van.

(Total for Question 3 = 1 mark)

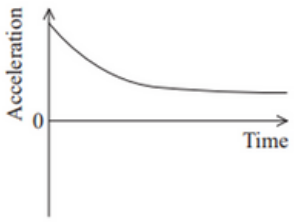
76. **May 2021, Q8**

A constant forward force acts on a car. The car accelerates along a straight road. After a while, the speed of the car reaches a constant value.

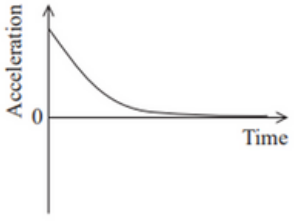
Which graph shows the variation of acceleration with time for the car?



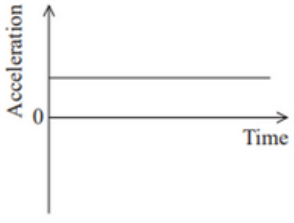
A



B



C



D

77. **May 2019, Q2**

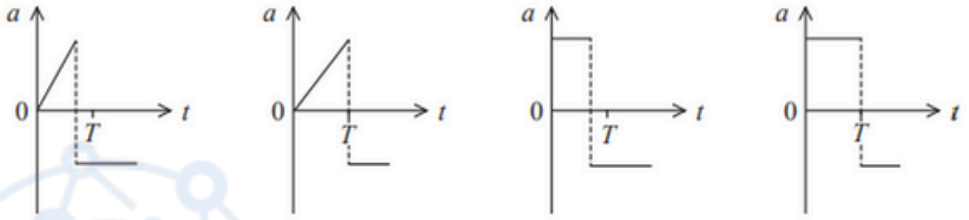
Once in orbit above the Earth's atmosphere, the engines on a space rocket are switched off.
Which row of the table correctly states the resulting motion of the rocket and the law explaining this motion?

	Motion of rocket	Explanation
☒ **A**	uniform velocity	Newton's 2nd law
☒ **B**	uniform velocity	Newton's 3rd law
☒ **C**	changing velocity	Newton's 2nd law
☒ **D**	changing velocity	Newton's 3rd law

(Total for Question 2 = 1 mark)

78. **May 2019, Q8**

A model rocket is launched and moves vertically upwards while still burning fuel to give a constant upwards thrust. The fuel runs out, and the rocket reaches the maximum height at time T before falling back to the ground.
Which of the following graphs could show how the acceleration a of the rocket varies with time t, if the decrease in mass as the fuel burns is neglected?



☒ **A** ☒ **B** ☒ **C** ☒ **D**

(Total for Question 8 = 1 mark)

79. **May 2019, Q10**

A lift moves upwards from rest with an acceleration a. A student of mass 70 kg standing in the lift exerts a force of 800N on the floor of the lift.

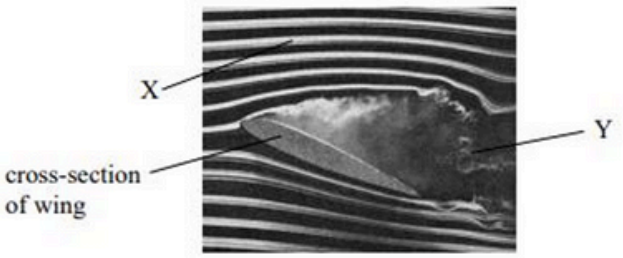
Which of the following expressions could be used to determine a?

☒ **A** $70g = 70a$
☒ **B** $800 = 70a$
☒ **C** $800 - 70g = 70a$
☒ **D** $70g - 800 = 7a$

(Total for Question 10 = 1 mark)

80. **Sample Assess., Q5**

The photograph shows the flow of air around the wing of an aeroplane.



Source from: http://ffden 2.phys.uaf.edu/211.fall2000.web.projects/c.%20Schaefer/aero4.htm

X and Y are two points in the path of the air flow.
Which of the following statements about the speed of the air is correct?

☒ **A** The speed of the air at X is constant.
☒ **B** The speed of the air at X is continuously changing.
☒ **C** The speed of the air at X is equal to the speed of the air at Y
☒ **D** The speed of the air at Y is constant.

(Total for Question 5 = 1 mark)

1.3.10 (Equations for gravitational field strength $g = \frac{F}{m}$ and $W = mg$)

81. **Jan 2023, Q2**

Which of the following describes gravitational field strength?

- ☒ **A** weight per unit mass
- ☒ **B** acceleration per unit mass
- ☒ **C** gravitational potential energy per unit mass
- ☒ **D** acceleration per unit weight

(Total for Question 2 = 1 mark)

82. **Jan 2020, Q2**

Which of the following statements describes the gravitational field strength acting on a body at a point?

- ☒ **A** gravitational force per unit length
- ☒ **B** gravitational force per unit mass
- ☒ **C** gravitational potential energy per unit length
- ☒ **D** gravitational potential energy per unit mass

(Total for Question 2 = 1 mark)

1.3.11 (CORE PRACTICAL 1: Determine the acceleration of a freely-falling object)

83. **Jan 2025, Q7**

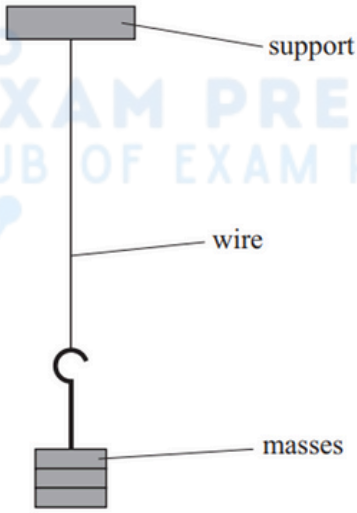
A student drops a ball and measures the time taken for the ball to reach the ground.
He repeats this for different heights.
He uses a graphical method to determine a value for g, the acceleration of free fall.
He plots height on the y-axis of his graph.
Which row of the table is correct for the student's graph?

	Quantity plotted on *x*-axis	Gradient of graph
☒ **A**	time	$\frac{1}{g}$
☒ **B**	time	g
☒ **C**	$(\text{time})^2$	$\frac{g}{2}$
☒ **D**	$(\text{time})^2$	$2g$

(Total for Question 7 = 1 mark)

84. **MAY 2024, Q8**

A student attached one end of a wire to a support. The student added masses to the other end of the wire, as shown. The student measured the corresponding extension for each added mass.



The wire broke when the extension was small.

The student replaced the wire with a second wire made of the same material. The second wire had a larger extension before breaking.

Which of the following produced this result?

☒ **A** The second wire had a greater diameter.

☒ **B** The second wire had a longer length.

☒ **C** The second wire had a smaller diameter.

☒ **D** The second wire had a shorter length.

(Total for Ouestion 9 = 1 mark)

85. **Jan 2024, Q5**

A student dropped a table tennis ball. The ball fell for time t and had velocity v just before it hit the ground.

The student used the equations of motion to calculate t and v. These equations ignore air resistance.

Which row of the table shows how the actual values compared with the student's calculated values for t and v?

	t	v
☒ **A**	Less than calculated	Less than calculated
☒ **B**	Less than calculated	Greater than calculated
☒ **C**	Greater than calculated	Less than calculated
☒ **D**	Greater than calculated	Greater than calculated

(Total for Question 5 = 1 mark)

86. **May 2023, Q6**

A student determined the acceleration of free fall g.

She measured the time t for a ball bearing to fall from rest through a distance s.

She repeated this for a range of values of s.

Which row of the table shows the graph that would give a gradient equivalent to g?

	y-axis	x-axis
☒ **A**	s	$2t^2$
☒ **B**	$2s$	t^2
☒ **C**	s	$2t$
☒ **D**	$2s$	t

(Total for Question 6 = 1 mark)

87. **Jan 2023, Q4**

A student measures the time taken for a steel ball bearing to fall a measured distance in air. The student uses these measurements to determine the acceleration due to gravity.

Which of the following conditions is needed to determine an accurate value for the acceleration due to gravity?

☒ **A** The air flow around the ball bearing should be laminar.
☒ **B** The time taken to achieve terminal velocity should be short.
☒ **C** The ball bearing should begin to fall before the timer is started.
☒ **D** Air resistance and upthrust should both be negligible.

(Total for Question 4 = 1 mark)

88. **May 2022, Q5**

A student determined a value for g by dropping a metal sphere from rest. The student measured the distance fallen and the time taken for the sphere to fall.

The student obtained a value for g of $11.2 ms^{-2}$.

Which of the following could explain the difference between the student's value and the accepted value?

- ☒ **A** The air resistance was not negligible.
- ☒ **B** The student's measured distance was greater than the actual distance.
- ☒ **C** The sphere did not fall vertically.
- ☒ **D** The student's measured time was greater than the actual time taken.

(Total for Question 5 = 1 mark)

89. **Jan 2021, Q4**

A student measures the time t taken for a ball bearing to fall different measured distances s from rest.
The student uses his measurements to plot a graph with a gradient equal to the acceleration due to gravity g.
Which row of the table shows a graph with a gradient equal to g?

		y-axis	*x*-axis
☒	**A**	s	t^2
☒	**B**	$2s$	t^2
☒	**C**	t^2	s
☒	**D**	t^2	$2s$

(Total for Question 4 = 1 mark)

90. **Oct 2020 (May), Q7**

A student used a falling sphere to determine the acceleration of free-fall g. The sphere was released from rest.
Which two quantities would require the fewest measurements to be taken in order to determine g?

- ☒ **A** displacement and initial velocity
- ☒ **B** displacement and time
- ☒ **C** final velocity and displacement
- ☒ **D** final velocity and time

(Total for Question 7 = 1 mark)

1.3.12 (Newton's third law of motion)

91. **May 2025, Q4**

The forces acting on a person sitting on a chair are weight and normal contact force.
Which of the following gives a reason why these forces do not form a Newton's third law pair?

- ☒ **A** The chair is stationary.
- ☒ **B** The forces act in opposite directions.
- ☒ **C** The forces act on the same object.
- ☒ **D** The forces have the same magnitude.

(Total for Question 4 = 1 mark)

92. **Oct 2024, Q4**

The photograph shows a cable car hanging from a cable. The cable car is in equilibrium.

(Source: © zefart/Getty Images)

Which of the following forms a Newton's third law pair of forces with the weight of the cable car?

- ☒ **A** air resistance acting on the cable car
- ☒ **B** gravitational pull of the cable car on the Earth
- ☒ **C** upthrust of the displaced air acting on the cable car
- ☒ **D** normal contact force of the cable car on the cable

(Total for Question 4 = 1 mark)

93. **May 2023, Q5**

Two forces form a Newton's third law pair.

Which of the following statements is not true?

- ☒ **A** The forces act on the same object.
- ☒ **B** The forces have the same magnitude.
- ☒ **C** The forces act for the same time.
- ☒ **D** The forces are the same type of force.

(Total for Question 5 = 1 mark)

94. **Jan 2023, Q10**

Two forces make a Newton's third law pair.
Which of the following statements is true for these forces?

- ☒ **A** They act in different directions on the same body.
- ☒ **B** They are the same type of force and act on different bodies.
- ☒ **C** They have different magnitudes and act in different directions.
- ☒ **D** They are the same type of force and have different magnitudes.

(Total for Question 10 = 1 mark)

95. **Jan 2022, Q7**

A person is pushing a trolley at a constant velocity.
The floor exerts a force P on the person, the person exerts a force Q on the trolley.
The trolley exerts a force R on the person and the total drag force on the trolley is S.

Which pair of forces is a Newton's Third Law pair?

- ☒ **A** P and R
- ☒ **B** Q and R
- ☒ **C** Q and S
- ☒ **D** P and S

(Total for Question 7 = 1 mark)

96. **Oct 2021, Q2**

A massive star exerts a gravitational force F_{star} on a small distant planet. The planet exerts a gravitational force F_{planet} on the star.
Which row of the table is correct?

	Magnitude of forces	Direction of forces
☒ **A**	$F_{planet} < F_{star}$	opposite
☒ **B**	$F_{planet} < F_{star}$	the same
☒ **C**	$F_{planet} = F_{star}$	opposite
☒ **D**	$F_{planet} = F_{star}$	the same

(Total for Question 2 = 1 mark)

97. **Jan 2021, Q9**

Which of the following statements is not correct for a Newton's 3rd Law pair of forces?

- ☒ **A** The forces act in opposite directions.
- ☒ **B** The forces act on the same body.
- ☒ **C** The forces are of the same type.
- ☒ **D** The forces have the same magnitude.

(Total for Question 9 = 1 mark)

98. **Oct 2020 (May), Q2**

A box was placed at the top of a ramp and released.
The free-body force diagram for the box as it moved down the ramp at a constant velocity is shown.

D = air resistance
F = frictional force
R = normal contact force
W = weight of the box

Which two forces acting on the box have, according to Newton's third law, corresponding forces acting on the ramp?

- ☒ **A** F and D
- ☒ **B** F and R
- ☒ **C** W and D
- ☒ **D** W and R

(Total for Question 2 = 1 mark)

99. **Jan 2020, Q7**

Trolleys X and Y of masses m and 3m respectively are travelling at the same speed towards each other.
The trolleys collide and move off together.

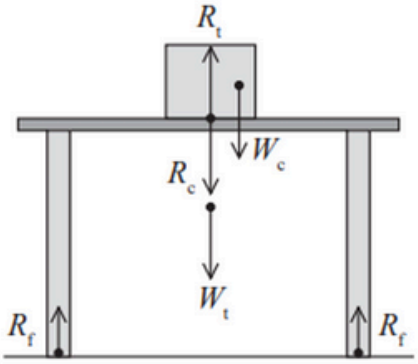
Which of the following statements is correct?

- ☒ A The force of X on Y during the collision is greater than the force of Y on X.
- ☒ B The force of X on Y during the collision is less than the force of Y on X.
- ☒ C The speed of X after the collision is greater than v.
- ☒ D The speed of X after the collision is less than v.

(Total for Question 7 = 1 mark)

100. **Oct 2019, Q7**

A uniform solid cube is placed on a table. The diagram shows the forces acting on the table and on the cube.



R_c = reaction force of cube on table
R_f = reaction force of floor on table
R_t = reaction force of table on cube
W_c = weight of cube
W_t = weight of table

The table has four legs.
Which of the following statements is correct according to Newton's third law?

- ☒ **A** $R_f = R_c + R_t$
- ☒ **B** $R_f = R_c + W_t$
- ☒ **C** $R_c = R_t$
- ☒ **D** $R_t = W_c$

(Total for Question 7 = 1 mark)

101. **Jan 2019, Q5**

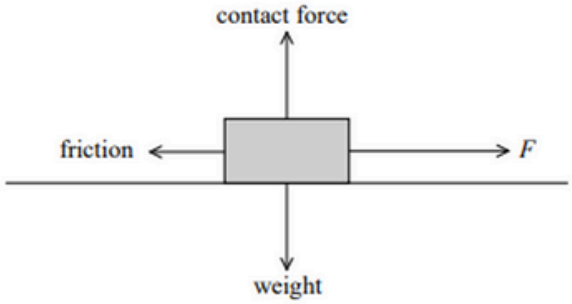
According to Newton's third law, when two objects interact they exert forces on each other.
Which of the following statements is not a correct description of these forces?

- ☐ **A** The forces act at the same time.
- ☐ **B** The forces act in the same direction.
- ☐ **C** The forces act on different objects.
- ☐ **D** The forces have the same magnitude.

(Total for Question 5 = 1 mark)

102. **Sample Assess., Q4**

A man applies a force F to a box and the box accelerates. The forces acting on the box are shown on the diagram.



According to Newton's third law, the box will exert a force on the man.
Select the row of the table that correctly describes the magnitude and direction of the force of the box on the man.

	Magnitude	In the direction of
☐ **A**	*F*	*F*
☐ **B**	*F*	friction
☐ **C**	friction	*F*
☐ **D**	friction	friction

(Total for Question 4 = 1 mark)

1.3.13 (Momentum is defined as $p = mv$)

103. **Oct 2023, Q2**

Which of the following is an SI unit for momentum?

- ☒ **A** kg ms^{-1}
- ☒ **B** Jm^{-1}
- ☒ **C** ms^{-2}
- ☒ **D** Ns^{-1}

(Total for Question 2 = 1 mark)

1.3.13 (Momentum is defined as $p = mv$)

103. **Oct 2023, Q2**

Which of the following is an SI unit for momentum?

- ☒ **A** kg ms^{-1}
- ☒ **B** Jm^{-1}
- ☒ **C** ms^{-2}
- ☒ **D** Ns^{-1}

(Total for Question 2 = 1 mark)

1.3.14 (Principle of conservation of linear momentum)

104. **May 2025, Q10**

A toy train of mass 3m is moving with a speed v.
A toy truck of mass m is moving with a speed 2v in the opposite direction, as shown.

The train and truck collide and move off together.
Which of the following expressions gives the new speed of the train and truck?

- ☒ **A** $\frac{v}{4}$
- ☒ **B** $\frac{4v}{5}$
- ☒ **C** v
- ☒ **D** $\frac{5v}{4}$

(Total for Question 10 = 1 mark)

105. **Oct 2024, Q8**

A student uses a wooden bat to hit a stationary ball of mass m.
As the bat hits the ball, the momentum of the bat decreases by Δp.
The ball then moves with velocity v.
The student then uses the bat to hit a stationary ball of mass 3m.
The momentum of the bat decreases by 2Δp.
Which of the following expressions gives the velocity of the ball of mass 3m after being hit?

- ☒ **A** $\frac{1}{6}v$
- ☒ **B** $\frac{2}{3}v$
- ☒ **C** $\frac{3}{2}v$
- ☒ **D** $6V$

(Total for Question 8 = 1 mark)

106. **Jan 2021, Q6**

Two objects are travelling directly towards each other and then collide. Object A is a mass of 2 kg initially travelling to the right at $3ms^{-1}$ and object B is a mass of 5kg initially travelling to the left at $2ms^{-1}$.
What is the total momentum of A and B after the collision?

- ☒ **A** $4kgms^{-1}$ to the left
- ☒ **B** $4kgms^{-1}$ to the right
- ☒ **C** $16kgms^{-1}$ to the left
- ☒ **D** $16kgms^{-1}$ to the right

(Total for Question 6 = 1 mark)

107. **Jan 2020, Q6**

A ball is travelling horizontally at a speed of $7.0ms^{-1}$. The ball hits a vertical wall and rebounds along its initial path at a speed of $5.0ms^{-1}$.
The ball has an acceleration of $300ms^{-2}$ while in contact with the wall.
Which of the following expressions gives the time of contact t between the ball and the wall?

- ☒ **A** $t = \frac{-5-7}{-300}$
- ☒ **B** $t = \frac{5-7}{-300}$
- ☒ **C** $t = \frac{-5-7}{300}$
- ☒ **D** $t = \frac{5-7}{300}$

(Total for Question 6 = 1 mark)

108. **Jan 2020, Q7**

Trolleys X and Y of masses m and 3m respectively are travelling at the same speed towards each other. The trolleys collide and move off together.

Which of the following statements is correct?

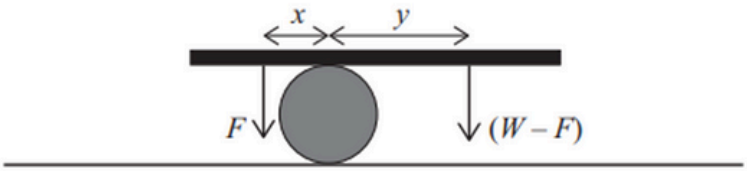
- ☐ A The force of X on Y during the collision is greater than the force of Y on X.
- ☐ B The force of X on Y during the collision is less than the force of Y on X.
- ☐ C The speed of X after the collision is greater than v.
- ☐ D The speed of X after the collision is less than v.

(Total for Question 7 = 1 mark)

1.3.15 (Moment of force = Fx)

109. **Oct 2024, Q10**

A student puts a piece of wood on top of a cylinder. He stands on the wood with his feet at distances x and y from the cylinder.
The weight of the student is W.
The diagram shows the force of each foot acting on the wood.



The wood is horizontal and in equilibrium.
The weight of the wood is negligible.
Which of the following expressions is equal to W?

- ☒ **A** $\frac{Fx}{y} + F$
- ☒ **B** $\frac{Fx}{y} - F$
- ☒ **C** $\frac{Fy}{x} + F$
- ☒ **D** $\frac{Fy}{x} - F$

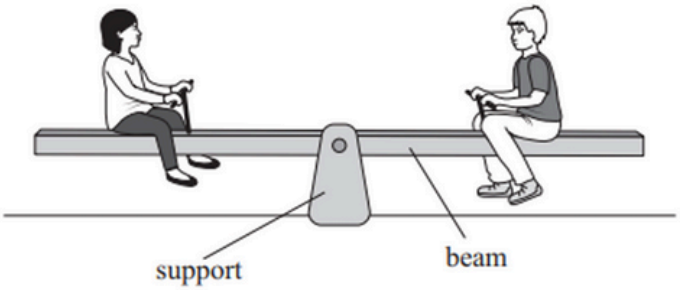
(Total for Question 10 = 1 mark)

1.3.16 (Apply the principle of moments to an extended body in equilibrium)

110. **May 2025, Q2**

A see-saw is a uniform beam that balances on a support. The beam can rotate around the top of the support.

Two children of equal weight sit on a see-saw at equal distances from the support, as shown.



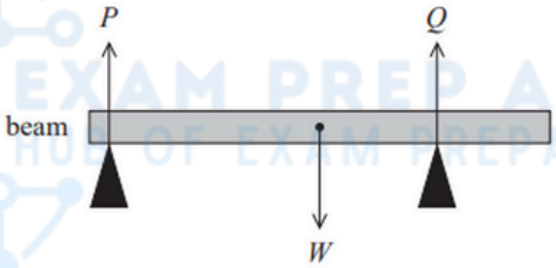
Which row of the table describes the resultant force and resultant moment on the beam?

	Resultant force	Resultant moment
☒ **A**	zero	zero
☒ **B**	zero	anticlockwise
☒ **C**	downwards	zero
☒ **D**	downwards	anticlockwise

(Total for Question 2 = 1 mark)

111. **Jan 2022, Q9**

A beam is balanced on two supports as shown.



The beam has a weight W and the reaction forces at the two supports are P and Q.

Which of the following statements about the magnitudes of the forces is correct?

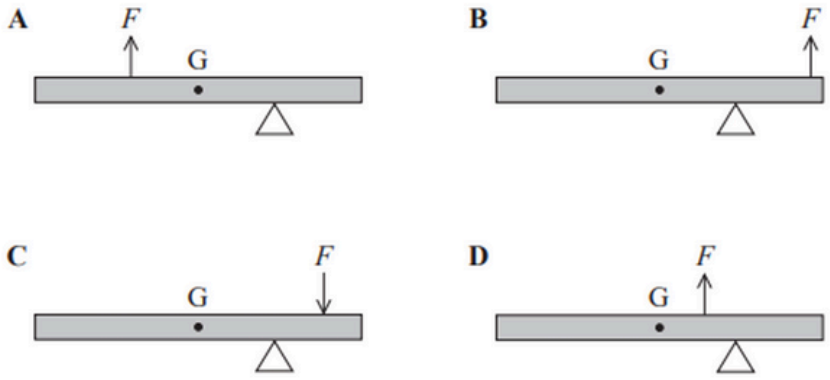
☒ **A** P > Q
☒ **B** Q > W
☒ **C** Q > P
☒ **D** (P + Q) > W

(Total for Question 9 = 1 mark)

112. **Oct 2021, Q5**

A beam is supported by a pivot as shown in the diagrams. The centre of gravity of the beam is at G. The beam is acted on by a force F.

Which diagram shows an arrangement where the beam could not be in equilibrium?



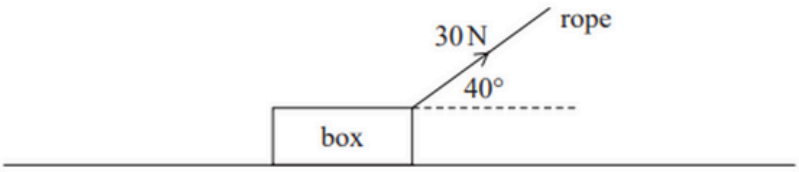
- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 5 = 1 mark)

1.3.17 (Work done $\Delta W = F\Delta s$)

113. **Oct 2023, Q10**

A box is pulled along the ground by a rope inclined at an angle of 40° to the horizontal as shown.



The tension in the rope is 30N.

The box is pulled 5m along the ground.

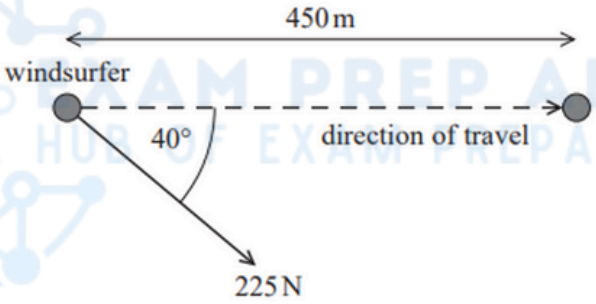
Which of the following is the work done on the box?

- ☒ **A** 150 J
- ☒ **B** 115 J
- ☒ **C** 96 J
- ☒ **D** 23 J

(Total for Question 10 = 1 mark)

114. **May 2023, Q2**

The wind exerts a force of 225N on a windsurfer. The windsurfer moves a distance of 450m at an angle of 40° to the wind, as shown.



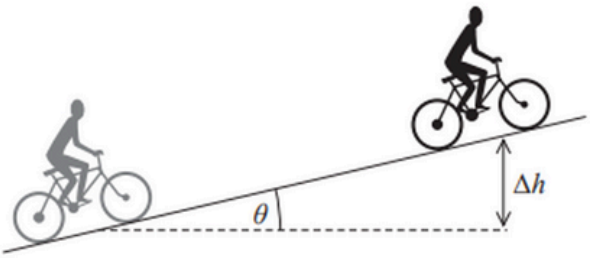
Which of the following expressions gives the work done, in joules, on the windsurfer?

- ☒ **A** 225×450
- ☒ **B** 225×450×cos 40°
- ☒ **C** 225×450×sin40°
- ☒ **D** 225×450×tan 40°

(Total for Question 2 = 1 mark)

115. **May 2022, Q9**

A cyclist rode along a slope at a constant speed. The increase in vertical height of the cyclist was Δh. The slope was at an angle θ to the horizontal as shown.



The forward force of the road on the bicycle was F and air resistance was negligible.

Which of the following gives the work done by the cyclist?

- ☐ **A** $F\,\Delta h \cos\theta$
- ☐ **B** $\frac{F\,\Delta h}{\cos\theta}$
- ☐ **C** $F\,\Delta h \sin\theta$
- ☐ **D** $\frac{F\,\Delta h}{\sin\theta}$

(Total for Question 9 = 1 mark)

1.3.18 (Kinetic energy $E_k = \frac{1}{2}mv^2$)

116. **Oct 2023, Q6**

An object moves with a velocity v.

The kinetic energy of the object is doubled.

Which of the following is an expression for the new velocity of the object?

- ☒ **A** $\sqrt{2v}$
- ☒ **B** 2v
- ☒ **C** $2\sqrt{2}v$
- ☒ D 4v

(Total for Question 6 = 1 mark)

117. **Oct 2022, Q9**

A proton and an electron have equal kinetic energies. The speed of the proton is v.
The mass of a proton is 2000 times greater than the mass of an electron.
Which of the following expressions gives the speed of the electron?

- ☒ **A** $\sqrt{2000} \times v$
- ☒ **B** $\frac{v}{\sqrt{2000}}$
- ☒ **C** $\frac{v}{2000}$
- ☒ **D** $2000 \times v$

(Total for Question 9 = 1 mark)

118. **May 2019, Q7**

A water pump causes g of water to be ejected from the nozzle of a garden hose each second at a velocity of $3ms^{-1}$.
Which of the following expressions could be used to determine the minimum output power in watts required from the pump?

- ☒ **A** $\frac{200\times3^2}{2}$
- ☒ **B** $\frac{0.2\times3^2}{2}$
- ☒ **C** $\frac{200\times3}{2}$
- ☒ **D** $\frac{0.2\times3}{2}$

(Total for Question 7 = 1 mark)

119. **Sample Assess., Q3**

A car is travelling at a velocity v. The driver applies the brakes and the car decelerates until it comes to rest. The work done by the brakes on the car is W.
Which of the following expressions is correct?

- ☒ **A** $W \propto v$
- ☒ **B** $W \propto v^2$
- ☒ **C** $W \propto \frac{1}{v}$
- ☒ **D** $W \propto \frac{1}{v^2}$

(Total for Question 3 = 1 mark)

1.3.19 (Gravitational potential energy $\Delta E_{grav} = mg\Delta h$)

120. **Oct 2023, Q5**

A helicopter moves vertically upwards with an increasing speed.

Which of the following describes the increase in gravitational potential energy of the helicopter?

- ☒ **A** The work done on the helicopter by the force of gravity.
- ☒ **B** The total work done by the helicopter as it moves upwards.
- ☒ **C** The work done by the helicopter against the force of gravity.
- ☒ **D** The work done by the helicopter to increase speed.

(Total for Question 5 = 1 mark)

121. **Oct 2021, Q8**

A crane lifts a container of weight 4.0×10^5N through a height of 25m.

Which of the following gives the gravitational potential energy gained by the container in joules?

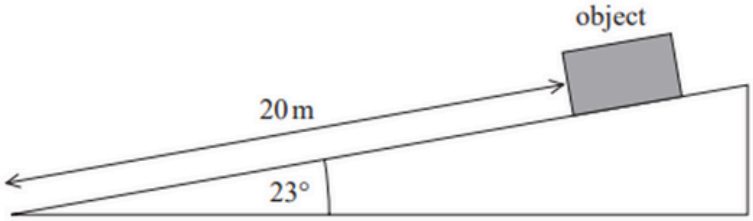
- ☒ **A** $4.0 \times 10^5 \times 9.81 \times 25$
- ☒ **B** $4.0 \times 10^5 \times 25$
- ☒ **C** $4.0 \times 10^5 \times 25 \div 9.81$
- ☒ **D** $4.0 \times 10^5 \div 9.81$

(Total for Question 8 = 1 mark)

1.3.20 (Principle of conservation of energy)

122. **May 2023, Q8**

An object accelerates from rest down a frictionless slope. The object moves a distance of 20m. The slope is at an angle of 23° to the horizontal, as shown.



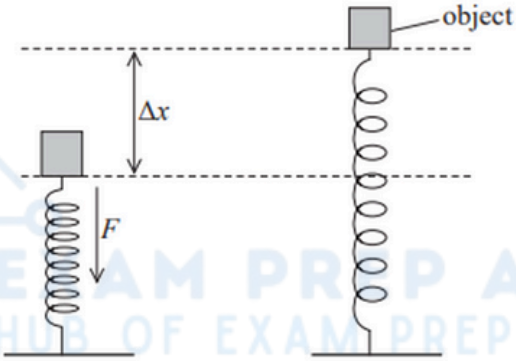
Which of the following gives the final speed of the object in ms^{-1}?

- ☐ **A** $\sqrt{2 \times 9.81 \times 20 \times cos\ 23°}$
- ☐ **B** $\sqrt{0.5 \times 9.81 \times 20 \times cos\ 23°}$
- ☐ **C** $\sqrt{2 \times 9.81 \times 20 \times sin\ 23°}$
- ☐ **D** $\sqrt{0.5 \times 9.81 \times 20 \times \sin 23°}$

(Total for Question 8 = 1 mark)

123. **Jan 2023, Q3**

An object of mass m is resting on top of a spring. The spring is compressed a further distance Δx by a vertical force F. The force is removed and the spring returns to its original length as shown



When Δx becomes zero the object has a vertical speed v.

Which of the following equations describes the energy transfer as the spring returns to its original length?

- ☐ **A** $\frac{1}{2} F\,\Delta x = \frac{1}{2} mv^2 - mg\,\Delta x$
- ☐ **B** $\frac{1}{2} F\,\Delta x = \frac{1}{2} mv^2 + mg\,\Delta x$
- ☐ **C** $F\,\Delta x = \frac{1}{2} mv^2 - mg\,\Delta x$
- ☐ **D** $F\,\Delta x = \frac{1}{2} mv^2 + mg\,\Delta x$

(Total for Question 3 = 1 mark)

124. **Jan 2021, Q2**

An object of mass 8.2 kg, initially at rest, falls a vertical distance of 25m through the air and has a final velocity of $20ms^{-1}$.

Which of the following gives the energy in joules dissipated by air resistance?

- ☐ **A** $8.2 \times 9.81 \times 25$
- ☐ **B** $0.5 \times 8.2 \times 20^2 + 8.2 \times 9.81 \times 25$
- ☐ **C** $8.2 \times 9.81 \times 25 - 0.5 \times 8.2 \times 20^2$
- ☐ **D** $0.5 \times 8.2 \times 20^2 - 8.2 \times 9.81 \times 25$

(Total for Question 2 = 1 mark)

125. **Oct 2020 (May), Q3**

The diagram shows a roller coaster. A roller coaster car stops momentarily at P before descending towards Q.

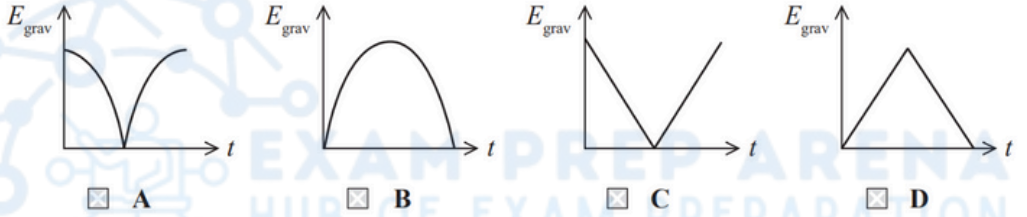
Which of the following expressions could be used to determine the velocity of the roller coaster car at Q?

- ☒ **A** $\sqrt{75g} - \sqrt{30g}$
- ☒ **B** $\sqrt{150g} - \sqrt{60g}$
- ☒ **C** $\sqrt{45g}$
- ☒ **D** $\sqrt{90g}$

(Total for Question 3 = 1 mark)

126. **Jan 2019, Q8**

A ball is dropped, bounces once and is then caught.
Which of the following graphs of gravitational potential energy Egrav against time t could represent the motion of the ball?



☒ **A** ☒ **B** ☒ **C** ☒ **D**

(Total for Question 8 = 1 mark)

1.3.21 (Power, time and energy transferred $P = \frac{E}{t}$)

127. **May 2025, Q9**

The driver of a car applies the brakes. The frictional force F between the tyres and the road is constant.
The average power dissipated by F is 50 kW.
The car moves a distance of 13m in a time of 2.3s before coming to rest.
Which of the following expressions gives F in newtons?

☒ **A** $\frac{50\times10^3\times2.3}{13}$
☒ **B** $\frac{50\times10^3\times13}{2.3}$
☒ **C** $\frac{13}{50\times10^3\times2.3}$
☒ **D** $\frac{2.3}{50\times10^3\times13}$

(Total for Question 9 = 1 mark)

128. **Oct 2024, Q1**

Which of the following units is equivalent to the watt?

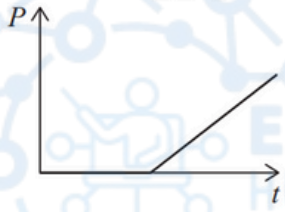
☒ **A** Nm
☒ **B** Nm^{-1}
☒ **C** Js
☒ **D** Js^{-1}

(Total for Question 1 = 1 mark)

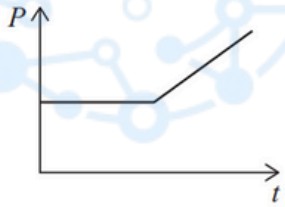
129. **Jan 2024, Q4**

A cyclist moves along a horizontal road at a constant speed. She then moves at the same speed up a hill with a constant gradient.
Which of the following graphs shows how the power output P of the cyclist varies with time t?

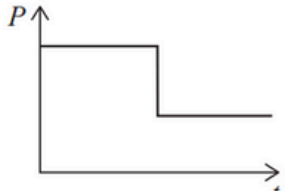
☒ **A**



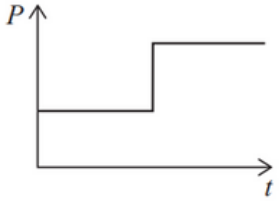
☒ **B**



☒ **C**



☒ **D**



(Total for Question 4 = 1 mark)

130. **Jan 2023, Q8**

A motor lifts a mass of 50000kg through a vertical height of 25m.
The motor has an output power of 700kW.
Which of the following gives the time in seconds taken to lift the mass?

- ☐ **A** $\frac{50000\times25}{700000}$
- ☐ **B** $\frac{50000\times9.81\times25}{700000}$
- ☐ **C** $\frac{50000\times25}{700}$
- ☐ **D** $\frac{50000\times9.81\times25}{700}$

(Total for Question 8 = 1 mark)

131. **May 2022, Q1**

A machine has a power of 750W and transfers 150kJ of energy during a time t.
Which of the following expressions gives t in seconds?

- ☐ **A** $\frac{750}{150}$
- ☐ **B** $\frac{750\times150}{1000}$
- ☐ **C** $\frac{150\times1000}{750}$
- ☐ **D** $\frac{750}{150\times1000}$

(Total for Question 1 = 1 mark)

132. **May 2021, Q6**

A tractor pulls a trailer a distance s in time t. The useful power output of the tractor is P.

Which of the following equations gives the force F of the tractor on the trailer?

- ☐ **A** F = Pts
- ☐ **B** $F = \frac{Pt}{s}$
- ☐ **C** $F = \frac{Ps}{t}$
- ☐ **D** $F = \frac{st}{P}$

(Total for Question 6 = 1 mark)

133. **Jan 2021, Q10**

A locomotive pulls a train at constant speed against a force of 8400kN. The output power of the locomotive is 70MW.
Which of the following gives the time in seconds for the locomotive to pull the train a distance of 1km?

- ☐ **A** $\frac{70\times10^6}{8400\times10^3}$
- ☐ **B** $\frac{70}{8400\times10^3}$
- ☐ **C** $\frac{8.4\times10^6\times10^3}{7\times10^7}$
- ☐ **D** $\frac{8400}{70\times1000}$

(Total for Question 10 = 1 mark)

134. **Jan 2020, Q1**

Which of the following quantities has the SI base units $kgm^2\ s^{-3}$?

- ☐ **A** force
- ☐ **B** momentum
- ☐ **C** power
- ☐ **D** work done

(Total for Question 1 = 1 mark)

135. **Oct 2019, Q2**

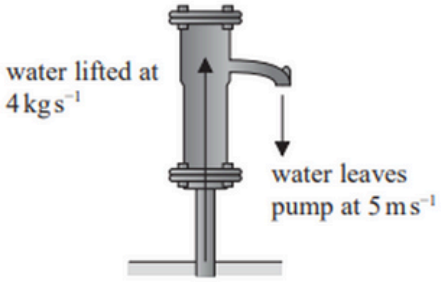
All quantities may be expressed in terms of SI base units.
Which of the following are the base units for the moment of a force?

- ☐ **A** kg ms^{-2}
- ☐ **B** kg $m^2 s^{-2}$
- ☐ **C** kg ms^{-1}
- ☐ **D** kg $m^2 s^{-3}$

(Total for Question 2 = 1 mark)

136. **Oct 2019, Q8**

An electric pump lifts water from a well through a height of 10m at a rate of$4kgs^{-1}$.
The water leaves the pump with a velocity of $5ms^{-1}$ a as shown.



Which of the following expressions could be used to determine the minimum power output of the pump in watts?

- ☐ **A** $\frac{1}{2}(4 \times 5^2)$
- ☐ **B** $(4 \times 9.81 \times 10)$
- ☐ **C** $(4 \times 9.81 \times 10) + \frac{1}{2}(4 \times 5^2)$
- ☐ **D** $(4 \times 9.81 \times 10) - \frac{1}{2}(4 \times 5^2)$

(Total for Question 8 = 1 mark)

137. **Jan 2019, Q2**

Which of the following is equivalent to 1 kilowatt-hour?

- ☐ **A** 0.28 J
- ☐ **B** 0.28 W
- ☐ **C** 3.6 × 106 J
- ☐ **D** 3.6 × 106

(Total for Question 2 = 1 mark)

1.3.22 (Efficiency)

138. **Oct 2024, Q6**

1 A person stands on a moving staircase.
The moving staircase increases the gravitational potential energy of the person by 5000J in a time of 42 s.
The efficiency of the moving staircase is 0.63
Which of the following expressions gives the power input to the moving staircase in watts?

- ☒ **A** $\frac{42}{5000 \times 0.63}$
- ☒ **B** $\frac{42 \times 0.63}{5000}$
- ☒ **C** $\frac{5000}{42 \times 0.63}$
- ☒ **D** $\frac{5000 \times 0.63}{42}$

(Total for Question 6 = 1 mark)

139. **MAY 2024, Q1**

An engine is used to remove water from a mine. The engine transfers energy to the water at a rate of 180 kW and wastes energy at a rate of 60 kW.

Which of the following expressions gives the efficiency of the engine?

- ☒ **A** $\frac{180}{240}$
- ☒ **B** $\frac{60}{240}$
- ☒ **C** $\frac{60}{180}$
- ☒ **D** $\frac{180}{300}$

(Total for Question 1 = 1 mark)

140. **Oct 2023, Q7**

A power station provides an electrical output power of 2.1 GW.

The power station transfers thermal energy to the surroundings at a rate of 3.4 GW.

Which of the following gives the efficiency of the power station?

- ☒ **A** $\frac{2.1}{3.4+2.1}$
- ☒ **B** $\frac{3.4}{3.4+2.1}$
- ☒ **C** $\frac{3.4-2.1}{2.1}$
- ☒ **D** $\frac{3.4-2.1}{3.4}$

(Total for Question 7 = 1 mark)

141. **Oct 2022, Q10**

An electric pump has an output power of 25kW and an efficiency of 52%.
Which of the following expressions gives the rate in kW at which energy is dissipated?

- ☒ **A** 0.48×25
- ☒ **B** 0.52×25
- ☒ **C** $\frac{0.48 \times 25}{0.52}$
- ☒ **D** $\frac{25}{0.52}$

(Total for Question 10 = 1 mark)

142. **May 2021, Q4**

A hydroelectric power station has an efficiency of 32%. In one hour the useful energy output of the power station is 1.2×10^{13} J.

Which of the following expressions gives the total power input to the power station in watts?

- ☒ **A** $1.2 \times 10^{13} \times 0.32$
- ☒ **B** $\frac{12 \times 10^{13}}{0.32 \times 3600}$
- ☒ **C** $\frac{1.2 \times 10^{13} \times 0.32}{3600}$
- ☒ **D** $\frac{1.2 \times 10^{13}}{0.32}$

(Total for Question 4 = 1 mark)

143. **Oct 2020 (May), Q6**

A lamp with an efficiency of 0.68 usefully transfers 120 J of energy.

Which of the following can be used to determine E, the energy supplied to the lamp?

- ☒ **A** $E = 0.68 \times 120 \times 100$
- ☒ **B** $E = 0.68 \times 120$
- ☒ **C** $E = \frac{120}{0.68} \times 100$
- ☒ **D** $E = \frac{120}{0.67}$

(Total for Question 6 = 1 mark)

144. **Jan 2020, Q8**

A motor with an efficiency of 68% is used to raise a load of 350N through a height of 25m.

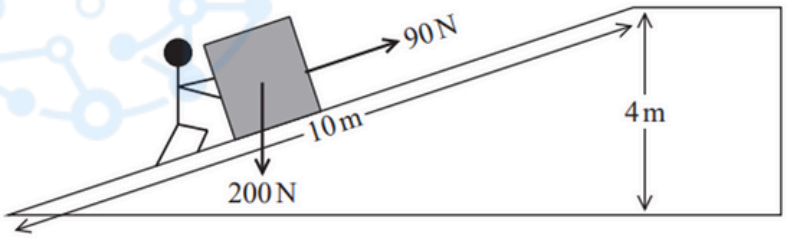
Which of the following expressions gives the energy supplied to the motor?

- ☒ **A** $\frac{68}{350 \times 25}$
- ☒ **B** $\frac{0.68}{350 \times 25}$
- ☒ **C** $\frac{350 \times 25}{68}$
- ☒ **D** $\frac{350 \times 25}{0.68}$

(Total for Question 8 = 1 mark)

145. **Jan 2019, Q4**

A force of 90 N is used to push a box along a ramp of length 10 m, up to a platform. The platform is 4 m above the ground. The weight of the box is 200 N.



Which of the following expressions could be used to determine the efficiency of the ramp?

- ☒ A $\frac{90 \times 10}{200 \times 4}$
- ☒ B $\frac{200 \times 4}{(90 \times 10) + (200 \times 4)}$
- ☒ C $\frac{200 \times 4}{90 \times 10}$
- ☒ D $\frac{90 \times 10}{(90 \times 10)(200 \times 4)}$

(Total for Question 4 = 1 mark)