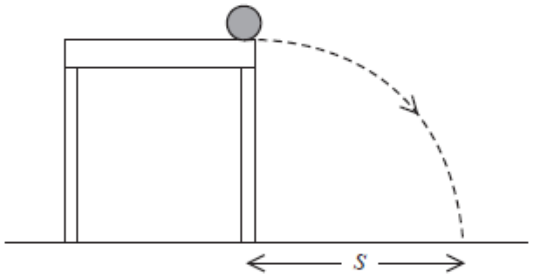
Questions

Q1.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A ball rolls off a table with a horizontal velocity of 1.2 m s^{-1}. The ball takes 0.9 s to reach the ground and lands a distance *s* from the table as shown.



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

☒ **A** $\frac{1.2^2}{2 \times 9.81}$

☒ **B** 1.2×0.9

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

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

(Total for question = 1 mark)

Q2.

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?

(1)

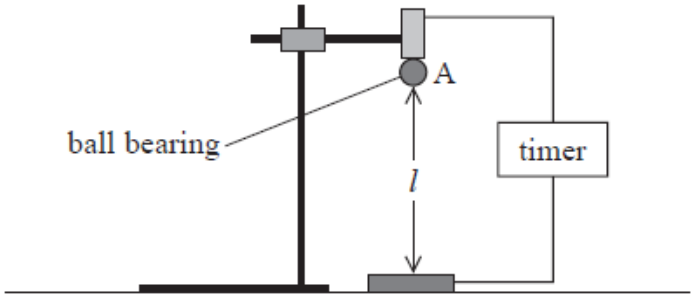
- **A** P
- **B** Q
- **C** R
- **D** S

(Total for question = 1 mark)

Q3.

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

A ball bearing was released from position A. The time *t* for the ball bearing to fall a distance *l* was measured. This was repeated for decreasing values of *l*.



Explain how the measurements obtained can be used to determine a value for *g* in m s^{-2}. Your answer should include a sketch on the axes below of the graph that the student would expect to obtain.

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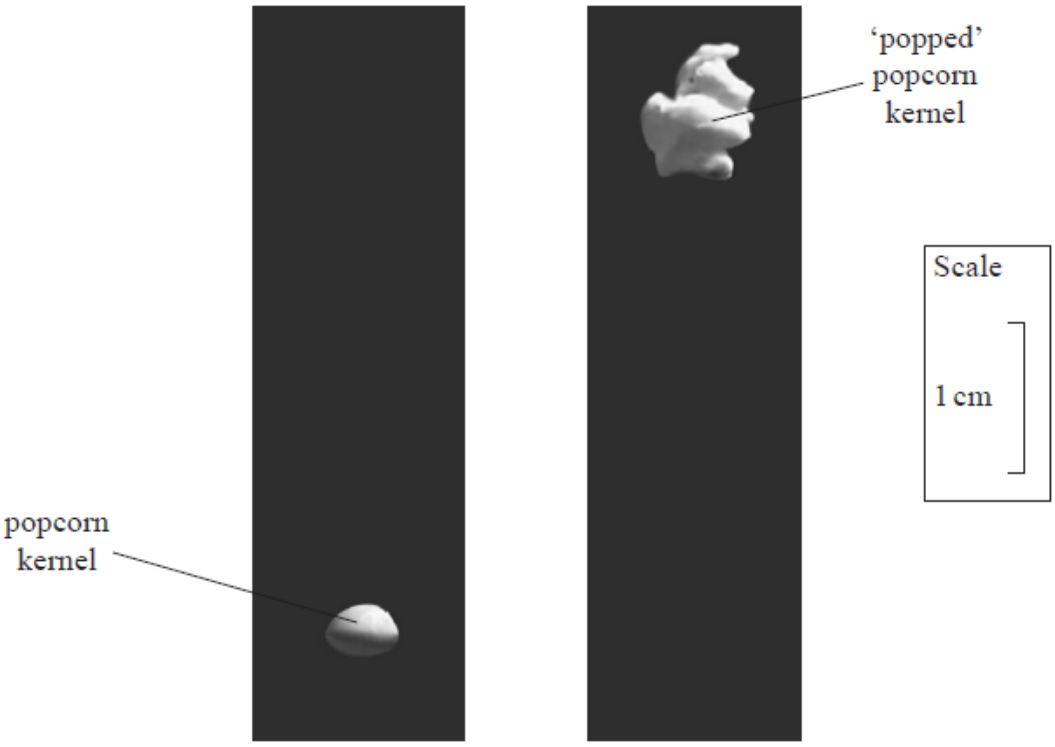
(Total for question = 5 marks)

Q4.

Popcorn kernels contain water. When heated, the water turns to steam. The kernel 'pops' and moves upwards.



(a) The photographs above show a popcorn kernel just before popping and at the maximum height after popping. The time between the two photographs was 83 ms.

(i) Determine the maximum height after popping.

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Maximum height = ...

(ii) Calculate the initial speed of the 'popped' popcorn kernel.

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Initial speed = ...

(b) The average water content in a popcorn kernel is 14% of the total mass of the kernel.

A kernel is heated until it pops. Steam is ejected downwards, and the popped kernel moves upwards with an initial speed of 1.5 m s^{-1}.

Calculate the speed at which the steam is ejected.

total mass of unpopped kernel = 0.11 g

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Speed = ...

(Total for question = 9 marks)

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Quantities in physics are classified as either vectors or scalars.

Which of the following units could **only** be used for a scalar quantity?

☒ **A** $m\ s^{-1}$

☒ **B** $m\ s^{-2}$

☒ **C** $kg\ m\ s^{-2}$

☒ **D** $kg\ m^{-3}$

(Total for question = 1 mark)

Q6.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

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

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

☐ **A** $1 \div 0.32^2$

☐ **B** $0.5 \div 0.32$

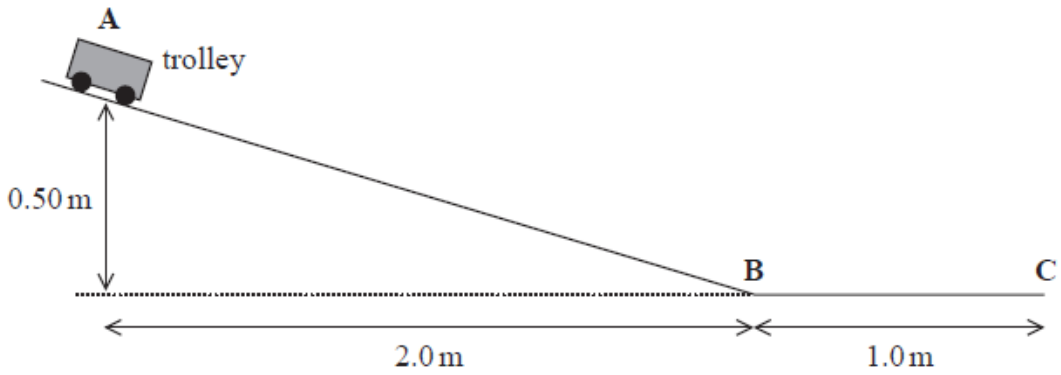
☐ **C** $100 \div 0.32^2$

☐ **D** $50 \div 0.32$

(Total for question = 1 mark)

Q7.

A trolley accelerates from rest at point A, down a straight track to point B. The trolley then continues along a horizontal track to point C, as shown.



The effects of air resistance and friction are negligible.

(a) Show that the trolley reaches point B with a speed of about 3 m s^{-1} .

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(b) Determine the time taken by the object to move from point A to point C.

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Time taken = ...

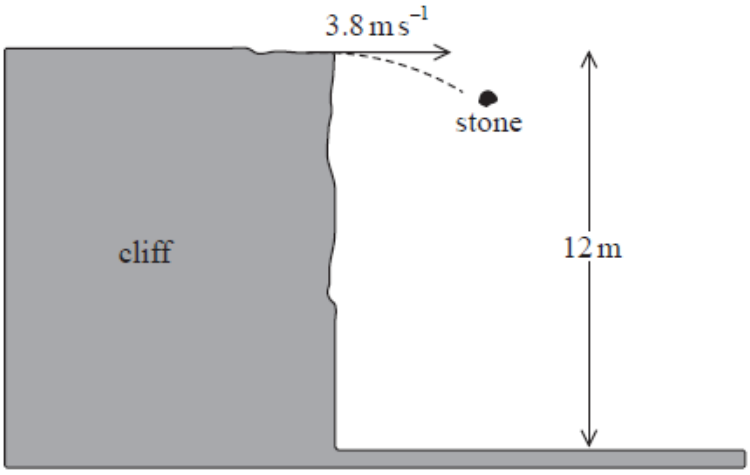
(Total for question = 7 marks)

Q8.

A stone is projected horizontally from a cliff.

The initial horizontal velocity of the stone is 3.8 m s^{-1}.

The initial height of the stone is 12 m, as shown.



Calculate the horizontal distance from the bottom of the cliff to where the stone hits the ground.

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Horizontal distance = ...

(Total for question = 3 marks)

Q9.

A rock falls from rest through a small distance s to the surface of Mars. The rock hits Mars with velocity v_M.

Another rock falls from rest through distance s to the surface of Earth and hits Earth with velocity v_E.

Calculate the ratio $\frac{v_M}{v_E}$.

acceleration due to gravity on Mars = 0.38g

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$\frac{v_M}{v_E}$ = ...

(Total for question = 3 marks)

Q10.

A ball is travelling horizontally at a speed of 7.0 m s^{-1}. The ball hits a vertical wall and rebounds along its initial path at a speed of 5.0 m s^{-1}.
The ball has an acceleration of 300 m s^{-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 = 1 mark)

Q11.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer

with a cross ☒.

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

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

☒ **A** $\frac{5-3}{15}$

☒ **B** $\frac{5-3}{2\times 15}$

☒ **C** $\frac{5^2-3^2}{15}$

☒ **D** $\frac{5^2-3^2}{2\times 15}$

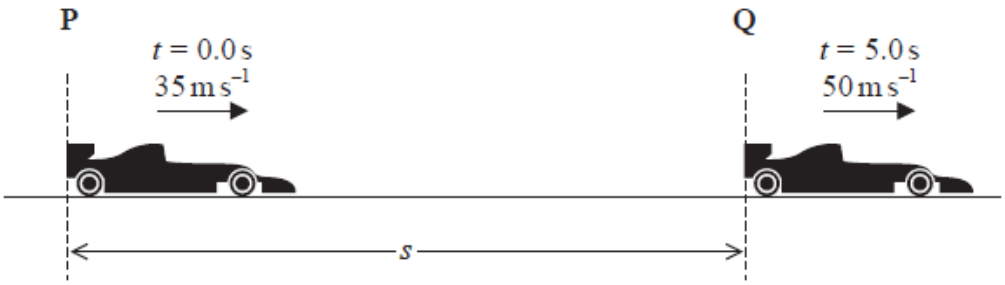
(Total for question = 1 mark)

Q12.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A racing car passes point P at a speed of 35 m s^{-1}.

The car accelerates uniformly and after 5.0 s passes point Q at a speed of 50 m s^{-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 = 1 mark)

Q13.

A car is moving towards a stop sign at a speed of 25 m s^{-1}. The driver applies the brakes 20 m 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 m s^{-2}?

☒ **A** $\frac{25}{40}$

☒ **B** $\frac{25}{20}$

☒ **C** $\frac{25^2}{40}$

☒ **D** $\frac{25^2}{20}$

(Total for question = 1 mark)

Q14.

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	$9.81\,m\,s^{-2}$
☒ B	$9.81\,m\,s^{-2}$	0
☒ C	$9.81\,m\,s^{-2}$	$9.81\,m\,s^{-2}$
☒ D	0	0

(Total for question = 1 mark)

Q15.

Select one answer from A to D and put a cross in the box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

An object on the Moon falls a vertical distance of 0.32 m, from rest, in a time of 0.63 s.

Which of the following expressions gives the acceleration due to gravity on the Moon in m s^{-2}?

☒ **A** $\dfrac{0.32}{2 \times 0.63}$

☒ **B** $\dfrac{0.32}{2 \times 0.63^2}$

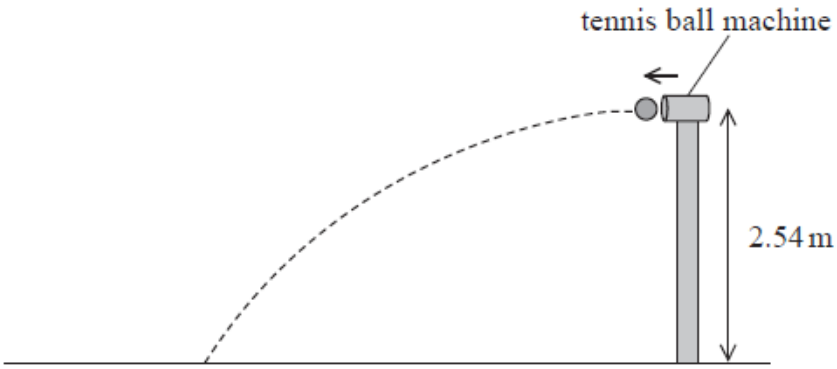
☒ **C** $\dfrac{2 \times 0.32}{0.63^2}$

☒ **D** $\dfrac{2 \times 0.32}{0.63}$

(Total for question = 1 mark)

Q16.

Tennis players can practise using a tennis ball machine. The machine projects tennis balls horizontally from a height of 2.54 m, as shown.



(a) (i) Show that the time taken for a ball to reach the ground is about 0.7 s.

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(ii) The ball lands on the ground at a horizontal distance of 17.89 m from the machine.

Calculate the velocity of the ball as it is projected from the machine.

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Velocity = ...

(b) The initial velocity of the ball, as it is projected from the machine, can be increased.

Explain how increasing the initial velocity would affect the angle at which the ball hits the ground.

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(Total for question = 7 marks)

Q17.

A firework is launched into the air and explodes once it reaches a maximum height.

(a) The firework is designed to explode at a maximum height of 350 m.

(i) Show that the vertical component of the velocity at launch is about 80 m s^{-1}.

(2)

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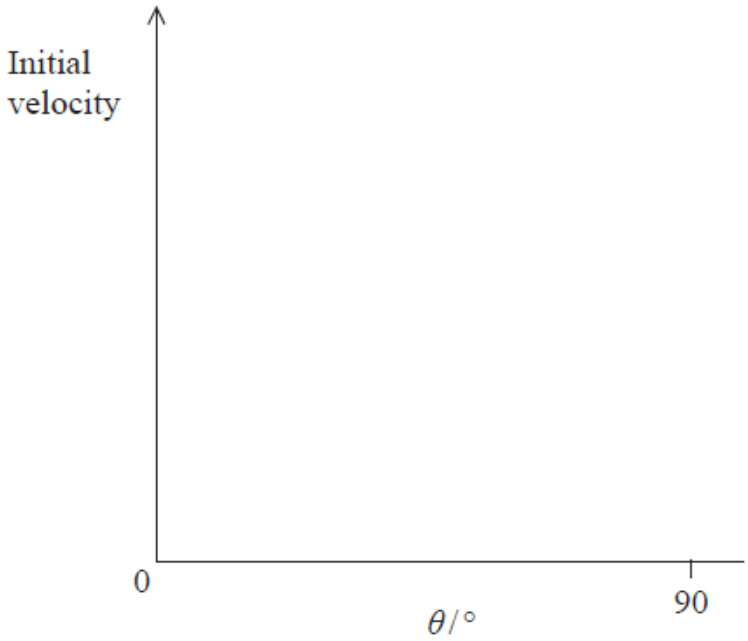
(ii) The vertical component of the velocity at launch depends on both the initial velocity of the firework and θ, the angle between the initial velocity and the horizontal.

Sketch a graph showing how the initial velocity required for the firework to reach the maximum height of 350 m varies with θ for the firework.

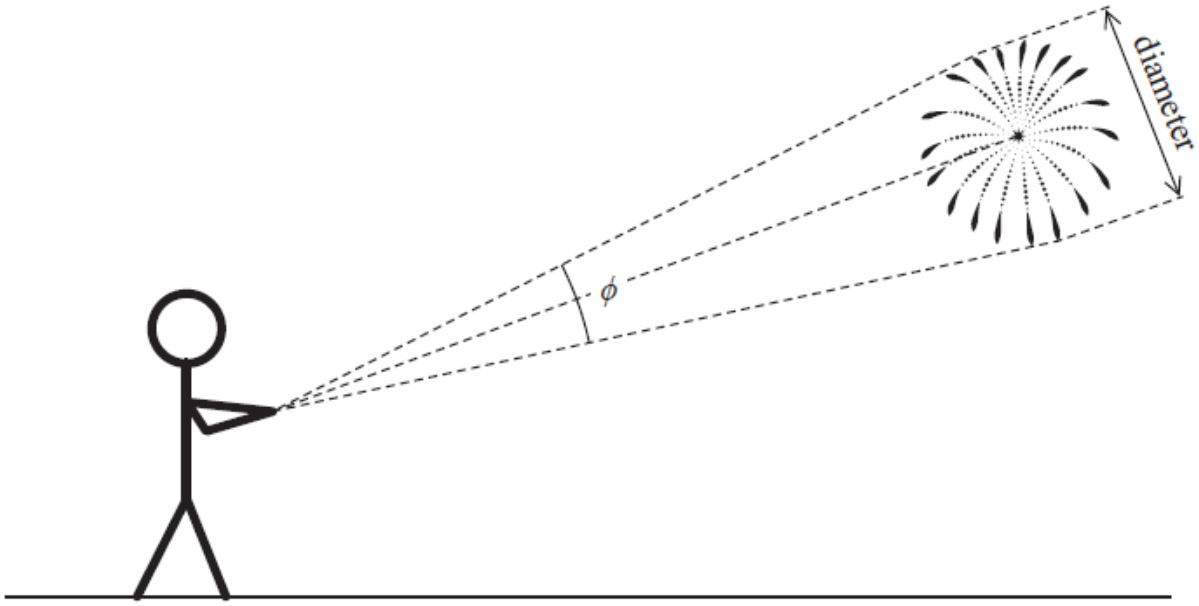
(4)



(b) A student wanted to estimate the maximum diameter of the firework after exploding.

The student estimated:

- the time taken between seeing the firework explode and hearing the firework explode
- the angle ϕ from the top to the bottom of the firework



Describe how the student could determine the maximum diameter of the exploded firework using the estimated data.

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(Total for question = 8 marks)