Student Number.....

Hornsby Girls' High School

2022

YEAR 11 YEARLY
EXAMINATION

Physics Assessment Task 3

General Instructions

- Reading time – **5 minutes**
- Working time – **2 hours**
- NESA approved calculators may be used
- A data sheet, formula sheet and Periodic Table are provided at the back of this paper
- For questions in Section II, show all relevant working in questions involving calculations

Total marks:
70

Section I — 20 marks

- Attempt Questions 1–20
- Allow about 30 minutes for this part
- Write your answers on the answer sheet provided

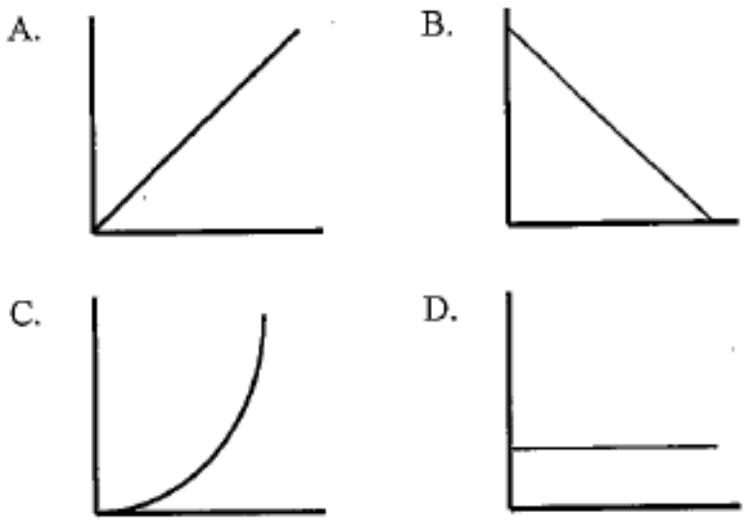
Section II — 50 marks

- Attempt All Questions
- Allow about 1 hour and 30 minutes for this part

Section I

Use the multiple-choice answer sheet provided for Questions 1–20.

1. An object is accelerating at a constant rate. Which graph best displays the relationship between the force applied to the object over time?



2. A car travelling at 60.0 kmh^{-1} applies its brakes and comes to a complete stop in 5.5 seconds.

What was the acceleration of the car?

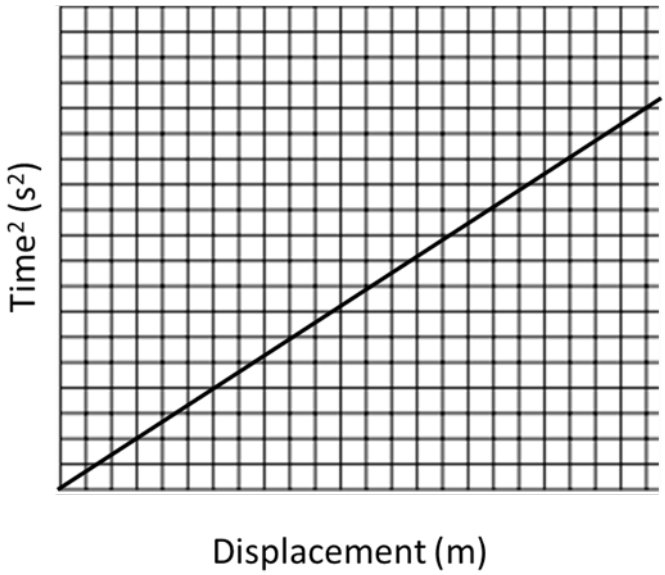
A. -3.0 ms^{-2}
B. 3.0 ms^{-2}
C. -10.9 ms^{-2}
D. 10.9 ms^{-2}

3. A ball was thrown straight up at 8.0 ms^{-1}. What is the maximum height it will reach relative to its release position?

A. 2.0 m
B. 2.1 m
C. 3.2 m
D. 3.3 m

4. Students used a ball-dropping experiment to determine the acceleration due to gravity. They timed how long it took a ball to reach the ground from different heights.

The graph below shows the line of best fit they produced. Note that the axes do not include their scales.



The students used the gradient (m) of the line of best fit to determine the acceleration due to gravity (g).

Which equation would the students then use to determine their value for gravity from the gradient?

A. g = 2m

B. g = m

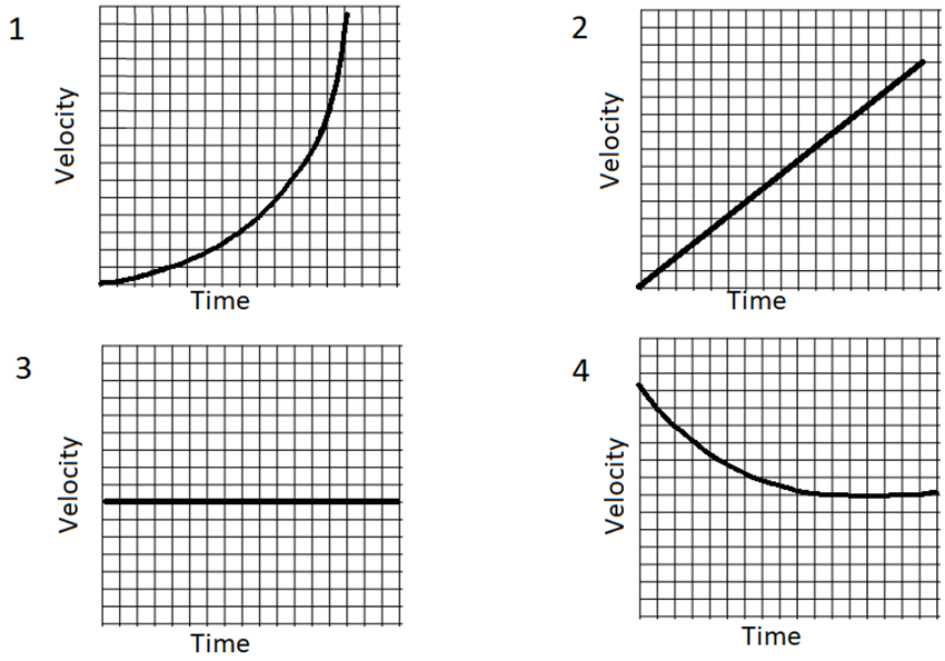
C. $g = \frac{2}{m}$

D. $g = \frac{m}{2}$

5. A new electric car on the market has a mass of 2250kg and can accelerate from 0 to 100 km.h^{-1} in 3.00 seconds. What is the power required to cause this acceleration?

A. 37.5 KW
B. 289 KW
C. 868 KW
D. 3.75 MW

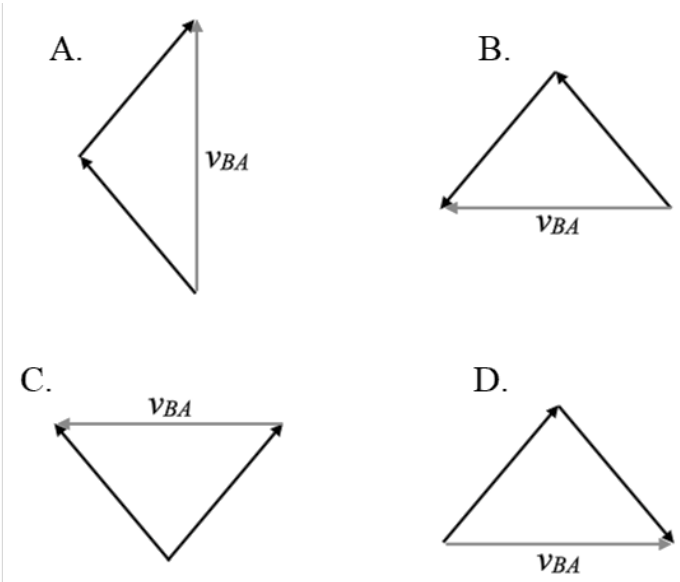
6. Shown below are four velocity vs time graphs.



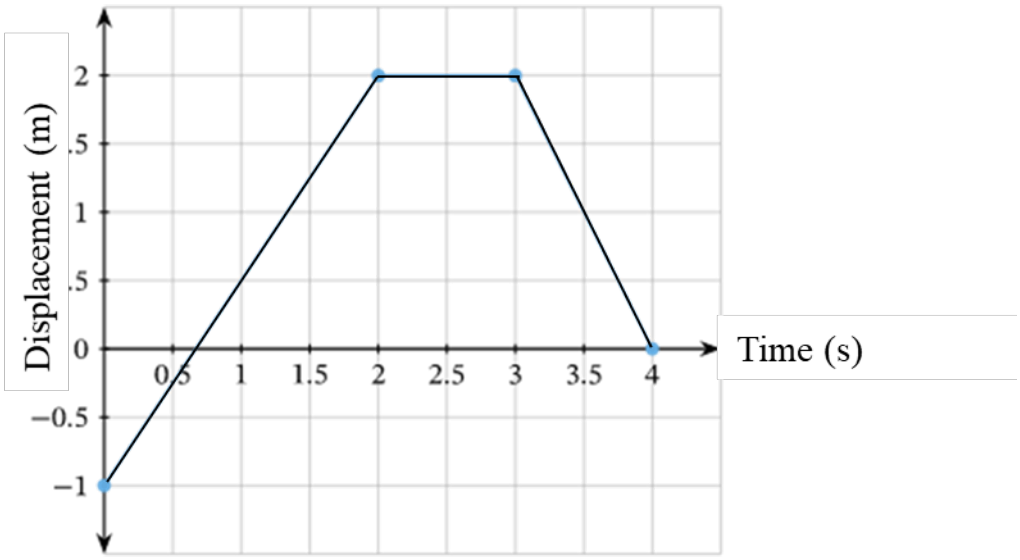
Which row correctly identifies the type of acceleration shown in each graph?

	Constant acceleration	Zero acceleration	Increasing acceleration	Decreasing acceleration
A.	2	3	1	4
B.	2	1	3	4
C.	3	4	1	2
D.	4	3	2	1

7. Plane A is travelling Northwest. Plane B is travelling Northeast.
Which of the following vector diagrams represents the velocity of B relative to A?



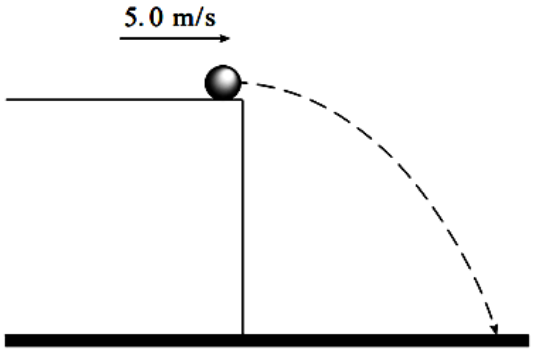
8. The graph below shows motion of an object over 4.0 s.



What is the average velocity of the object?

A. 0.0 ms^{-1}
B. 0.25 ms^{-1}
C. 0.75 ms^{-1}
D. 1.0 ms^{-1}

9. A 0.5 kg ball rolls off a horizontal surface as shown in the diagram.



Determine the magnitude of the impulse given to the ball by gravity during the 0.80 seconds it takes the ball to fall to the ground.

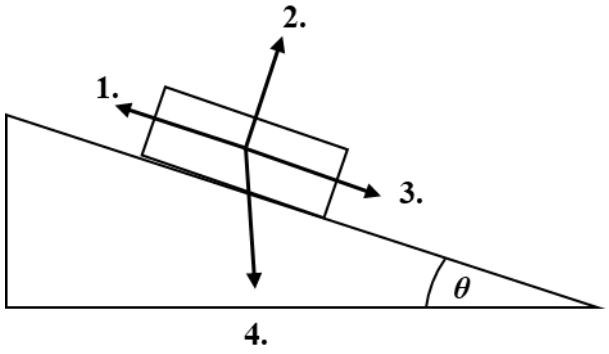
A. 0.9 N.s

B. 1.8 N.s

C. 2.9 N.s

D. 3.9 N.s

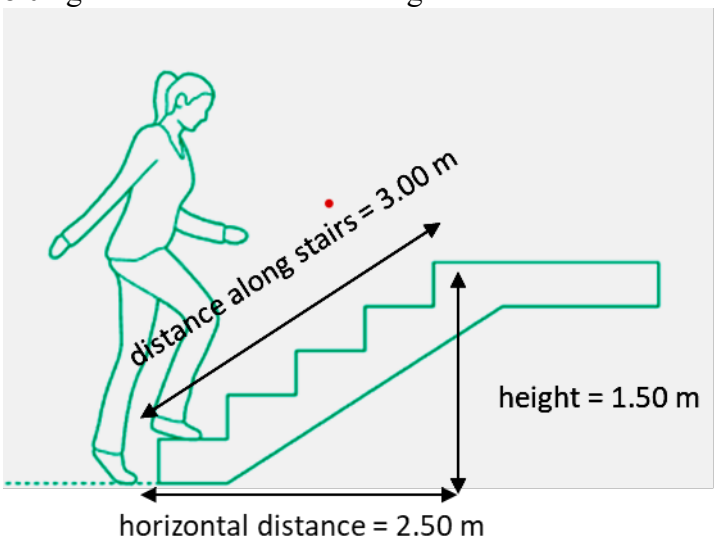
10. The diagram below shows a free body diagram of the 4 forces acting on a block on an inclined plane sliding down at a constant speed. The block has mass, m, and is situated on earth with a gravity, g, acting. The inclined angle is represented by θ



Which statement is correct regarding for the forces acting on the block?

A. there is a net force down the ramp
B. friction and the normal force are in balance
C. force 1 and 3 are equal and opposite
D. force 2 is independent of the angle

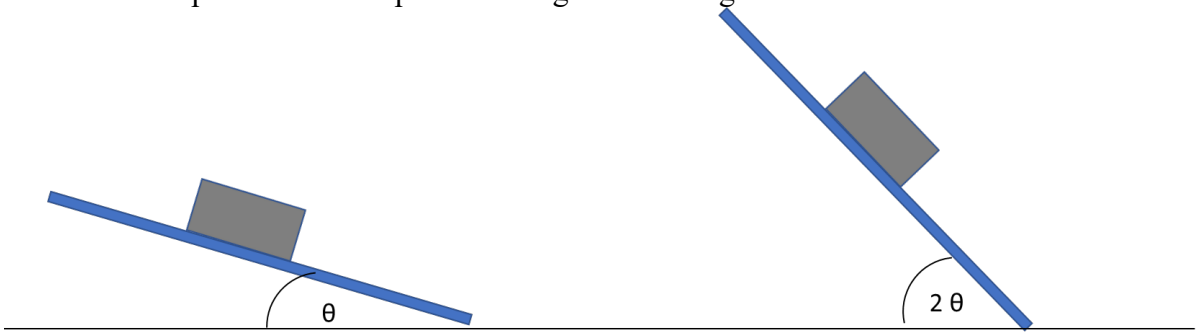
11. A 38.0 kg student climbs a short flight of stairs in a time of 4.5 s.



How much does her potential energy change?

A. 114 J
B. 559 J
C. 931 J
D. 1120 J

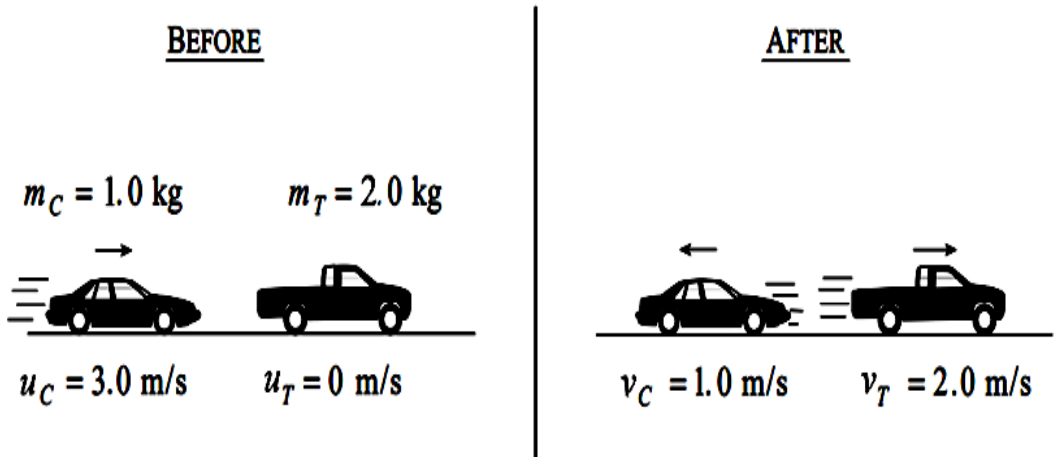
12. A block is placed on a ramp with an angle θ. The angle is then increased to 2θ.



Which statement is true about the friction between the block and the ramp?

A. the amount of friction is the same for both angles
B. there is more friction on the steeper ramp
C. there is less friction on the steeper ramp
D. the friction is different by a factor of 2

13. The diagram shows a collision between a 1.0 kg toy car and a stationary 2.0 kg toy truck. After the collision, the car bounces back at 1.0 ms-1 while the truck goes forward at 2.0 ms$^{-1.}$



Based on these values, are momentum and kinetic energy conserved?

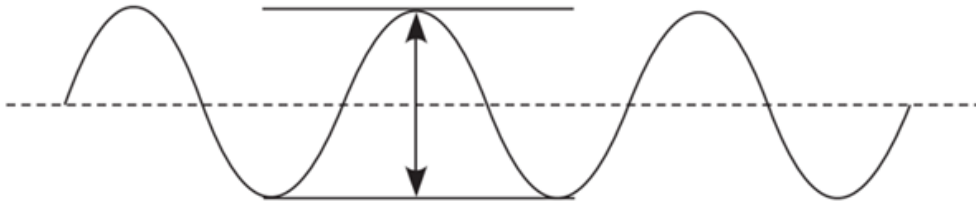
	Momentum conserved	Kinetic energy conserved
A.	Yes	Yes
B.	Yes	No
C.	No	Yes
D.	No	No

14. A taut string is plucked once and makes a note with a frequency of 875 Hz. The length of string is 25.0 cm.

What is the speed of sound in the string?

A. 170 ms^{-1}
B. 219 ms^{-1}
C. 340 ms^{-1}
D. 438 ms^{-1}

15. The diagram below shows a cross section of a medium at an instant in time as a wave moves through it.



What value does the double ended arrow show?

A. amplitude
B. wavelength
C. period
D. wave height

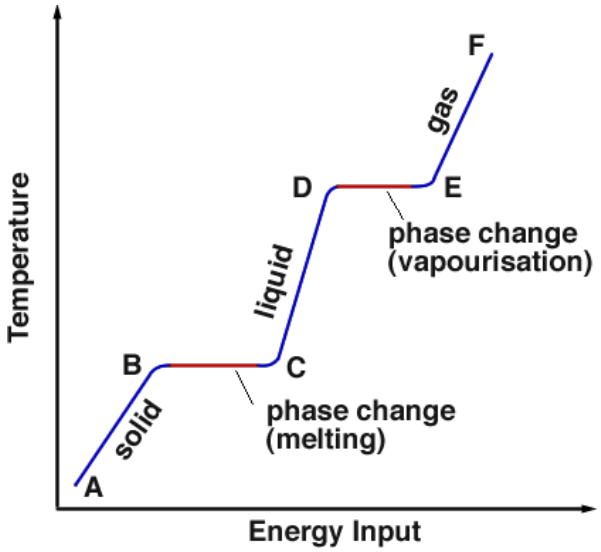
16. What conditions are necessary for total internal reflection to occur?

A. the wave must travel from a slower medium to a faster medium
B. the refractive index from medium 1 into medium 2 is greater than 1.0
C. the wave must travel from a more dense medium to a less dense medium
D. the wave must travel from one medium to another and the frequency increases

17. A coil of nichrome wire was placed into 200 ml of water. A voltage of 12.0 V was applied to the coil for 3.0 minutes resulting in a current of 4.5 A. Assuming no loss of energy to the environment, what is the change in temperate of the water?

A. 2.0°
B. 12°
C. 18°
D. 54°

18. The graph shows water, initially frozen, being heated at a steady rate.



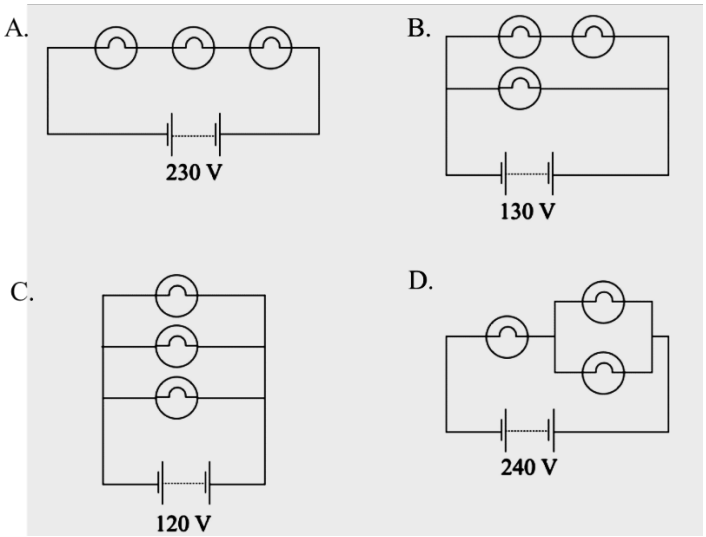
Which section of the graph is related to the latent heat of fusion?

A. AB
B. BC
C. CD
D. DE

19. Two electrons are at rest with a separated by 5.7 x 10^{-6} m. What is the magnitude of the electrostatic force they would experience from each other?

A. 4.1 x 10^{-23} N
B. 5.6 x 10^{-13} N
C. 2.5 x 10^{-4} N
D. 4.0 x 10^{-44} N

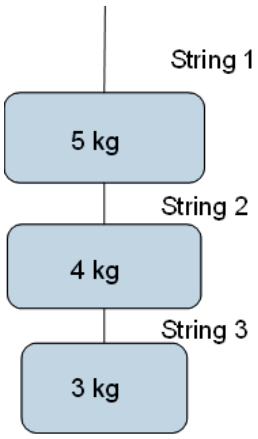
20. Four circuits were constructed using identical light globes. Which circuit has the lowest total resistance?



Section II

Question 21 (4 marks)

The diagram shows three blocks connected by strings.



What is the tension force in string 1 when the blocks are stationary? (2)

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The system now starts accelerating downwards at 5 $m.s^{-2}$

What is the tension in string 2 ? (2)

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Question 22 (3 marks)

A popular street in Hornsby will have its speed limit reduced from 40 km/hr to 30 km/hr. If the force applied by a braking car is the same at both speeds, how would this change affect the stopping distance of the vehicles travelling on this street? Use calculations or a sketch graph to support your answer.

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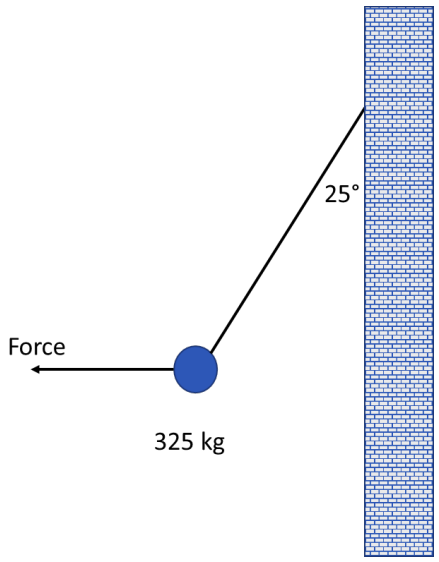
Question 23 (4 marks)

A wrecking ball with a mass of 325 kg is attached to a wall via a cable and is pulled horizontally by a force, F, so that is is held and an angle of 25.0 º to the vertical as shown.

Working space for vector diagram



a) Use vector analysis to find the magnitude of the force F. (3)

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b) What is the magnitude and direction of the vertical force that the wall exerts on the cable? (1)

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Question 24 (4 marks)

In a game of snooker the white ball (cue ball) has a mass of 0.17 kg and the number 5 ball has a mass of 0.16 kg. The cue ball collides with the stationary number 5 ball at 2.2 ms^{-1}. It then comes to a stop. The number 5 ball moves along same line as the cue ball.

(a) Calculate the velocity of the number 5 ball after the collision. 2

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Q 24 continued next page

(b) If the collision occurred in 0.1 seconds, how much force did the number 5 ball exert on the cue ball? 2

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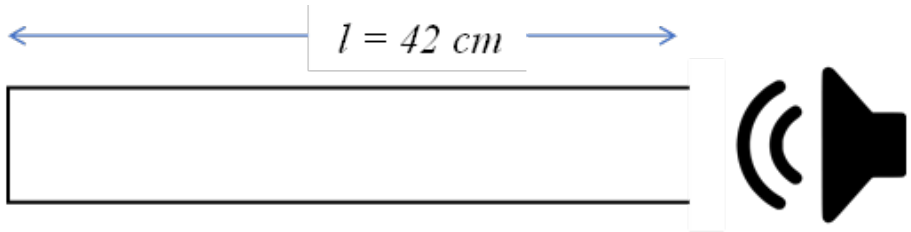
Question 25 (5 marks)

A speaker is used to direct a sound wave into a pipe closed at one end shown below.



a) Sketch the standing wave for the fundamental frequency on the diagram and **label** any nodes and antinodes. (2)

b) The speed of sound is measured as 340 ms^{-1}. Determine the fundamental frequency. (2)

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c) What is the frequency of the 2^{nd} overtime? (1)

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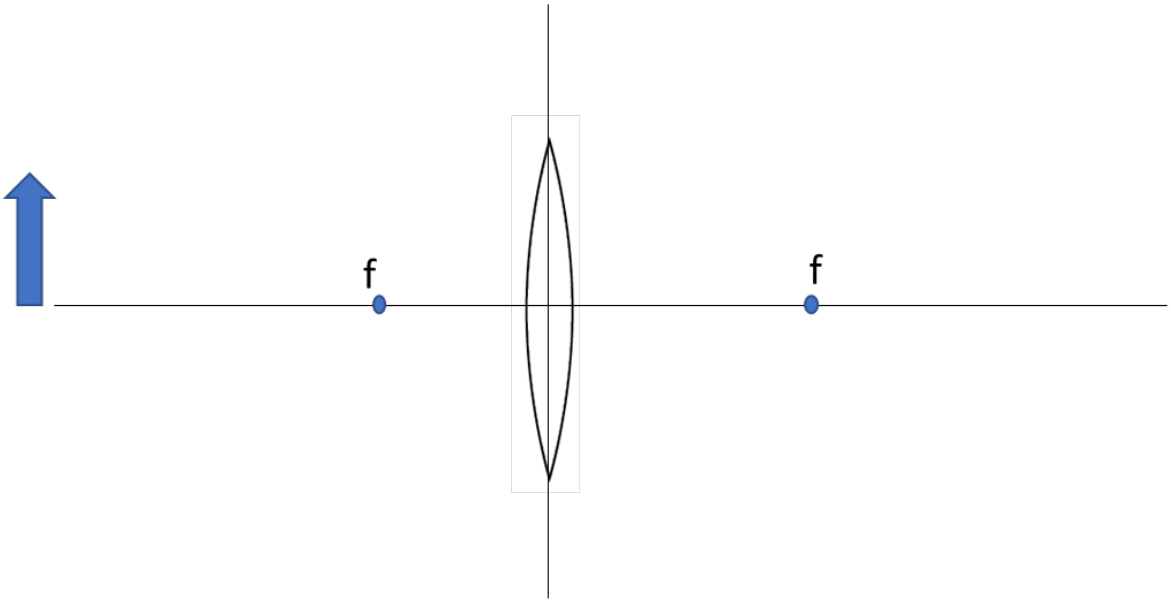
Question 26 (4 marks)

An object is placed as shown in the diagram



a) Construct a ray diagram to show the image that would be formed. (2)

b) Describe the nature of the image. (2)

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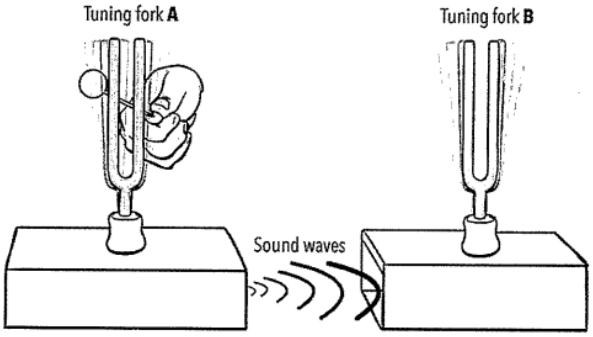
Question 27 (3 marks)

Both tuning forks produce the same frequency of 256 Hz when struck by a hammer.



Tuning fork A is struck and allowed to vibrate. Tuning fork B is brought close to A and it begins to vibrate at 256 Hz. Explain the behaviour of tuning fork B

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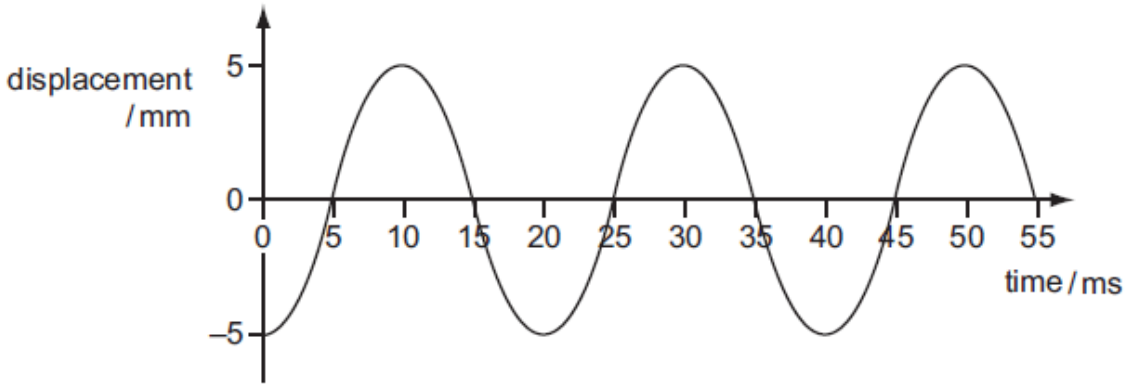
Question 28 (4 marks)

The wave show below is travelling at 50.0 cm s^{-1} through a medium.



a) What is the frequency and wavelength of the wave? (2)

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b) The wave encounters a change in medium and speeds up to 75.0 cm s^{-1}. What happens to the wavelength and frequency? (2)

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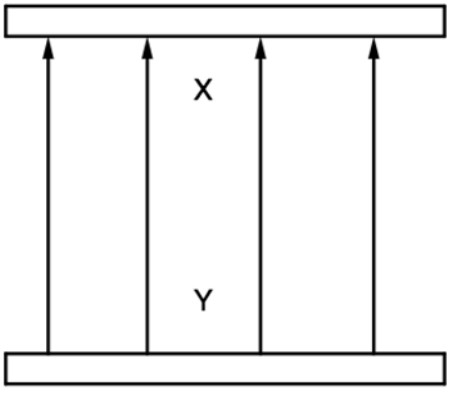
Question 29 (4 marks)

The diagram shows electric field lines between two parallel plates charged. A positive charge is placed at X. It is then moved to point Y.



a) There is a potential difference of 6 volts between the plates. Draw the equipotential line of 4 V. (1)

b) Compare the force due to the field at both positions. (1)

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Q29 continued on next page

c) What would the separation of the plates be, in cm, if the field strength is 10.5 Vm^{-1}? (2)

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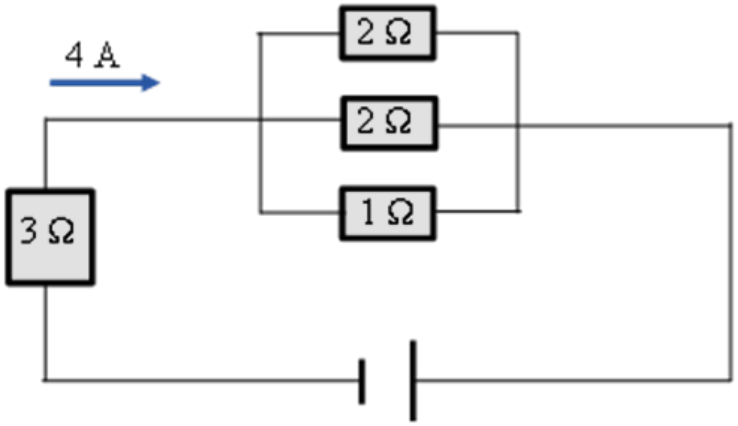
Question 30 (5 marks)

The diagram shows 4 resistors connected to a power supply.



a) What is the voltage drop across the 3 Ω resistor? (1)

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b) What is the current through the 1Ω resistor? (2)

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c) Determine the total voltage supplied to the circuit. (2)

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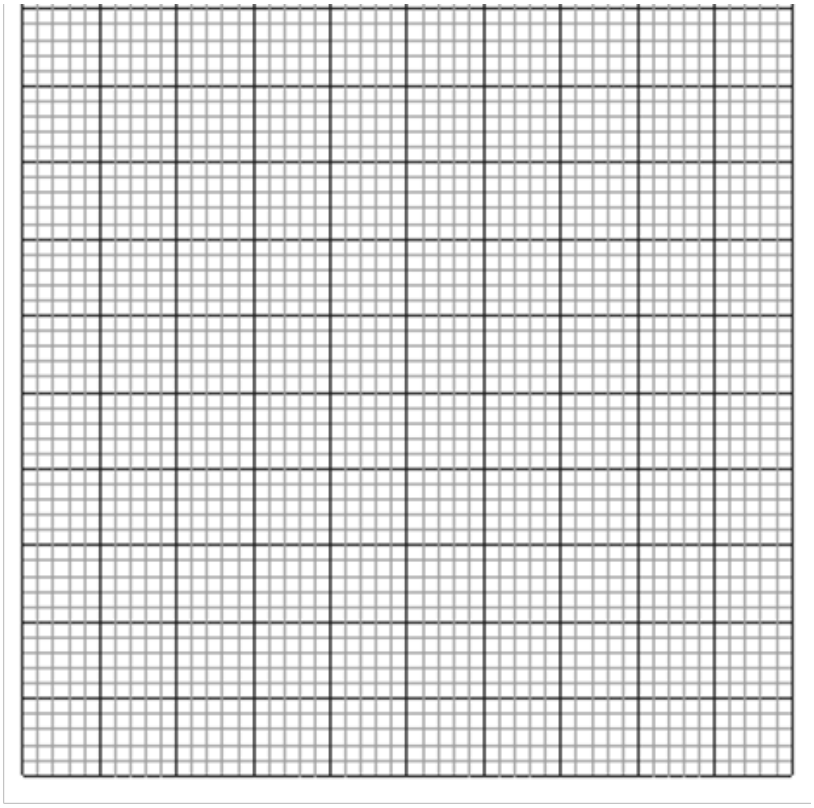
Question 31 (5 marks)

Some physics students conducted an experiment to determine the resistance of a ceramic resistor attached in a simple series circuit. The circuit consisted of only a transformer, ammeter, the ceramic resistor, voltmeter, and the wires needed to connect them.
Assume all equipment was ideal (correctly calibrated, no additional sources of resistance or voltage loss).
They collected the data below:

Voltage(V)	Current (A)
0.0	0.0
1.0	1.5
2.0	2.5
3.0	3.5
4.0	4.5
5.0	5.0
6.0	5.0
7.0	5.0

(a) Graph the students' results on the grid provided so that the gradient will be equal to the resistance. (3)



b) Is the resistor ohmic or non ohmic? Justify your answer. (2)

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Question 32 (5 marks)

Distinguish between the terms validity, reliability and accuracy. Use examples to support your answer.

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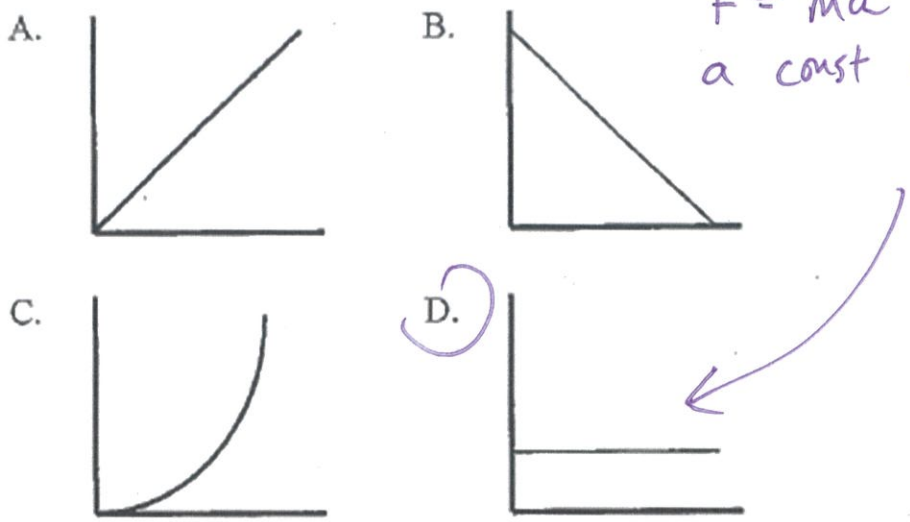
Spare pages for extra working if needed

Section I

Use the multiple-choice answer sheet provided for Questions 1–20.

1. An object is accelerating at a constant rate. Which graph best displays the relationship between the force applied to the object over time?



F = ma
a const ∴ F constant

2. A car travelling at 60.0 kmh^{-1} applies its brakes and comes to a complete stop in 5.5 seconds.

What was the acceleration of the car?

A. -3.0 ms^{-2}
B. 3.0 ms^{-2}
C. -10.9 ms^{-2}
D. 10.9 ms^{-2}

$t = 5.5\,s \quad u = \frac{60}{3.6} = 16.7\,ms^{-1} \quad v = 0$

$a = \frac{v-u}{t}$

$= \frac{-16.7}{5.5}$

$= -3.0\,ms^{-2}$

5 sons down
a is negative

3. A ball was thrown straight up at 8.0 ms^{-1}. What is the maximum height it will reach relative to its release position?

A. 2.0 m
B. 2.1 m
C. 3.2 m
D. 3.3 m

$u = 8.0\,ms^{-1} \quad v = 0$ (stops at max height)

$a = -9.8\,ms^{-2}$

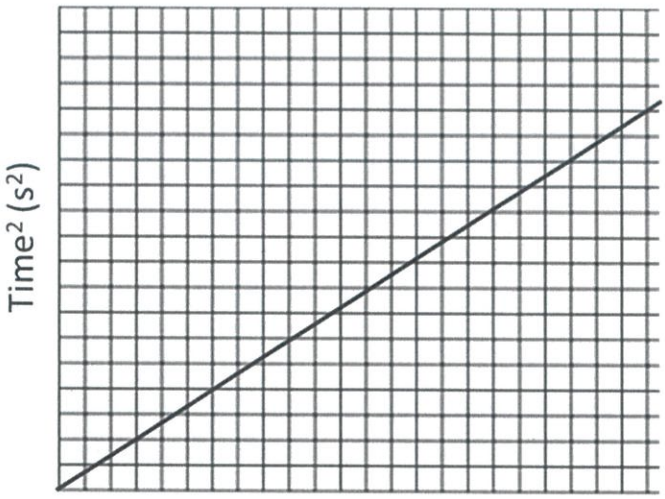
$v^2 = u^2 + 2as$

$s = \frac{v^2-u^2}{2a} = \frac{-8.0^2}{-19.6} = 3.26$

$= 3.3\,m$

4. Students used a ball-dropping experiment to determine the acceleration due to gravity. They timed how long it took a ball to reach the ground from different heights.

The graph below shows the line of best fit they produced. Note that the axes do not include their scales.



The students used the gradient (m) of the line of best fit to determine the acceleration due to gravity (g).

Which equation would the students then use to determine their value for gravity from the gradient?

A. $g = 2m$

B. $g = m$

C. $g = \frac{2}{m}$

D. $g = \frac{m}{2}$

$s = ut + \frac{1}{2}at^2$ $\quad u = 0$, $a = g$

$s = \frac{1}{2}gt^2$

$\text{grad} = m = \frac{t^2}{s} = \frac{2}{g}$ $\quad g = \frac{2}{m}$

5. A new electric car on the market has a mass of 2250kg and can accelerate from 0 to 100 km.h^{-1} in 3.00 seconds. What is the power required to cause this acceleration?

A. 37.5 KW

B. 289 KW

C. 868 KW

D. 3.75 MW

$\text{Power} = \frac{E}{t}$ $\quad E = \frac{1}{2}mv^2$

$t = 3.00s$ $\quad m = 2250kg$ $\quad v = 27.8 ms^{-1}$

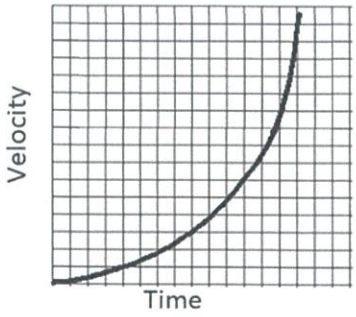
$P = \frac{mv^2}{2t}$

$= 289\ kW$

6. Shown below are four velocity vs time graphs.

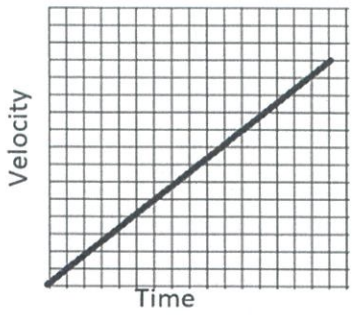
a = gradient

1



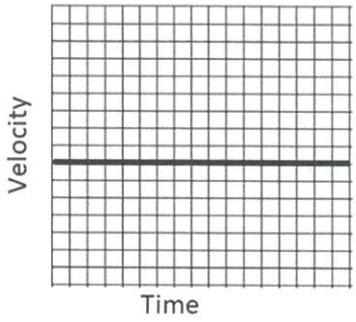
a increasing

2



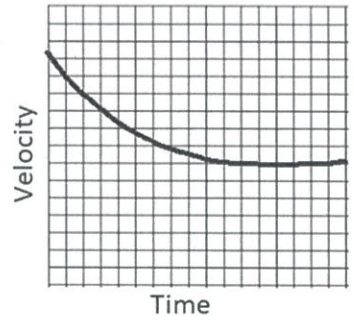
uniform

3



zero

4



decreasing

Which row correctly identifies the type of acceleration shown in each graph?

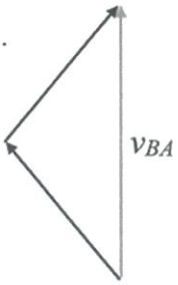
	Constant acceleration	Zero acceleration	Increasing acceleration	Decreasing acceleration
A.	2	3	1	4
B.	2	1	3	4
C.	3	4	1	2
D.	4	3	2	1

7. Plane A is travelling Northwest. Plane B is travelling Northeast.
Which of the following vector diagrams represents the velocity of B relative to A?

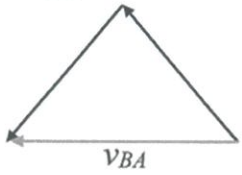
B relative to A is B − A

v_B $-v_A$

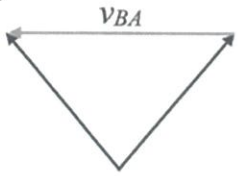
A.



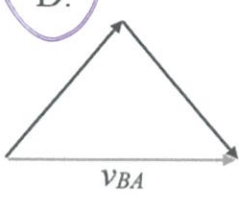
B.



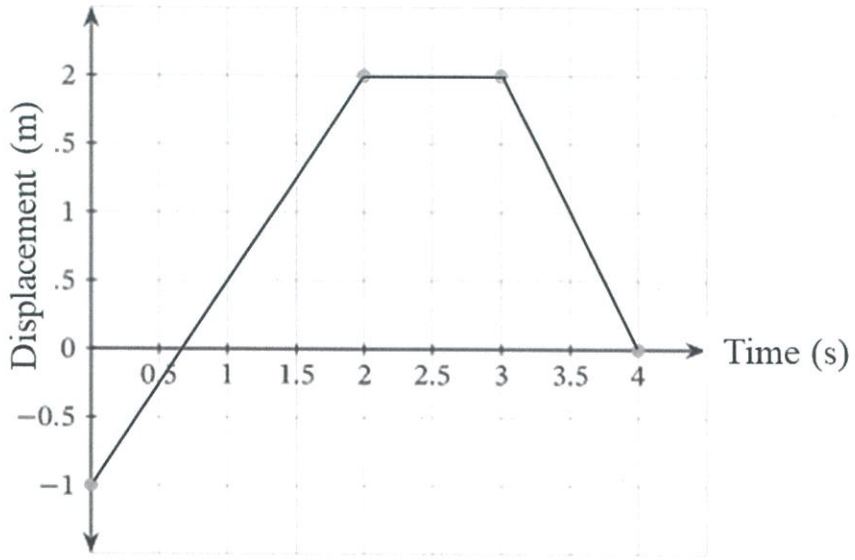
C.



D.



8. The graph below shows motion of an object over 4.0 s.



What is the average velocity of the object?

$v_{av} = \frac{\text{displacement}}{\text{time}}$

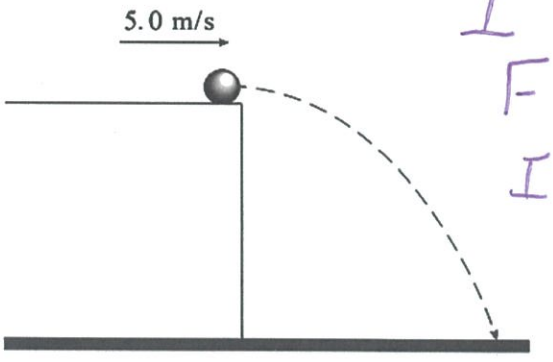
$t = 4.0\,s$

$s = 1.0\,m$

$v_{av} = \frac{1.0}{4.0} = 0.25\ ms^{-1}$

A. 0.0 ms^{-1}
B. 0.25 ms^{-1}
C. 0.75 ms^{-1}
D. 1.0 ms^{-1}

9. A 0.5 kg ball rolls off a horizontal surface as shown in the diagram.



$I = Ft$

$F = mg$

$I = mgt$

$= 0.5 \times 9.8 \times 0.8$

$= 3.92\ Ns$

Determine the magnitude of the impulse given to the ball by gravity during the 0.80 seconds it takes the ball to fall to the ground.

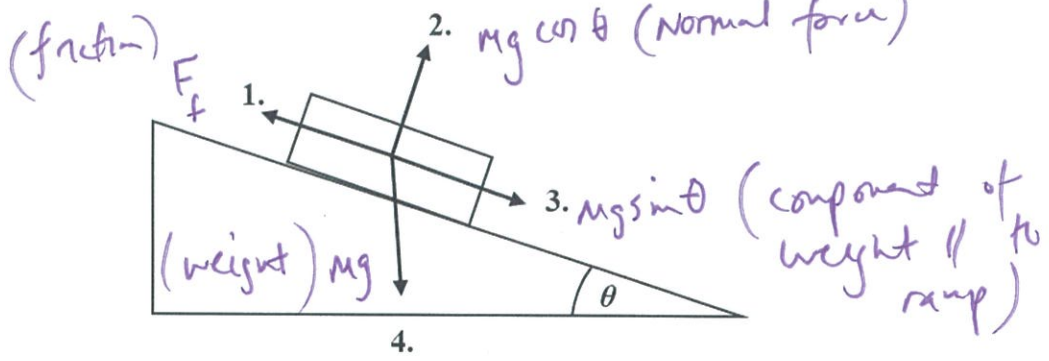
A. 0.9 N.s

B. 1.8 N.s

C. 2.9 N.s

D. 3.9 N.s

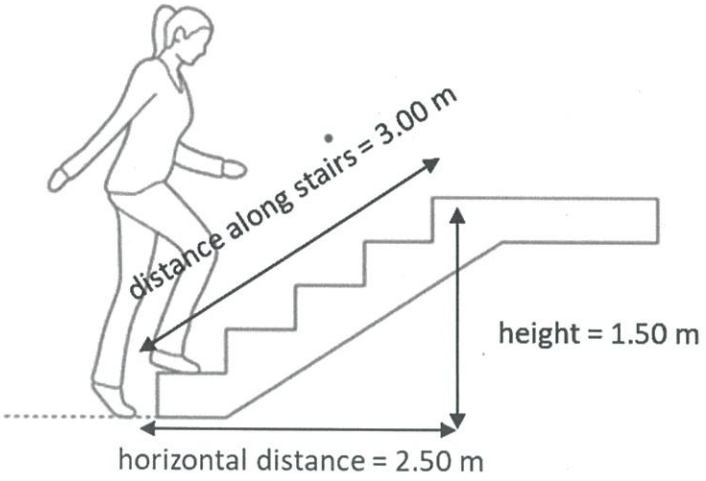
10. The diagram below shows a free body diagram of the 4 forces acting on a block on an inclined plane sliding down at a constant speed. The block has mass, m, and is situated on earth with a gravity, g, acting. The inclined angle is represented by θ



Which statement is correct regarding for the forces acting on the block?

A. there is a net force down the ramp NO - zero acceleration
B. friction and the normal force are in balance not in same line so can't be
C. force 1 and 3 are equal and opposite - zero acceleration
D. force 2 is independent of the angle $mg\cos\theta$

11. A 38.0 kg student climbs a short flight of stairs in a time of 4.5 s.



$U = mg\Delta h$

$\Delta h = 1.50\ m$

$m = 38.0$

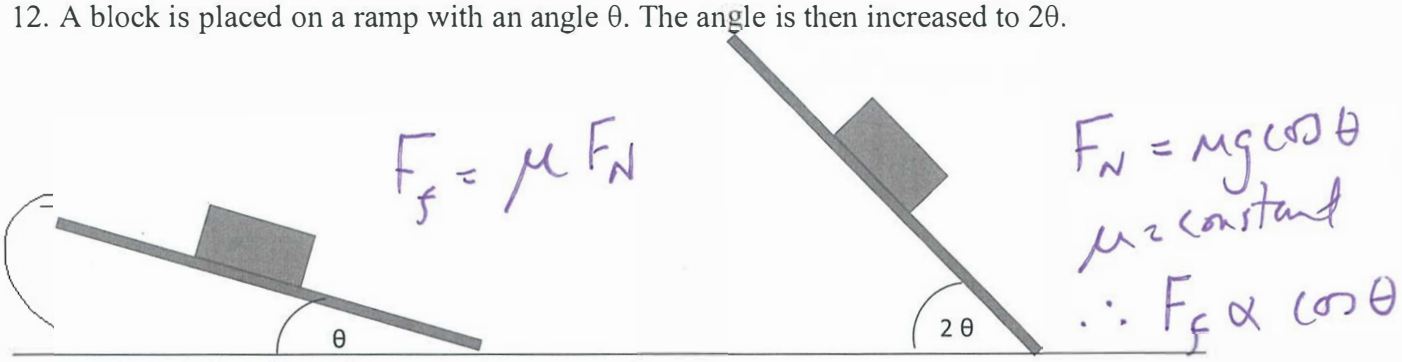
$g = 9.8$

$= 558.6\ J$

How much does her potential energy change?

A. 114 J
B. 559 J
C. 931 J
D. 1120 J

12. A block is placed on a ramp with an angle θ. The angle is then increased to 2θ.

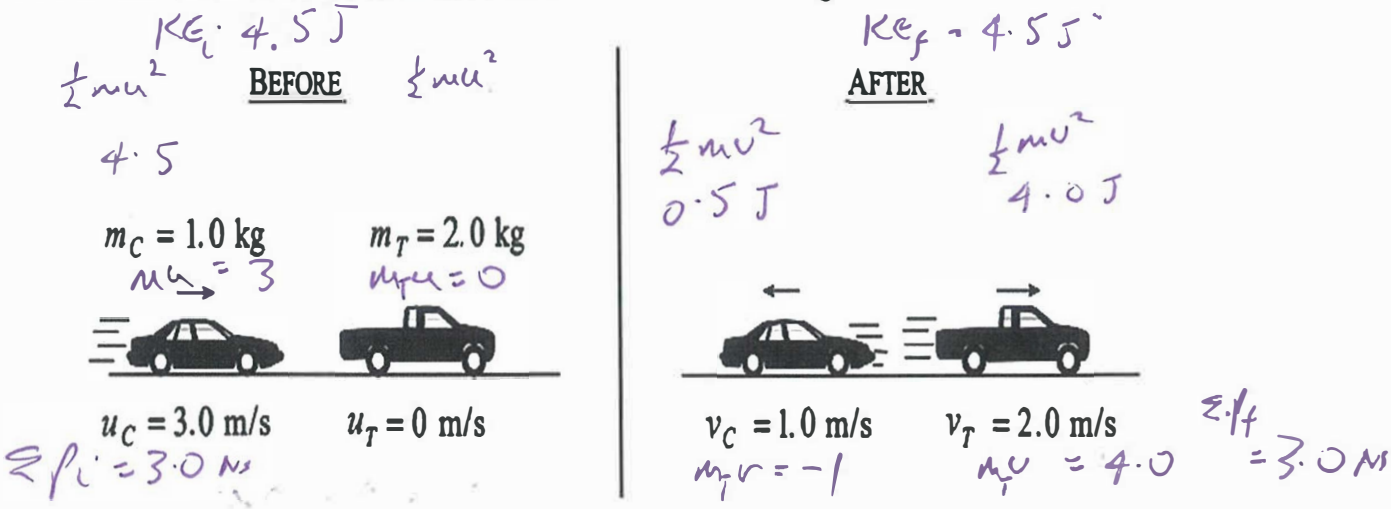


Which statement is true about the friction between the block and the ramp?

A. the amount of friction is the same for both angles
B. there is more friction on the steeper ramp
C. there is less friction on the steeper ramp
D. the friction is different by a factor of 2

$\propto \cos\theta$ not 0

13. The diagram shows a collision between a 1.0 kg toy car and a stationary 2.0 kg toy truck. After the collision, the car bounces back at 1.0 ms-1 while the truck goes forward at 2.0 ms^{-1}.

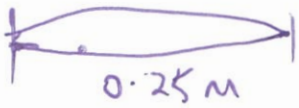


Based on these values, are momentum and kinetic energy conserved?

	Momentum conserved	Kinetic energy conserved
A.	Yes	Yes
B.	Yes	No
C.	No	Yes
D.	No	No

14. A taut string is plucked once and makes a note with a frequency of 875 Hz. The length of string is 25.0 cm.

What is the speed of sound in the string?



$\lambda = 2L$

$\lambda = 0.5\,m$

A. 170 ms^{-1}
B. 219 ms^{-1}
C. 340 ms^{-1}
D. 438 ms^{-1}

$v = f\lambda$

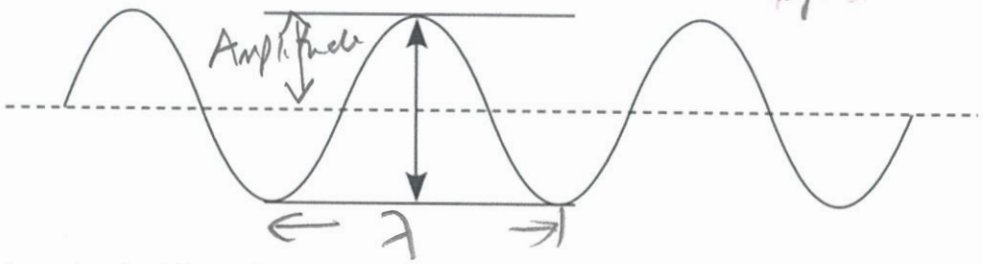
$= 875 \times 0.5$

$= 437.5$

$= 438\ ms^{-1}$

15. The diagram below shows a cross section of a medium at an instant in time as a wave moves through it.

displacement vs distance



What value does the double ended arrow show?

max total displacement = wave height

A. amplitude
B. wavelength
C. period – not a time graph
D. wave height

16. What conditions are necessary for total internal reflection to occur?

A. the wave must travel from a slower medium to a faster medium
B. the refractive index from medium 1 into medium 2 is greater than 1.0 (less than 1.0)
C. the wave must travel from a more dense medium to a less dense medium density ≠ speed
D. the wave must travel from one medium to another and the frequency increases

freq never changes across boundary

17. A coil of nichrome wire was placed into 200 ml of water. A voltage of 12.0 V was applied to the coil for 3.0 minutes resulting in a current of 4.5 A. Assuming no loss of energy to the environment, what is the change in temperate of the water?

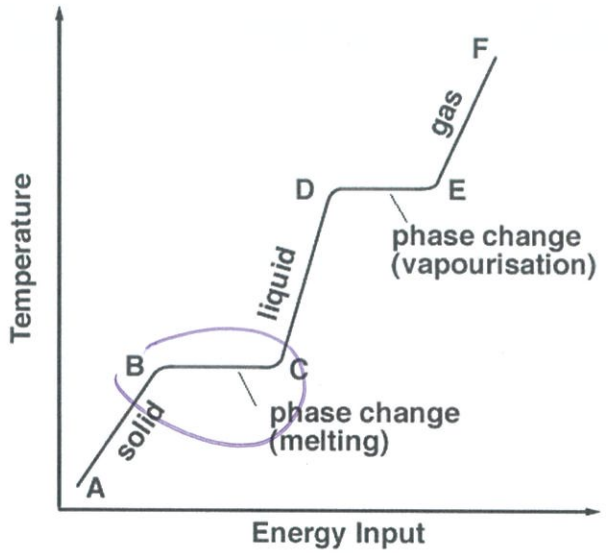
$E = VIt = mc\Delta T$

$\Delta T = \frac{IVt}{mc} = \frac{12.0 \times 4.5 \times 3 \times 60}{200 \times 4.18}$

$= 11.6$

A. 2.0°
B. 12°
C. 18°
D. 54°

18. The graph shows water, initially frozen, being heated at a steady rate.



LATENT HEAT OF VAPOURIZATION

Which section of the graph is related to the latent heat of fusion?

A. AB
B. BC — energy is going into breaking bonds in ice rather than raising temperature
C. CD
D. DE

19. Two electrons are at rest with a separated by 5.7×10^{-6} m. What is the magnitude of the electrostatic force they would experience from each other?

$q = 1.602 \times 10^{-19}$
$\varepsilon = 8.854 \times 10^{-12}$

$F = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{d^2}$

$= \frac{1}{4\pi 8.854 \times 10^{-12}} \frac{(1.602 \times 10^{-19})^2}{(5.7 \times 10^{-6})^2}$

$= 8.99 \times 10^{9}$

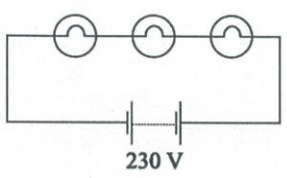
$= 7.1 \times 10^{-18}$

A. 4.1×10^{-23} N
B. 5.6×10^{-13} N
C. 2.5×10^{-4} N
D. 4.0×10^{-44} N

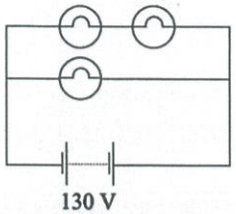
Sorry - made an error

20. Four circuits were constructed using identical light globes. Which circuit has the lowest total resistance?

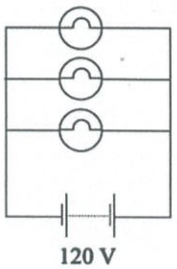
A. $R_T = 3R$



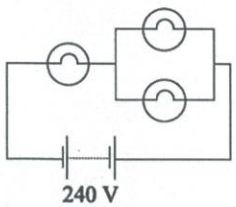
B. $R_T = \frac{1}{2R} + \frac{1}{R} = \frac{2R}{3}$



C. $R_T = \frac{1}{\frac{1}{R} + \frac{1}{R} + \frac{1}{R}} = \frac{R}{3}$



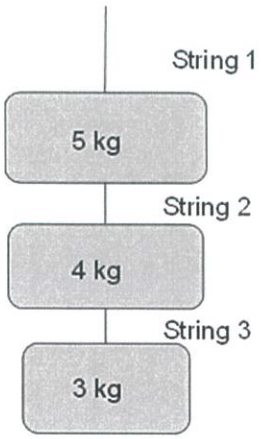
D. $R_T = R + \frac{1}{\frac{1}{R} + \frac{1}{R}} = \frac{3R}{2}$



Section II

Question 21 (4 marks)

The diagram shows three blocks connected by strings.



What is the tension force in string 1 when the blocks are stationary? (2)

String 1 holds all 3 masses

$\therefore T = M_{total}\, g$

$= (5+4+3)\, 9.8$

$= 117.6\ N$

The system now starts accelerating downwards at 5 $m.s^{-2}$

What is the tension in string 2 ? (2) $F = Ma = Mg - T_2$

$T_2 = Mg - Ma = M(g-a)$ $\quad M = 4+3 = 7\ kg$

$= 7(9.8-5)$ $\quad a = 5\ ms^{-2}$ $\quad g = 9.8\ ms^{-1}$

$= 33.6\ N$

Question 22 (3 marks)

A popular street in Hornsby will have its speed limit reduced from 40 km/hr to 30 km/hr. If the force applied by a braking car is the same at both speeds, how would this change affect the stopping distance of the vehicles travelling on this street? Use calculations or a sketch graph to support your answer.

SAMPLE WORKING - many possible approaches.

$v^2 = u^2 + 2as$

$v = 0$ $\quad a = const$ (and -ve)

$u^2 = 2as$

$s \propto u^2$

stopping distance $\propto$ initial velocity^2 $\therefore 40^2 = 1600$

$30^2 = 900$

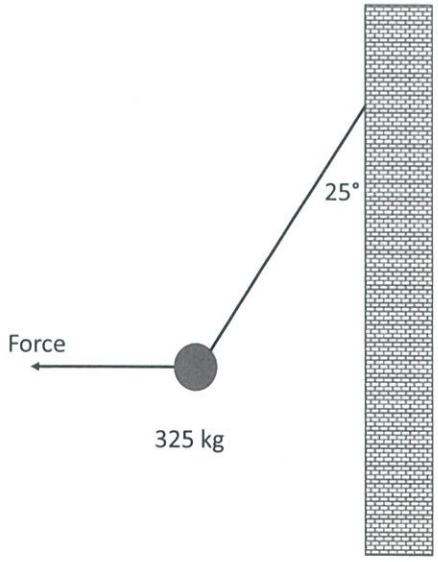
$\therefore$ stopping distance at 30 = 0.56 that of 40.

GRAPHICAL METHOD

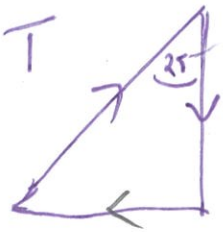
Stopping distance = area under graph

Question 23 (4 marks)

A wrecking ball with a mass of 325 kg is attached to a wall via a cable and is pulled horizontally by a force, F, so that is is held and an angle of 25.0 ° to the vertical as shown.



Working space for vector diagram



$mg = 325 \times 9.8$

$= 3185\ N.$

$\tan\theta = \frac{F}{mg}$

$F = mg\tan\theta$

$= 3185 \tan 25$

a) Use vector analysis to find the magnitude of the force F. (3)

$F = mg\tan\theta$

$= 3185 \tan 25$

$= 1485\ N$

b) What is the magnitude and direction of the vertical force that the wall exerts on the cable? (1)

mg upwards (to hold up weight) $= 3185\ N \uparrow$

Question 24 (4 marks)

In a game of snooker the white ball (cue ball) has a mass of 0.17 kg and the number 5 ball has a mass of 0.16 kg. The cue ball collides with the stationary number 5 ball at 2.2 ms^{-1}. It then comes to a stop. The number 5 ball moves along same line as the cue ball.

$u_1 = 2.2\ ms^{-1}$ $m_1 = 0.17\ kg$ $u_2 = 0$ $m_2 = 0.16\ kg$

(a) Calculate the velocity of the number 5 ball after the collision. 2

$\Sigma p_i = \Sigma p_f$ $\quad m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$0.17 \times 2.2 + 0 = 0 + m_2v_2$

$= 0.374\ Ns = m_2v_2$ $\quad v_2 = \frac{0.374}{0.16}$

$= 2.34\ ms^{-1}$

Q 24 continued next page

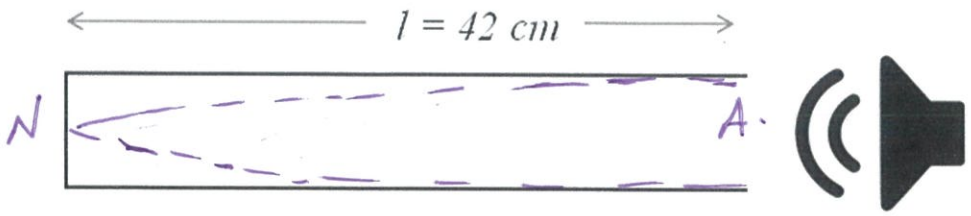
(b) If the collision occurred in 0.1 seconds, how much force did the number 5 ball exert on the cue ball? 2

$Ft = \Delta p$

$F = \frac{\Delta p}{t} = \frac{0.374}{0.1} = 3.74\ N$

Question 25 (5 marks)

A speaker is used to direct a sound wave into a pipe closed at one end shown below.



a) Sketch the standing wave for the fundamental frequency on the diagram and **label** any nodes and antinodes. (2)

b) The speed of sound is measured as 340 ms^{-1}. Determine the fundamental frequency. (2)

$\frac{\lambda}{4} = L \qquad \lambda = 4L = 4 \times 0.42$

$v = f\lambda$

$f_0 = \frac{v}{\lambda} = \frac{340}{4 \times 0.42} = 202\ Hz$

$200\ Hz$
2 sig fig

c) What is the frequency of the 2nd overtime? (1)

2nd overtone = 3rd standing wave position = 5th harmonic

$L = \frac{5}{4}\lambda$

$\lambda = \frac{4 \times 0.42}{5} = 0.336\ m$

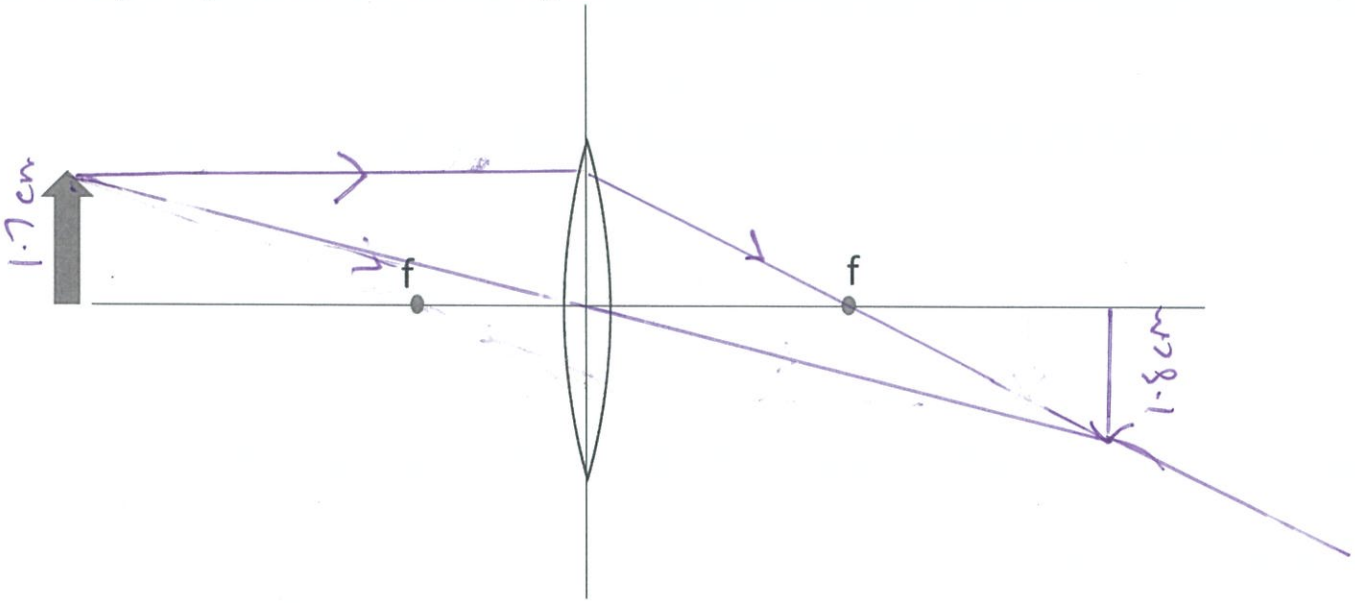
$f = \frac{v}{\lambda} = \frac{340}{0.336} = 1012\ Hz$

$= 1000\ Hz$
2 sig fig

$f = 5f_0$

Question 26 (4 marks)

An object is placed as shown in the diagram



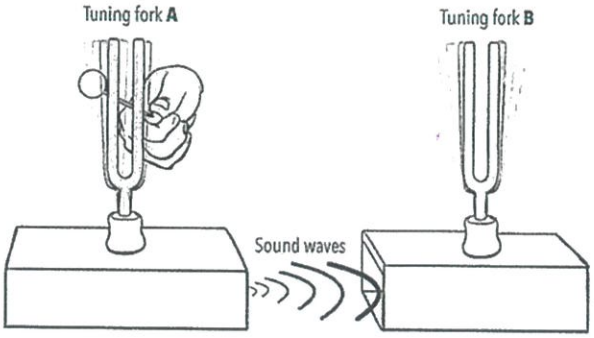
a) Construct a ray diagram to show the image that would be formed. (2)

b) Describe the nature of the image. (2)

- inverted
- real
- enlarged

Question 27 (3 marks)

Both tuning forks produce the same frequency of 256 Hz when struck by a hammer.

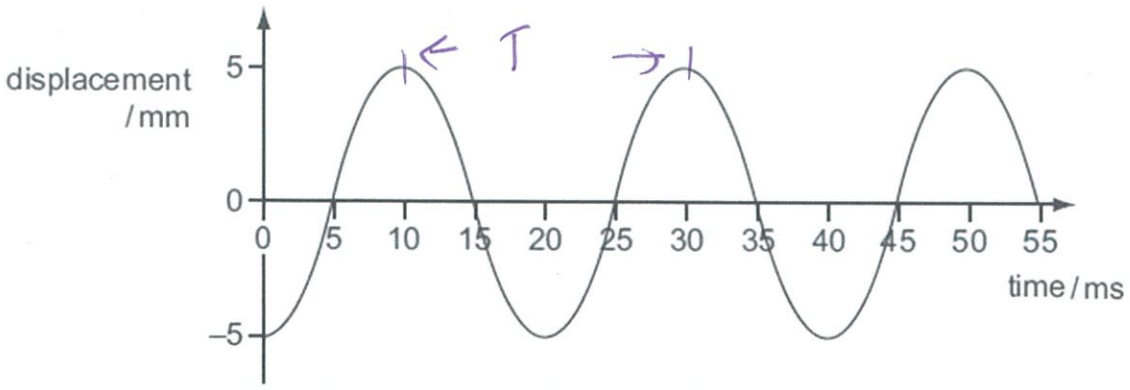


Tuning fork A is struck and allowed to vibrate. Tuning fork B is brought close to A and it begins to vibrate at 256 Hz. Explain the behaviour of tuning fork B

this is resonance in action
- A supplies a driving frequency to B at the resonant freq of B
- this produces an increased amplitude of vibration in B.

Question 28 (4 marks)

The wave show below is travelling at 50.0 cm s^{-1} through a medium.



a) What is the frequency and wavelength of the wave? (2)

$T = 20\ ms = 20 \times 10^{-3}\ s$

$f = \frac{1}{T} = \frac{1}{2 \times 10^{-3}} = 50\ Hz$

$\lambda = \frac{v}{f} = \frac{0.50}{50} = 0.01\ m$

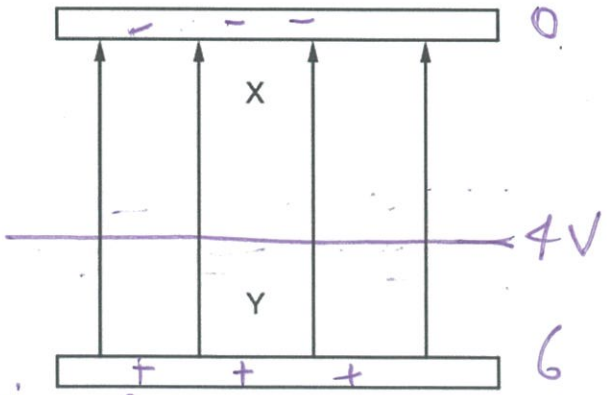
b) The wave encounters a change in medium and speeds up to 75.0 cm s^{-1}. What happens to the wavelength and frequency? (2)

freq = const = 50 Hz

$\lambda = \frac{v}{f} = \frac{0.75}{50} = 0.015\ m$ λ increases

Question 29 (4 marks)

The diagram shows electric field lines between two parallel plates charged. A positive charge is placed at X. It is then moved to point Y.



a) There is a potential difference of 6 volts between the plates. Draw the equipotential line of 4 V. (1)

b) Compare the force due to the field at both positions. (1)

same magnitude + direction

Q29 continued on next page

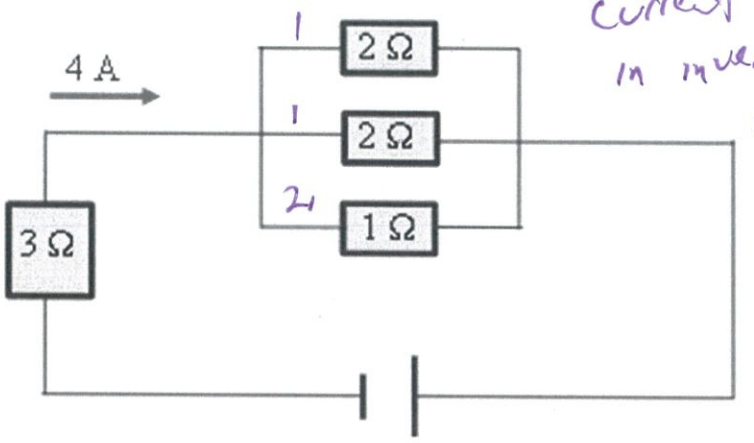
c) What would the separation of the plates be, in cm, if the field strength is 10.5 Vm^{-1}? (2)

$E = \frac{V}{d}$ $\quad d = \frac{V}{E}$ $\quad \frac{6}{10.5} = 0.57\ m$

$= 57\ cm$

Question 30 (5 marks)

The diagram shows 4 resistors connected to a power supply.



current splits in inverse ∝ to resistance

$\therefore I_1 = 2\ A.$

a) What is the voltage drop across the 3 Ω resistor? (1)

$V = IR$

$= 4 \times 3 = 12\ V.$

b) What is the current through the 1Ω resistor? (2)

$I_1 = \frac{V}{R_1}$ $\quad I_{TOT} = I_1 + I_2 + I_3$ $\quad I_1 = VR$

$4 = \frac{V}{1} + \frac{V}{2} + \frac{V}{2}$ $\quad = 2A.$

$4 = V(1 + \frac{1}{2} + \frac{1}{2})$

$V = \frac{4}{2} = 2V$

c) Determine the total voltage supplied to the circuit. (2)

V across $3\Omega = 12\ V$ $\quad V$ across $\| = IR = 4 \times 1 = 2.0\ V$

$V = 12 + 2.0 = 14\ V$

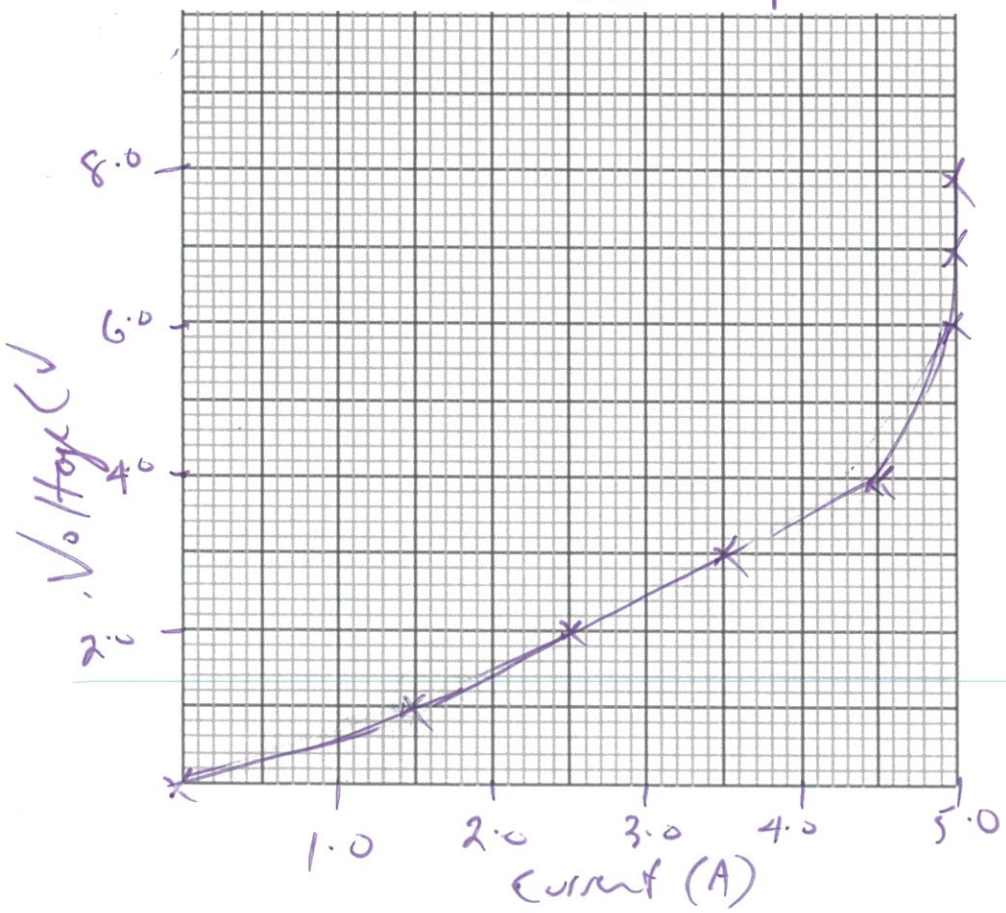
Question 31 (5 marks)

Some physics students conducted an experiment to determine the resistance of a ceramic resistor attached in a simple series circuit. The circuit consisted of only a transformer, ammeter, the ceramic resistor, voltmeter, and the wires needed to connect them.
Assume all equipment was ideal (correctly calibrated, no additional sources of resistance or voltage loss).
They collected the data below:

Voltage(V)	Current (A)
0.0	0.0
1.0	1.5
2.0	2.5
3.0	3.5
4.0	4.5
5.0	5.0
6.0	5.0
7.0	5.0

(a) Graph the students' results on the grid provided so that the gradient will be equal to the resistance. (3)

$V = IR$ $R = V/I$ ∴ plot V vs I



b) Is the resistor ohmic or non ohmic? Justify your answer. (2)

Non ohmic — gradient changes — resistance increases with current then

Question 32 (5 marks)

Distinguish between the terms validity, reliability and accuracy. Use examples to support your answer.

a valid investigation is one that is a true test of the aim - measurements genuinely inform the variables being investigated

reliability is about consistency or repeatability of data. Reliable data is consistent and has a high degree of repeatability

accuracy is how close the measured value is to the true value

eg. experiment to measure acceleration due to gravity by timing falling object