2022
Year 11
Yearly Exam
Hurlstone Agricultural High School

Physics

General Instructions

- Reading time – 5 minutes
- Working time – 120 minutes
- Board-approved calculators may be used
- Write using blue or black pen
- Draw diagrams using pencil
- A data sheet, formulae sheets and periodic table are provided at the back of this paper

WRITE YOUR NAME AT THE TOP OF EVERY PAGE

Total marks (75)

This paper has two parts.

Part A - 20 marks
- **Attempt Questions 1-20**
- **Allow about 35 minutes for this part**

Part B - 55 marks
- **Attempt Questions 21-33**
- **Allow about 1 hour and 25 minutes for this part**

Teacher in charge: Mr. Coombes

All sheets must be handed in at the end of the examination.
Do not remove any part of this paper from the examination room.

Write your name below.

Student Name: _____

Tick your class here: ☐ **Coombes** ☐ **Morante** ☐ **To**

Part A - 20 marks
Attempt Question 1-20
Allow about 35 minutes for this part

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

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

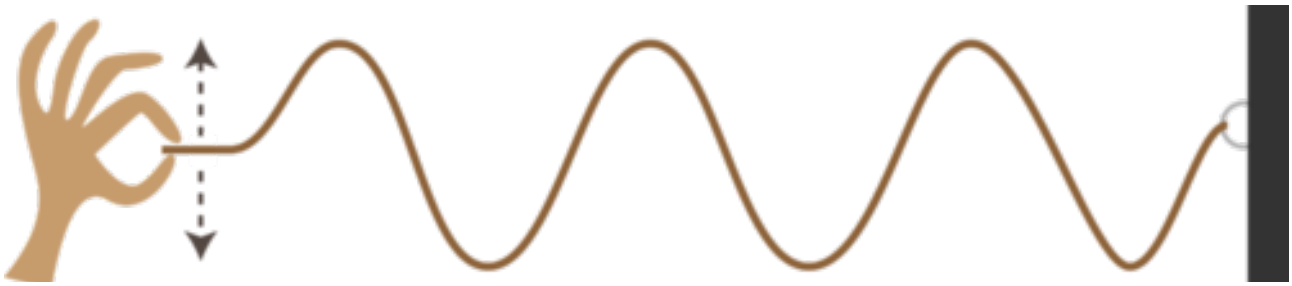
A ● B ⊗ C ○ D ○

If you have changed your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

correct

A ⊗ B ⊗ C ○ D ○

1. A wave moves in a string as shown in the diagram. Which statement correctly describes the role of the medium as the waves propagates?



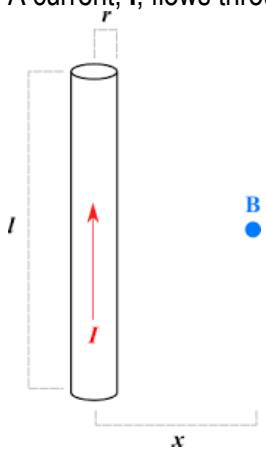
(A) Particles in the medium do not need to move as the wave passes.

(B) Particles in the medium oscillate in a direction perpendicular to the direction of propagation.

(C) Particles in the medium move back and forth parallel to the direction of propagation.

(D) Particles in the medium move randomly as the wave passes.

2. A current, **I**, flows through a wire as shown. In which direction is the magnetic field at the point B.



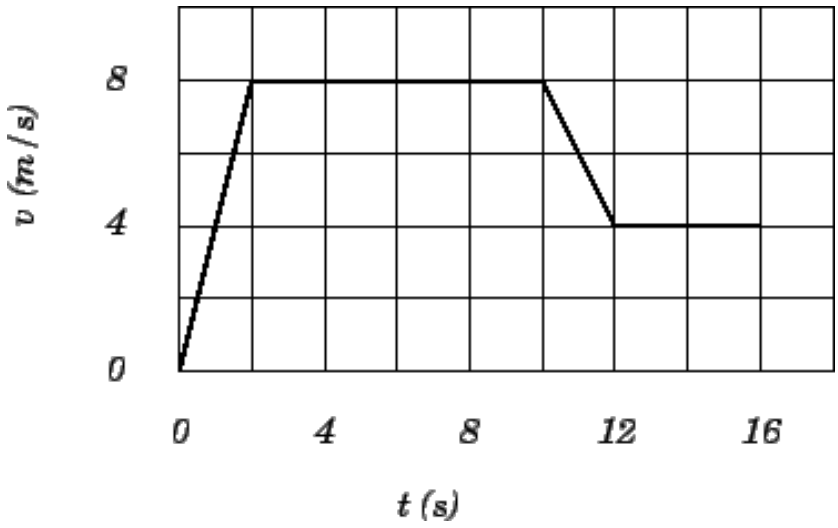
(A) Up

(B) Down

(C) Into the page

(D) Out of the page

3. The following is a velocity-time graph for a toy car.



What is the total displacement of the car over the 16s time interval?

(A) 8m.

(B) 64m

(C) 100m

(D) This information cannot be determined using this graph.

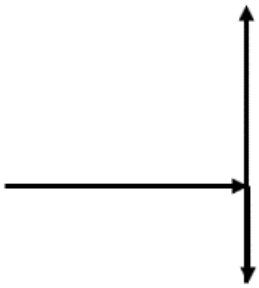
4. A drone is flown 500 m to the east. It turns to the south and flies for 300 m before turning West, flying for 250 m and landing again.

The drone's displacement vector is best represented by:

(A)



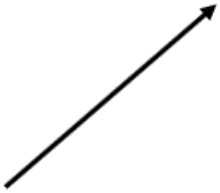
(B)



(C)



(D)



5. Cheryl is 160cm tall and wants to place a mirror on the wall so that she can see her whole body. Which placement and size of mirror will allow her to achieve this?

	Height of mirror (cm)	Distance of top of mirror from floor
A	80	80
B	80	160
C	40	80
D	40	60

6. A boy throws a ball straight up with a velocity of $35ms^{-1}$. How long does it take the ball to go up and then back down to the ground?

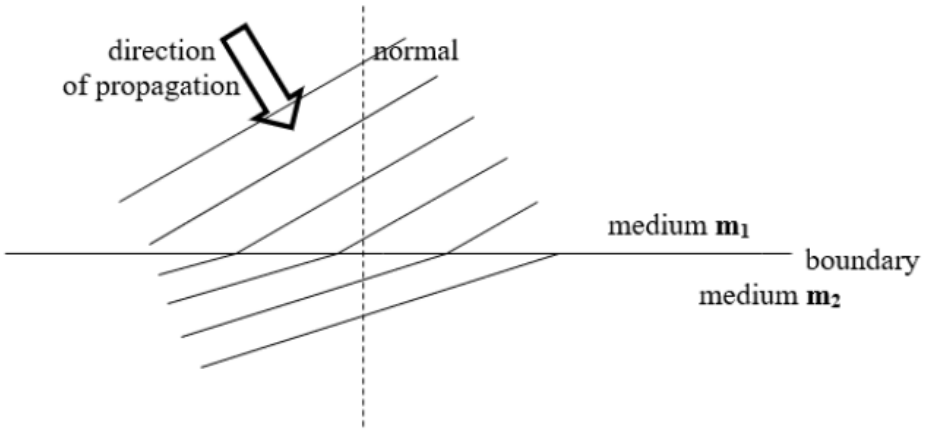
(A) 1.78s

(B) 3.57s

(C) 7.14s

(D) 14.28s

7. As it enters a second medium, $\mathbf{m_2}$, a wave refracts as shown in the diagram.



Which statement can be made about the wave as it enters medium, $\mathbf{m_2}$**?**

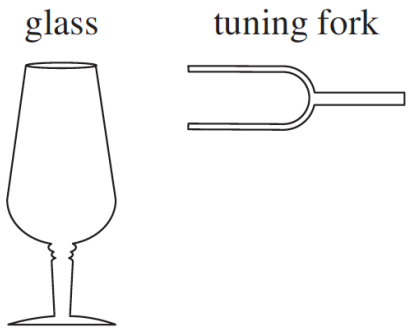
(A) Its frequency increases and the speed also increases.

(B) Its frequency decreases and the speed also decreases.

(C) The wavelength increases and the frequency decreases.

(D) The wavelength decreases and the speed also decreases.

8. A glass and tuning fork are shown.



When the tuning fork is struck and brought very close to the top of the glass, a loud sound is heard. Which of the following wave behaviours is responsible for this effect?

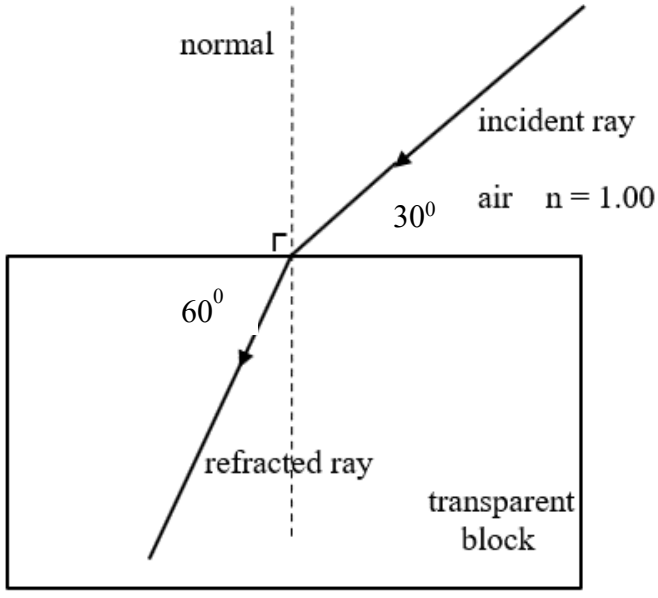
(A) diffraction

(B) dispersion

(C) resonance

(D) refraction

9. A ray of light enters a transparent block as shown.



Using the angles shown in the diagram, what is the refractive index of the block?

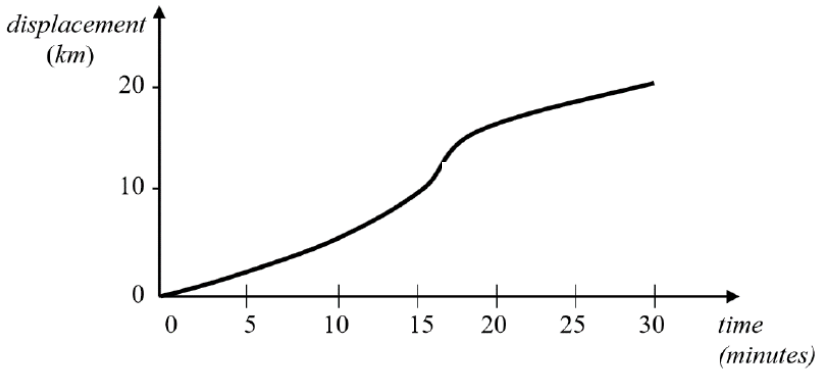
(A) 0.58

(B) 1.0

(C) 1.23

(D) 1.73

10. A train has its displacement from a station plotted against the time taken, as shown.



The average speed of the train is closest to

(A) 6.7 ms^{-1}

(B) 66.7 ms^{-1}

(C) 40 km/hr

(D) 80 km/hr

11. When a Perspex rod is rubbed with silk the rod becomes positively charged. The reason for this is

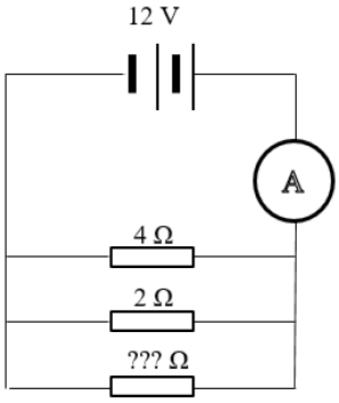
(A) Both substances gain protons.

(B) The Perspex rods loses electrons.

(C) The Perspex rod gains protons.

(D) The Perspex rods gains positive ions.

12. A circuit was connected as shown.



The reading on the ammeter is 21.0 A.

What is the resistance of the unknown resistor?

(A) 1 Ω

(B) 2 Ω

(C) 4 Ω

(D) 8 Ω

13. A sound wave has a wavelength of 30cm in air. What is the frequency of the source of the wave?

(A) 11.3 Hz

(B) 11.3 m/s

(C) 1133 Hz

(D) 1133 m/s

14. At a shooting range, a gun is fired and the bullet bounces off the top of a boulder. As the bullet hit the boulder, it exerted a force on the boulder, though the boulder did not move. At the same time, the boulder exerted a force on the bullet, resulting in the bullet slowing down and changing direction.
Which statement correctly describes this interaction?

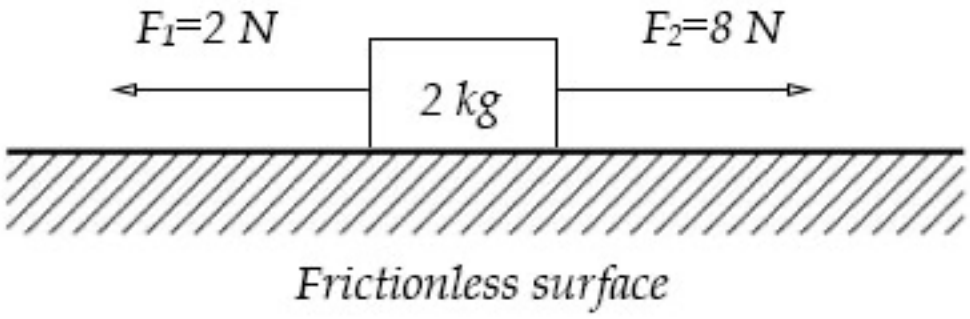
(A) The force of the bullet on the boulder is greater than the force of the boulder on the bullet, resulting in the bullet slowing down and changing direction.

(B) The force of the bullet on the boulder is less than the force of the boulder on the bullet, resulting in the boulder not moving.

(C)The force of the bullet on the boulder is greater than the force of the boulder on the bullet, though the boulder has much more inertia and, therefore, does not move.

(D) The force of the bullet on the boulder is equal to the force of the boulder on the bullet, and their mass difference accounts for their subsequent motion.

15. A smooth block with a mass of 2 kg experiences two forces as shown.



What is the resulting motion of the block

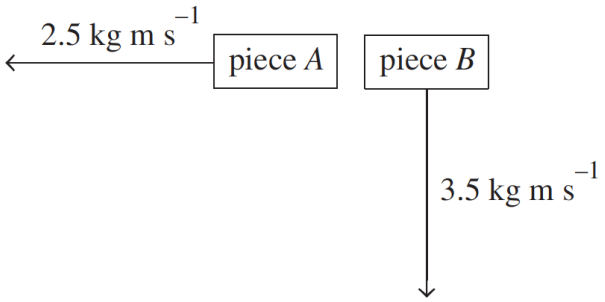
(A) Constant speed of 3m/s to the right.

(B) Accelerates at $3ms^{-2}$ to the right.

(C) Constant speed of 4m/s to the right.

(D) Accelerates at $4ms^{-2}$ to the right.

16. A stationary explosive with a mass of 5.5 kg is detonated and separates into three individual pieces, A, B and C. The momentum of piece A is 2.5 kg m s–1 west and the momentum of piece B is 3.5 kg m s–1 south, as shown in the diagram.



What is the magnitude and direction of the momentum of piece C?

(A) 2.5 kg m s–1 N54°E

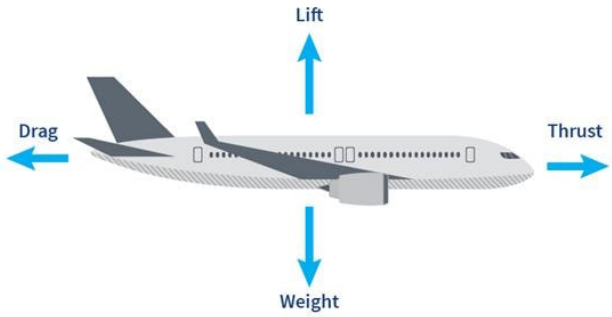
(B) 4.3 kg m s–1 N36°E

(C) 5.5 kg m s–1 N54°E

(D) 6.0 kg m s–1 N36°E

17. An airplane has the following forces acting.

Lift	4 x10^{7}N
Drag	3 x10^{7}N
Thrust	2.5 x10^{7}N
Weight	5 x10^{7}N



The airplane is most likely :

(A) coming in to land.

(B) taking off.

(C) cruising at maximum altitude.

(D) ascending to maximum altitude

18. A white ball with mass **m** and an initial speed **u** collides with a stationary black ball, also with mass **m**.

After the collision, the black ball moves off with a speed **v**.



This collision is known to be elastic.

What is the speed of the white ball after the collision?

(A) zero

(B) **u**

(C) **v**

(D) **v**/2

19. An electric dryer has a power rating of 2000W. If the owner pays 30c per kW hr for electrical energy, then what will be the cost of operating the dryer for 3 hours?

(A) 20c

(B) $20

(C) $1.80

(D) $18

20. The intensity of light coming from a point source is measured to be 6 Wm^{-2} at a distance of 0.8m. What would be the intensity of the light at a distance of 1.4m?

(A) 1.96 Wm^{-2}

(B) 3.43 Wm^{-2}

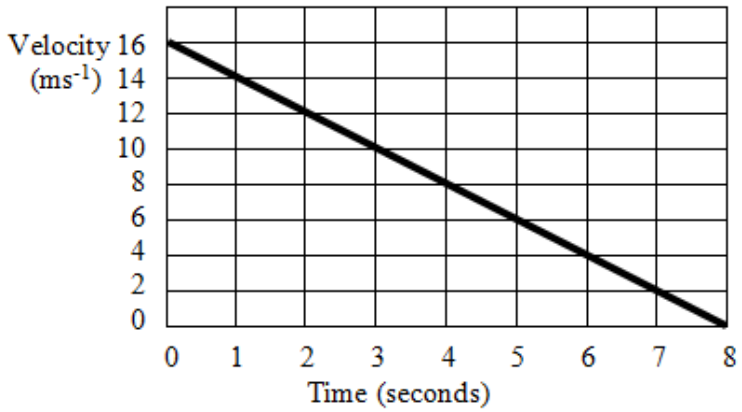
(C) 10.5 Wm^{-2}

(D) 18.4 Wm^{-2}

Part B - 55 marks
Allow about 1 hour and 25 minutes for this part
Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Question 21 (5 marks)

The velocity vs. time graph below describes a vehicle's journey.



(a) Describe the motion of the vehicle during the 8 seconds of the journey shown. **2**

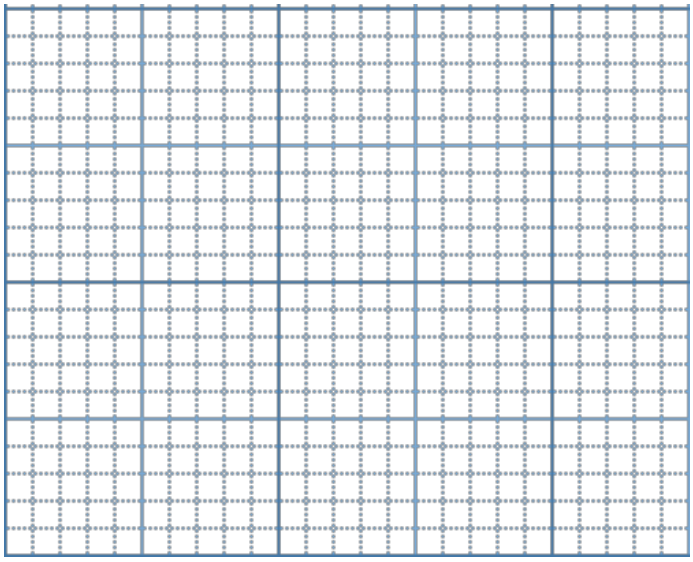
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(b) In the space below sketch a displacement time graph demonstrating the motion of the car over the 8 seconds shown. Include any relevant quantitative information.

3



Question 22 (3 marks)
A hiker is standing on the top of a cliff of height 300m. He throws a ball straight up at a velocity of $20ms^{-1}$. How long will it take for the rock to hit the ground at the bottom of the cliff? **3**

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Question 23 (4 marks)

Tiger woods strikes a 46g stationary golf ball with a golf club head of mass 200g. The club head was initially moving at 180km/hr and slowed down by 20% just after the ball was struck. At what velocity does the ball leave the club head? **4**

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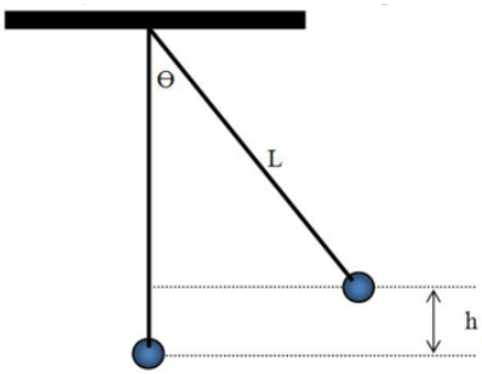
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Question 24 (3 marks)

The pendulum shown is lifted to a height of 20cm above its vertical hanging position.



If the pendulum is released from this height what is the maximum speed it will reach at the bottom of its motion?

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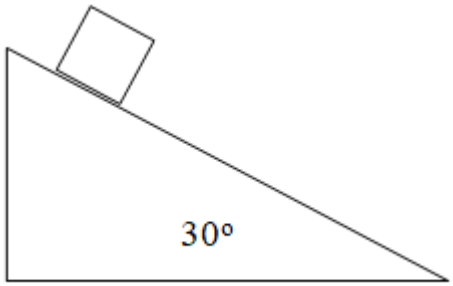
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Question 25 (3 marks)

A smooth block with a mass of 2 kg is placed on a 30° slope. The block experiences a constant frictional force of 4N.



Calculate the acceleration of the block.

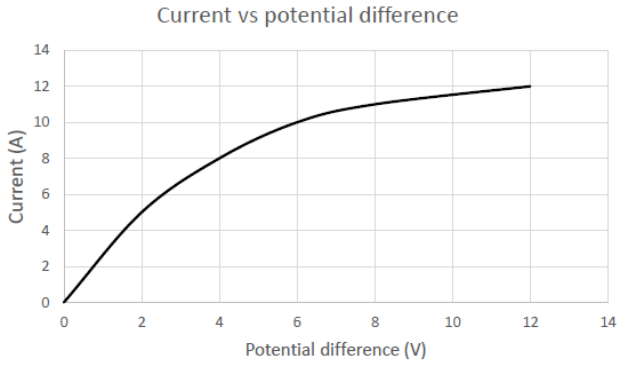
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Question 26 (3 marks)

A small light globe has the potential difference across it and the current flowing through it measured as the voltage of the power source is varied.



Explain the shape of the graph shown in terms of the resistance of the globe. **4**

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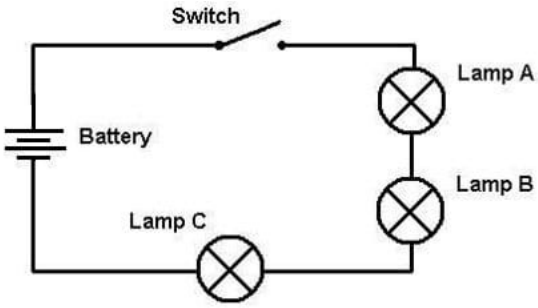
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Question 27 (5 marks)

The following circuit was connected using a 12V battery. Lamp A,B and C have an equal resistance of 4Ω at maximum operating temperature. The switch is closed and measurements taken.

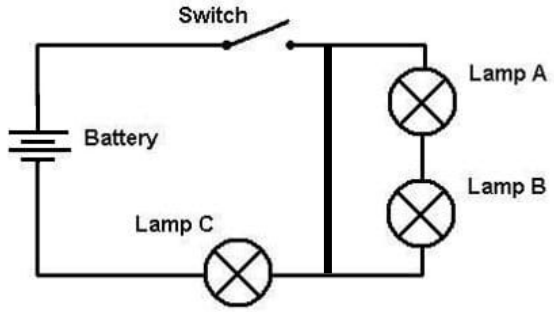


(a) Calculate the current in lamp A. **2**

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(b) Another wire was then connected in the circuit as shown. The switch is closed again and the light globes are observed.



Explain any change in the brightness of the globes due to this wire being added. **3**

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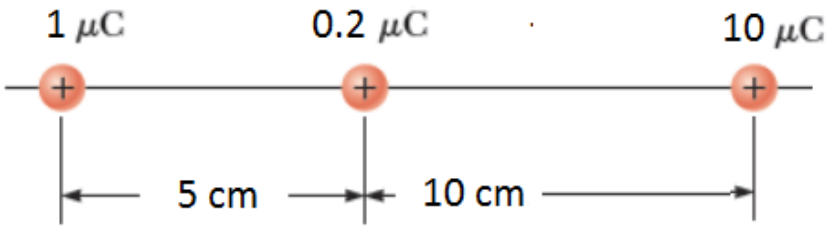
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Question 28 (4 marks)

Three positive charges are at rest as shown in the following diagram.



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Calculate the magnitude and direction of the force acting on the 0.2 μC charge.

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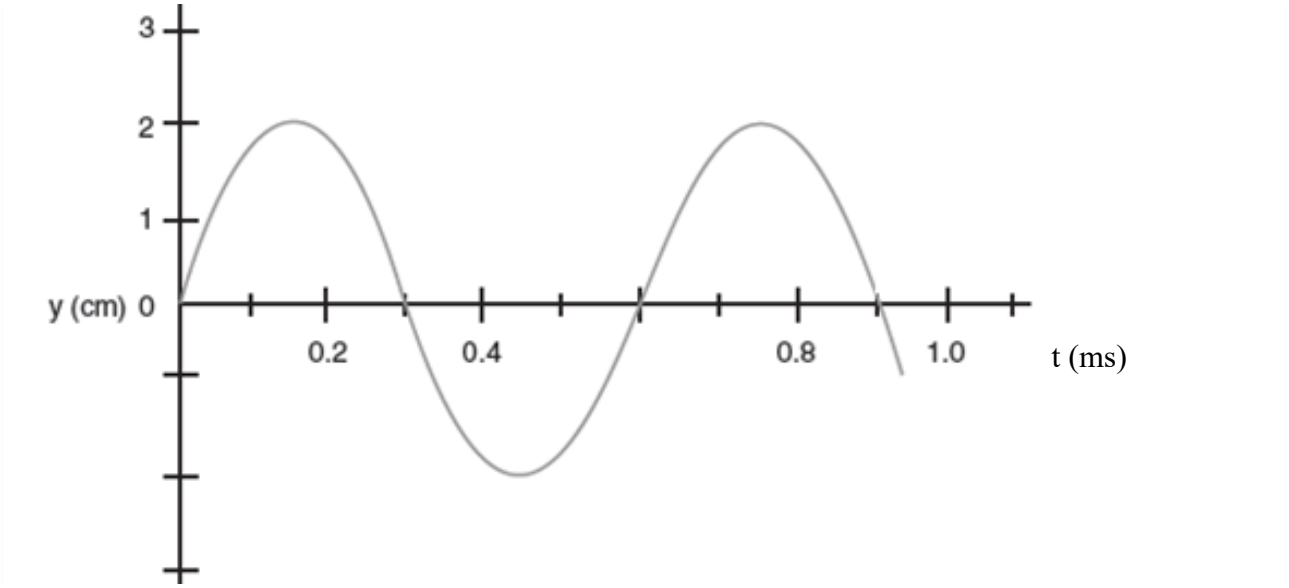
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Question 29 (4 marks)

The following graph was constructed from observing a particle in a sound wave.



(a) What is the amplitude of particles in this wave. _____ **1**

(b) Calculate the period, frequency and wavelength of this sound wave. Assume the speed of sound is 340 ms^{-1}. **3**

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Question 30 (4 marks)

(a) Calculate the observed frequency when an ambulance moving at 30 ms^{-1} towards a stationary observer emits a sound with a frequency of 400 Hz. **2**

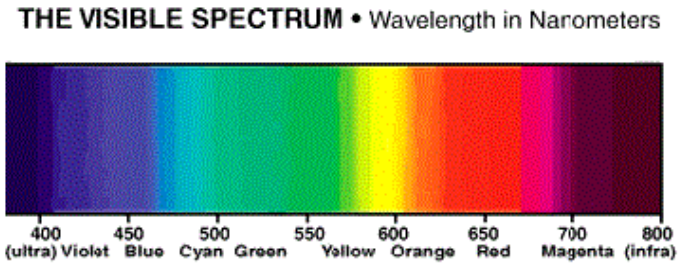
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(b) Most observable stars are moving away from the Earth. Explain why this results in the observed light coming from the star to appear more of a red colour (red shift). In your answer make reference to the visible spectrum shown. **2**



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Question 31 (4 marks)

A metal tray of mass 200g was placed in an oven at 100^0C for 5 minutes. At the same time 200mL of water was placed on a stove and heated to 100^0C.
The tray was removed from the oven and the water removed from the stove. A short time later the temperature of the water and metal tray were measured using an infrared thermometer.
The tray had reached room temperature of 20^0C and the water temperature was still 84^0C.

Account for the temperature changes measured during this experiment. **4**

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Question 32 (6 marks)

A student aimed to investigate the relationship between frequency and wavelength of a slinky. The following equipment was provided to the student.

- Slinky
- Metre ruler or tape measure.
- Stopwatch.

Outline a suitable method that could be used to investigate this relationship and provide both valid and reliable results.
Ensure that you refer to the independent and dependent variables as well as any variables that need to be controlled.

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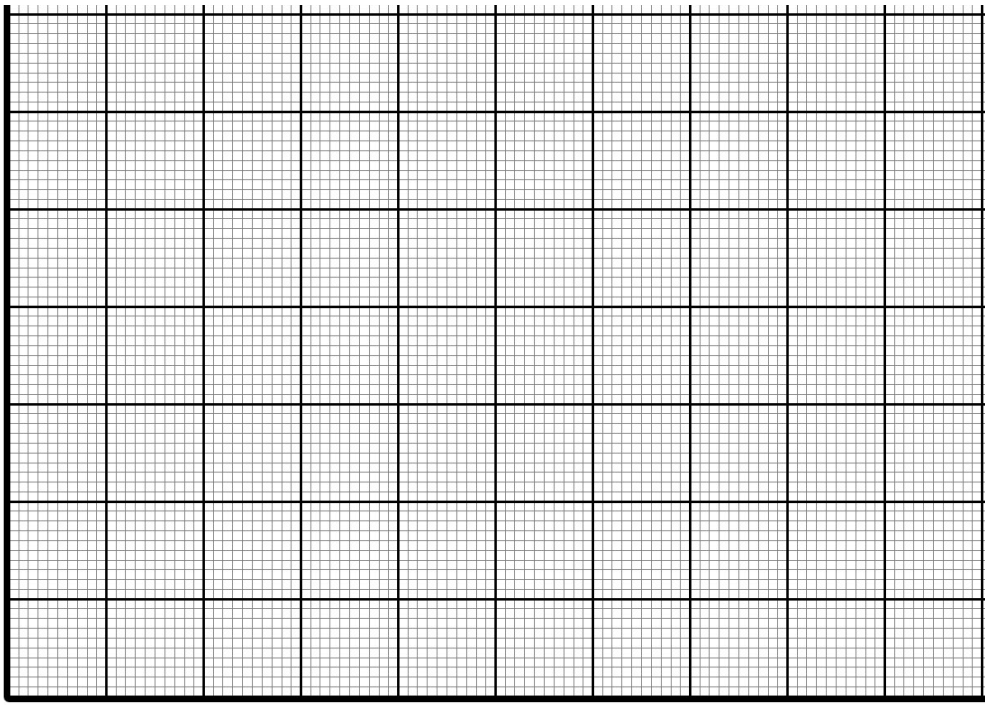
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Question 33 (6 marks)

An astronaut conducts an experiment on the moon. He drops a tennis ball from a height of 5m and recorded the velocity of the ball (using a motion sensor) during it's fall to the ground. The following data was collected by the astronaut.

Velocity (ms^{-1})	Time (s)
0	0
1.28	0.80
1.92	1.20
2.24	1.55
2.56	1.60
2.80	1.75
3.12	1.95
3.40	2.10

(a)Plot a line of best fit graph of the data above. Place the independent variable on the appropriate axis. **4**



(b) Using the graph calculate the acceleration of the ball. **2**

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Spare Paper (Please label clearly the question if it is answered here).

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