Student Number.....

Hornsby Girls' High School

2018

YEAR 11
YEARLY
EXAMINATION

Physics Assessment Task 3

General Instructions

- Reading time – 5 minutes
- Working time – **2 hours**
- Write using black pen
- Draw diagrams using pencil
- NESA approved calculators may be used
- A data sheet, formulae 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 — 15 marks

- Attempt Questions 1–15
- Allow about 25 minutes for this part

Section II — 55 marks

- Attempt All Questions
- Allow about 1 hour and 35 minutes for this part

Section I

15 marks
Attempt Questions 1–15
Allow about 25 minutes for this part

Use the multiple-choice answer sheet for Questions 1–15

---

1 Blue light in the visible part of the electromagnetic spectrum has a wavelength of 450 nm.

Calculate the frequency of this light.

(A) 1.5×10^{-15} Hz

(B) 6.6×10^{5} Hz

(C) 6.6×10^{14} Hz

(D) 6.7×10^{14} Hz

2 An ambulance is approaching a stationary observer at a constant speed of 60 kmh^{-1}. The speed of the sound is 340 ms^{-1} and the siren has a frequency of 650 Hz according to the source.

What is the frequency, according to the observer, as the ambulance approaches them?

(A) 618 Hz

(B) 633 Hz

(C) 682 Hz

(D) 789 Hz

3 A material to be used for a fibre-optic cable has a refractive index of 1.44.

Which of the following would be the critical angle for this material?

(A) 14.5^0

(B) 35.2^0

(C) 44.0^0

(D) 53.2^0

4 Which statement correctly shows how a sound wave is different to a light wave?

(A) Sound waves are capable of diffraction and light waves are not.

(B) Sound waves always have a smaller frequency than light waves.

(C) Sound waves are produced by oscillating objects and light waves are not.

(D) Sound waves require a medium to propagate whereas light waves do not.

5 A car travelling at 80 kmh^{-1} applies its brakes and comes to a complete stop in 7 seconds.

What was the acceleration of the car?

(A) $-11.4\ ms^{-2}$

(B) $-3.2\ ms^{-2}$

(C) $3.2\ ms^{-2}$

(D) $11.4\ ms^{-2}$

6 Which of the following is NOT a method by which thermal energy can be transferred?

(A) Radiation

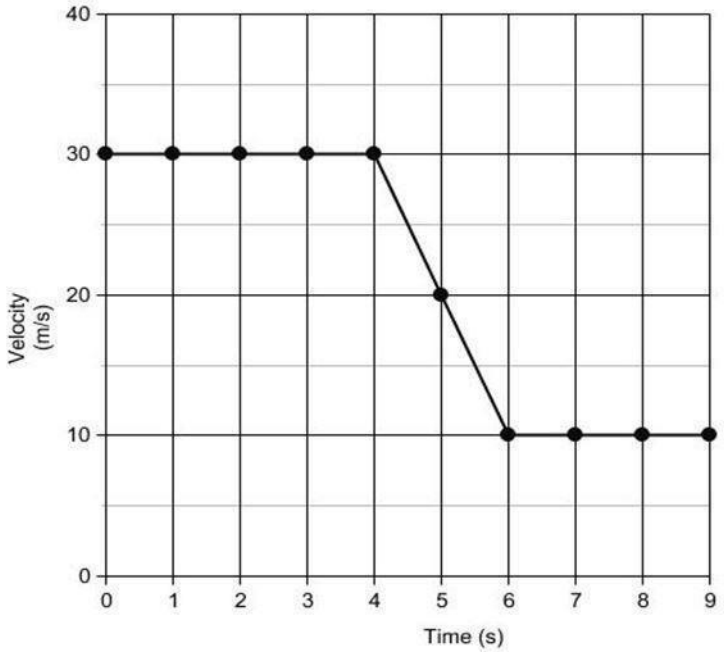
(B) Convection

(C) Conduction

(D) Contraction

Use the following information to answer Questions **7** and **8.**

The following graph shows the motion of Car A, mass 300 kg, travelling south along a road.



At time 4 s, Car A collides with Car B, also mass 300 kg, resulting in the change in velocity shown in the graph above.

After the collision, the two cars are joined together and travel as one object.

7 What was the velocity of Car B just before the collision?

(A) 20 ms^{-1} South

(B) 30 ms^{-1} South

(C) 20 ms^{-1} North

(D) 10 ms^{-1} North

8 What was the force experienced by Car A in this collision?

(A) 3000 N South

(B) 6000 N South

(C) 3000 N North

(D) 6000 N North

9 Which option correctly shows how each factor influences the movement of electricity through a conductor?

	Increased length	*Increased cross sectional area*	*Increased temperature*	*Change in conducting material*
(A)	Resistance increased	Resistance decreased	Resistance increased	Resistance varies with different materials
(B)	Resistance increased	Resistance decreased	Resistance decreased	Resistance varies with different materials
(C)	Resistance increased	Resistance increased	Resistance increased	Resistance increased
(D)	Resistance decreased	Resistance decreased	Resistance decreased	No change in resistance with change of materials

10 Which of the following is the best example of an elastic collision?

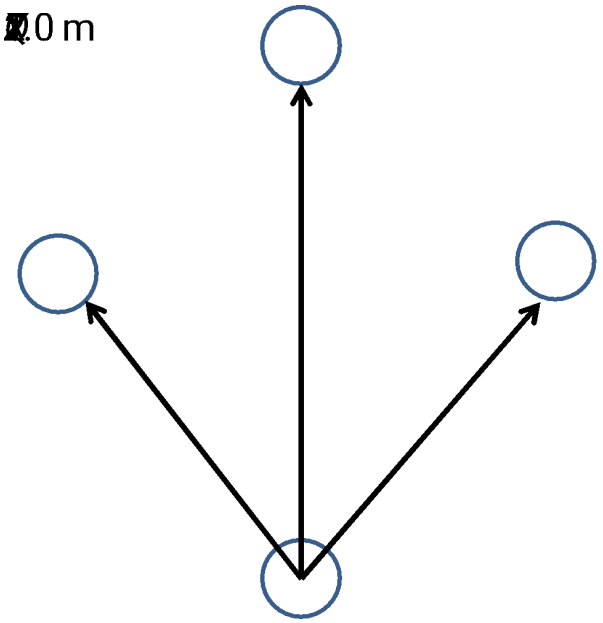
(A) Two cars colliding

(B) Two atoms colliding

(C) Two billiard (pool) balls colliding

(D) A cricket ball bouncing on a concrete floor

11 The diagram below shows the force vectors experienced by charge *Q* due to charges *X*, *Y* and *Z*.



$< xqy \;=\; < zqy \;=\; 35^0$

Which vector diagram most correctly represents the resultant force felt by *q*?

(A) 

(C)

(B) 

(D)

12 What quantity is best defined as the product of the resultant force experienced by an object and its total displacement?

(A) Work

(B) Momentum

(C) Acceleration

(D) Kinetic Energy

13 A loud speaker is set up at the front of the room at ear level. Which of the following statement best describes the sound waves that pass through the room towards you?

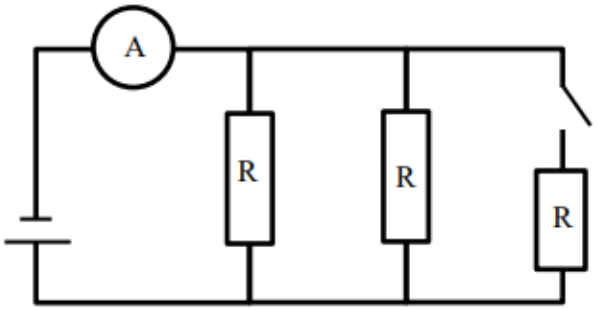
(A) The air molecules vibrate vertically up and down.

(B) The air molecules vibrate horizontally backwards and forwards.

(C) The air molecules vibrate both vertically and horizontally.

(D) The air molecules move toward you in waves.

14 Three identical resistors are connected in parallel in the circuit below.



What would be the current through any resister if the current on the ammeter is *I*?

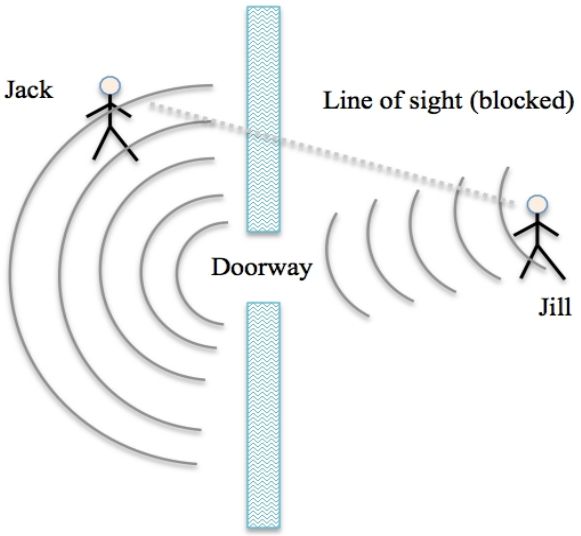
(A) $\frac{1}{3}I$

(B) $\frac{3}{2}I$

(C) I

(D) $3I$

15 In the situation depicted below, Jill is talking to Jack.



What is the property of sound waves that makes it possible for Jack to hear Jill?

(A) Beats
(B) Diffraction
(C) Dispersion
(D) Interference

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Student ID: _____

2018 YEAR 11 YEARLY EXAMINATION

Physics

Section II
Answer Booklet

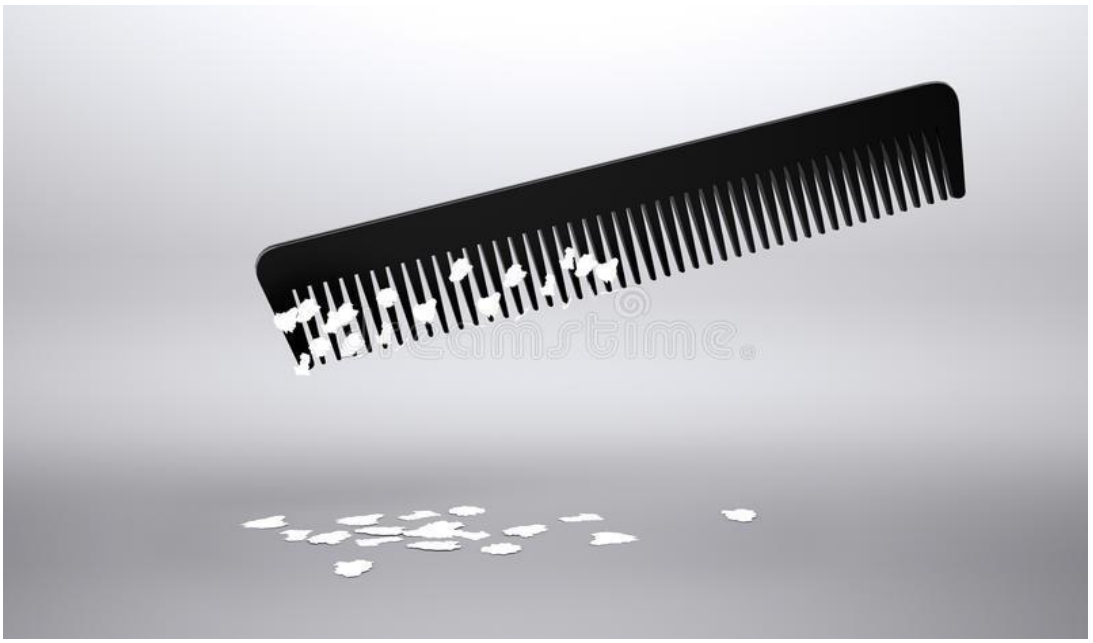
55 marks
Attempt All Questions
Allow about 1 hour 35 minutes for this part

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Show all relevant working in question involving calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.
- Write your Student ID at the top of this page.

Question 16 (3 marks)

The diagram shows small pieces of paper clinging to a plastic comb that has just been used to comb hair.

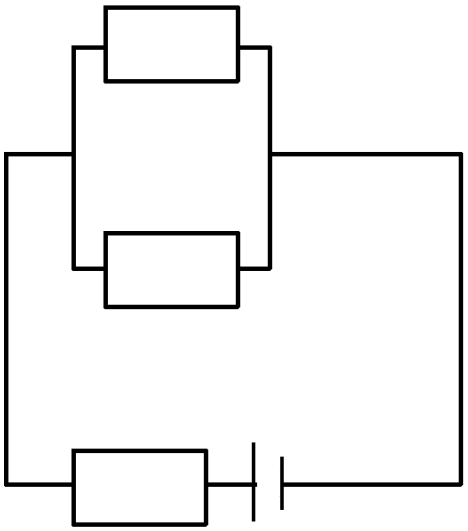


Explain what is happening, in terms of the scientific principles involved. **3**

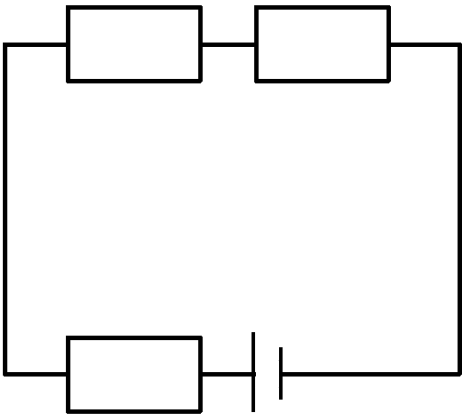
Question 17 (6 marks)

Consider the following two electric circuits, Y and Z:

Circuit Y



Circuit Z



The current flowing through the 150 Ω resistor in each circuit is the same.

(a) Calculate the current flowing in Circuit Z. **1**

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(b) Calculate the potential difference across the 80 Ω resistor in Circuit Y. **2**

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(c) Determine the value of Resistor X in Circuit Y. **3**

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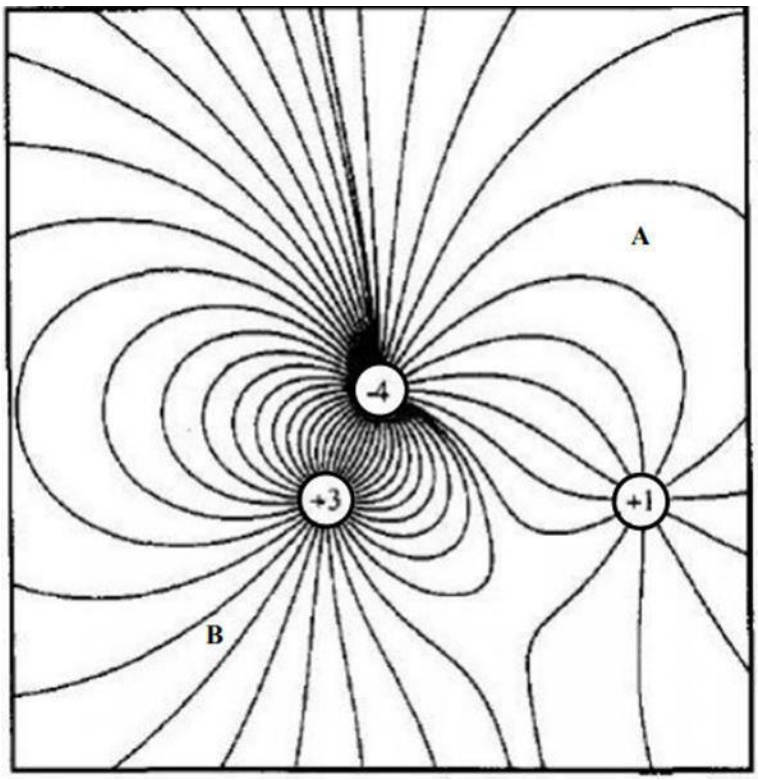
Question 18 (5 marks)

The following diagram shows the electric field produced by three charges, +3 C, +1 C, and -4 C.



(a) Draw arrows on the diagram above to show the direction of the electric field at A and at B. **2**

(b) Is the electric field strength greater at Point A or Point B? Justify your answer. **2**

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(c) A +2 C charge is placed at Point A and it experiences a 5 N force. **1**

Calculate the magnitude of the electric field at Point A.

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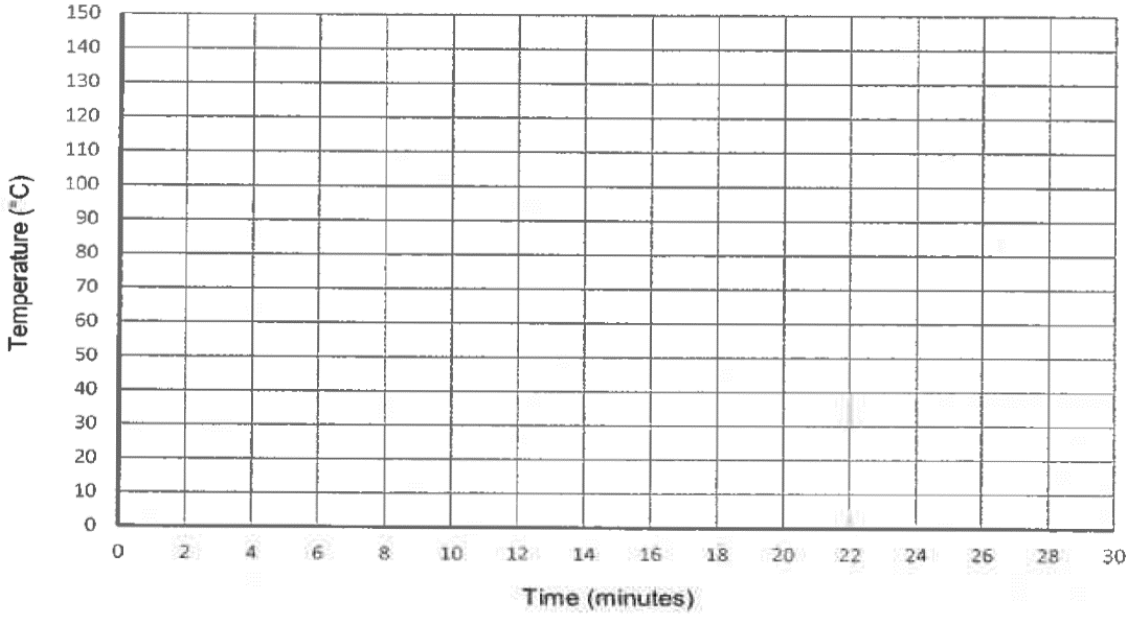
Question 19 (6 marks)

Some students provided constant heat at a rate of 2700 joules per minute to 100 grams of liquid. The initial temperature of the liquid was 18 ºC. The liquid took 8 minutes to reach its boiling point of 70 ºC and after a further 18 minutes, the students stopped heating before all the liquid had evaporated.

(a) Plot the data and draw a graph to show the temperature–time relationship for this experiment. **2**



(b) Explain the shape of the graph. **2**

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(c) Calculate the specific heat of the liquid in appropriate units.

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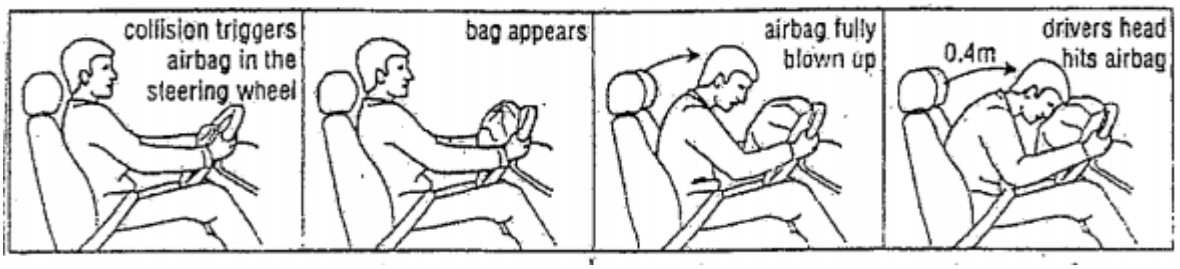
Question 20 (7 marks)

The diagrams below show an airbag inflating during a car collision.



A car of mass 840 kg was travelling at 50 kmh^{-1} when it hit a tree, with no chance to brake.

(a) Calculate the amount of force that the car experiences if it came to a complete stop after 0.35 second. **2**

(b) Is mechanical energy conserved during this collision? Justify your answer. **3**

(c) Explain, using precise terminology and reference to physical laws, how an airbag reduces the injury of the driver. **2**

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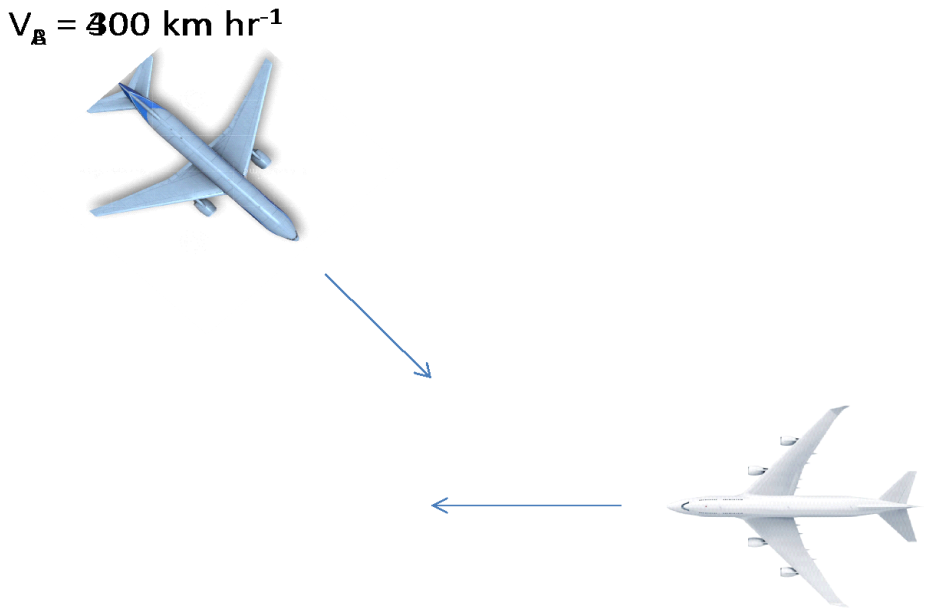
Please write student number here

Student Number……

Question 21 (3 marks)

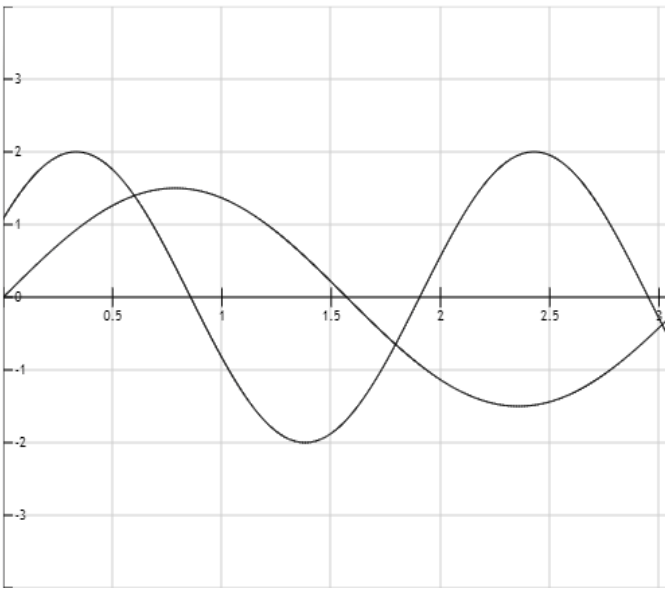
Two planes A and B fly at the same height and constant velocities. A is flying on a bearing of 120° at 400 km hr^{-1} relative to the ground, while B is flying due West ° at 300 km hr^{-1} .



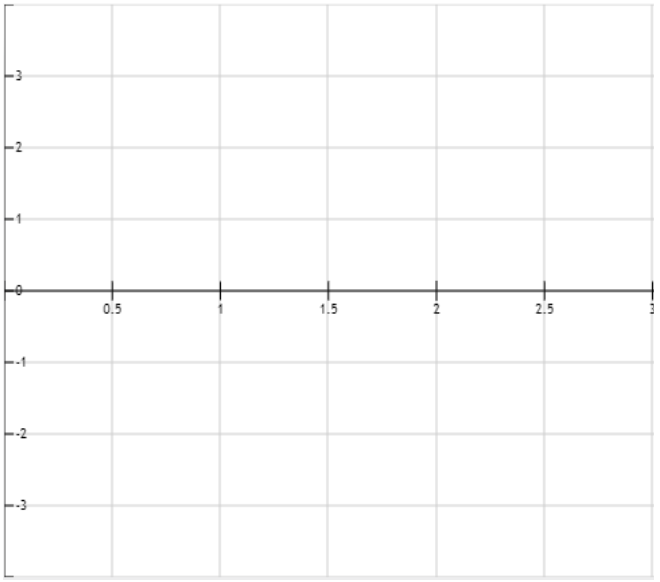
Use vector analysis to determine the velocity of A relative to B. **3**

Question 22 (4 marks)

The following two sound waves were detected separately by a microphone during a simple scientific experiment and displayed on an oscilloscope screen.



(a) The oscilloscope is capable of a superimposing these two waves. Draw the resultant wave on the graph axes below. **2**



(b) With reference to their physical properties, outline why electromagnetic waves, and not mechanical waves, are generally used for long-distance communication. **2**

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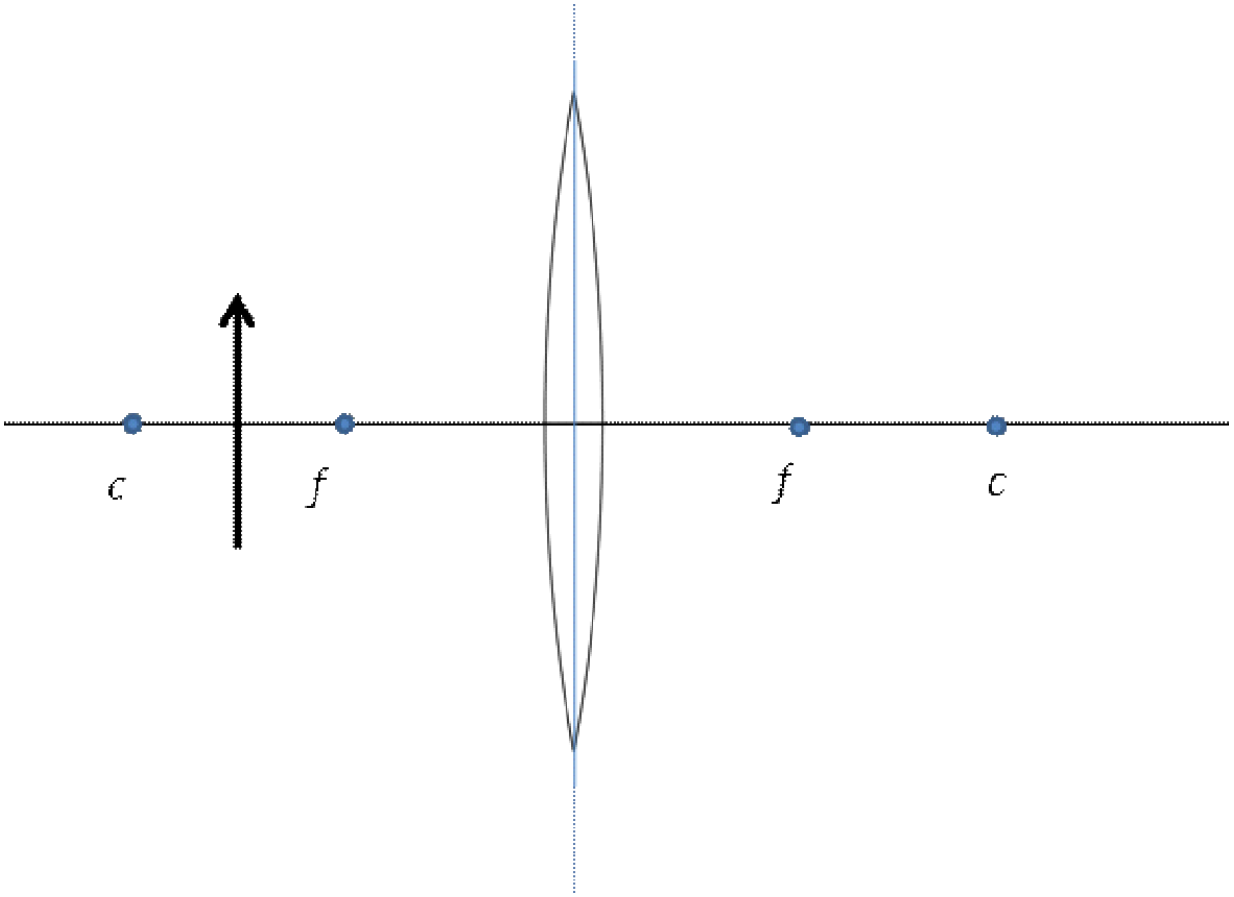
Question 23 (4 marks)

A biconvex lens is set up on a bench as shown below.

f is the focal point and *c* is the centre of curvature of the lens



(a) On the diagram, construct relevant rays to show where an image would form on the right-hand side of the lens. **2**

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

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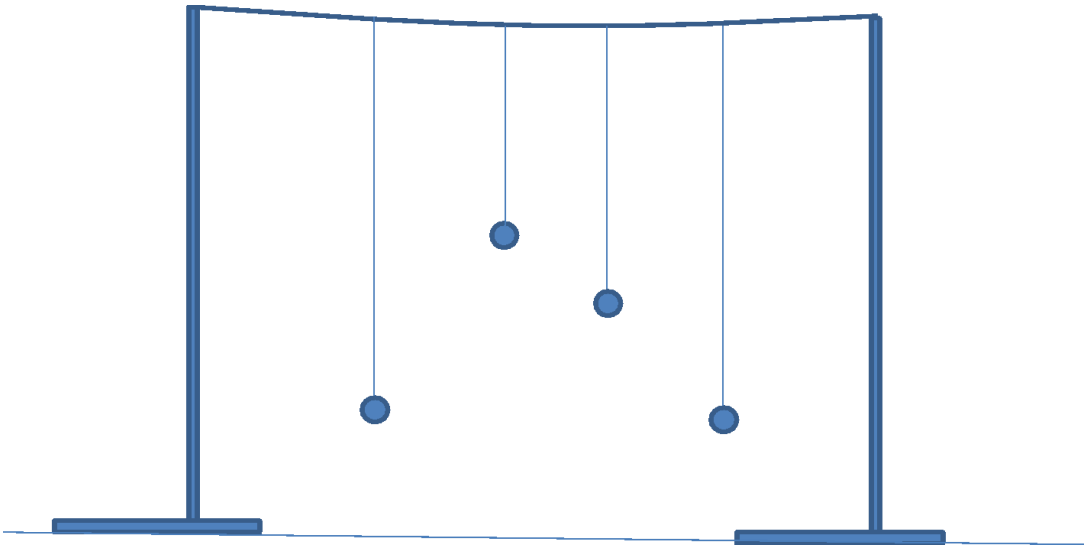
Question 24 (4 marks)

Four pendulums were attached to a string stretched between two retort stands as shown in the diagram.



Pendulum 1 was pulled back and allowed to swing freely. It was noted that after a short while pendulum 4 started to swing with the same frequency as pendulum 1, while the other two pendulums just vibrated a little bit.

Explain these observations. **4**

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Question 25 (8marks)

A practical investigation was conducted to analyse the strength of the magnetic field around a straight current-carrying conductor while varying the current and distance from the wire. Because the magnetic field is very weak a bundle of 2500 insulated wires was used instead of a single conductor.

Run	Numbers of conductors	Current in each conductor (A)	Distance of point from conductor (cm)	Magnetic field at point (x 10^{-2} T)
1	2500	1.0	5	1.0
2	2500	2.0	5	2.0
3	2500	3.0	5	3.0
4	2500	4.0	5	4.0
5	2500	5.0	5	5.0
6	2500	5.0	10	2.5
7	2500	5.0	15	1.7
8	2500	5.0	20	1.3
9	2500	5.0	25	1.0
10	2500	5.0	30	0.8

Students want to determine the relationship between the distance of a point from the conductor and the magnetic field at that point.

(a) Which runs should they use? **1**

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(b) For the runs selected for part (a), identify the dependent, independent, and controlled variables. **2**

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Question continues on next page

Question 2 5continued

(c) Draw a graph of these results from part (a) above. **4**

(d) Describe the relationship from the graph.

1

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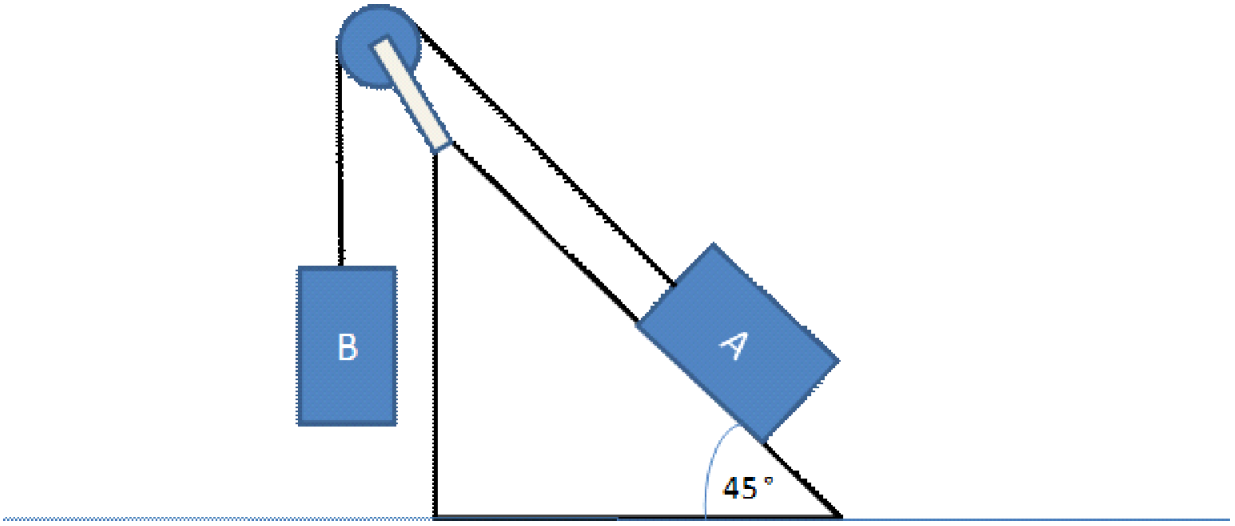
Question 26 (5 marks)

Block A is held motionless on a frictionless inclined plane by Block B suspended over a pulley as shown.



a. Block A has a mass of 20 .0 kg. Draw a vector diagram of the forces acting on Block A. The diagram must be labelled but does not need to be drawn to scale. (3)

b. What is the mass of Block B? (2)

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Section I Part B -- extra writing space

If you use this space, clearly indicate which question you are answering.

Section I Part B extra writing space

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Physics Assessment Task 3

General Instructions

- Reading time – 5 minutes
- Working time – **2 hours**
- Write using black pen
- Draw diagrams using pencil
- NESA approved calculators may be used
- A data sheet, formulae 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 — 15 marks

- Attempt Questions 1–15
- Allow about 25 minutes for this part

Section II — 55 marks

- Attempt All Questions
- Allow about 1 hour and 35 minutes for this part

Section I

15 marks
Attempt Questions 1–15
Allow about 25 minutes for this part

Use the multiple-choice answer sheet for Questions 1–15

---

1 Blue light in the visible part of the electromagnetic spectrum has a wavelength of 450 nm.

Calculate the frequency of this light.

$c = f\lambda$

$f = \frac{c}{\lambda} = \frac{3.0 \times 10^8}{450 \times 10^{-9}}$

$= 6.666 \times 10^{14}$

rounded up

(A) 1.5×10^{-15} Hz

(B) 6.6×10^{5} Hz

(C) 6.6×10^{14} Hz

(D) 6.7×10^{14} Hz

2 An ambulance is approaching a stationary observer at a constant speed of 60 kmh^{-1}. The speed of the sound is 340 ms^{-1} and the siren has a frequency of 650 Hz according to the source.

$V_{source} = \frac{60}{3.6} = 16.7\ ms^{-1}$

What is the frequency, according to the observer, as the ambulance approaches them?

$f' = f\left(\frac{V_w + V_{obs}}{V_w - V_{source}}\right) = \left(\frac{340}{340 - 16.7}\right)650$

(A) 618 Hz

(B) 633 Hz

(C) 682 Hz

(D) 789 Hz

not exact but closest answer $= \left(\frac{340}{323.3}\right)650 = 683$

3 A material to be used for a fibre-optic cable has a refractive index of 1.44.

Which of the following would be the critical angle for this material?

$\theta_c = \sin^{-1}\frac{1}{n}$

$= \sin^{-1}\frac{1}{1.44}$

$= 43.96$

(A) 14.5°

(B) 35.2°

(C) 44.0°

(D) 53.2°

4 Which statement correctly shows how a sound wave is different to a light wave?

(A) Sound waves are capable of diffraction and light waves are not.

(B) Sound waves always have a smaller frequency than light waves.

(C) Sound waves are produced by oscillating objects and light waves are not.

(D) Sound waves require a medium to propagate whereas light waves do not.

$u = \frac{80}{3.6} = 22.2 \quad v = 0$

5 A car travelling at 80 kmh^{-1} applies its brakes and comes to a complete stop in 7 seconds.

What was the acceleration of the car?

$a = \frac{v-u}{t} = \frac{-22.2}{7}$

$= -3.17$

(A) $-11.4\ ms^{-2}$

(B) $-3.2\ ms^{-2}$

(C) $3.2\ ms^{-2}$

(D) $11.4\ ms^{-2}$

6 Which of the following is NOT a method by which thermal energy can be transferred?

(A) Radiation ✓ through space

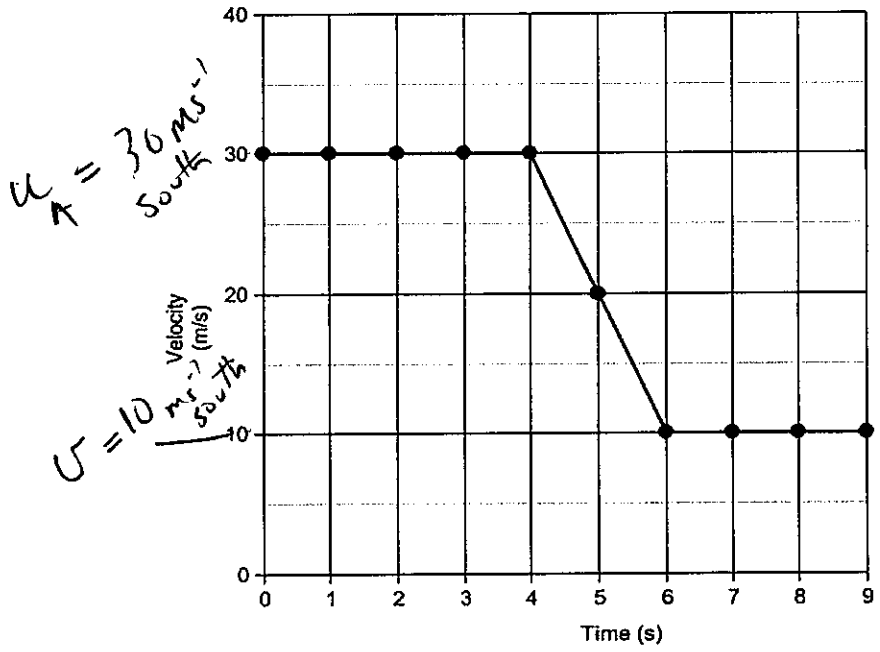
(B) Convection ✓ – in fluid

(C) Conduction ✓ – through matter

(D) Contraction

Use the following information to answer Questions **7** and **8.**

The following graph shows the motion of Car A, mass 300 kg, travelling south along a road.



$u_A = 30\ ms^{-1}$ South

$v = 10\ ms^{-1}$ South

South = +ve

At time 4 s, Car A collides with Car B, also mass 300 kg, resulting in the change in velocity shown in the graph above.

After the collision, the two cars are joined together and travel as one object.

$m_1u_1 + m_2u_2 = (m_1 + m_2)v$

7 What was the velocity of Car B just before the collision?

(A) 20 ms^{-1} South

(B) 30 ms^{-1} South

(C) 20 ms^{-1} North

(D) 10 ms^{-1} North

$300(30) + 300u_2 = 600 \times 0$

$u_2 = \frac{-6000 - 9000}{300}$

$= \frac{-3000}{300}$

$= -10$

$= 10$ North

8 What was the force experienced by Car A in this collision?

(A) 3000 N South

(B) 6000 N South

(C) 3000 N North

(D) 6000 N North

$F = ma = m\left(\frac{v-u}{t}\right)$

$= 300\left(\frac{10-30}{2.0}\right)$

$= -3000\ N$

$= 3000\ N$ North

9 Which option correctly shows how each factor influences the movement of electricity through a conductor?

	Increased length	*Increased cross sectional area*	*Increased temperature*	*Change in conducting material*
(A)	Resistance increased	Resistance decreased	Resistance increased	Resistance varies with different materials
(B)	Resistance increased	Resistance decreased	Resistance decreased	Resistance varies with different materials
(C)	Resistance increased	Resistance increased	Resistance increased	Resistance increased
(D)	Resistance decreased	Resistance decreased	Resistance decreased	No change in resistance with change of materials

10 Which of the following is the best example of an elastic collision?

(A) Two cars colliding

(B) Two atoms colliding

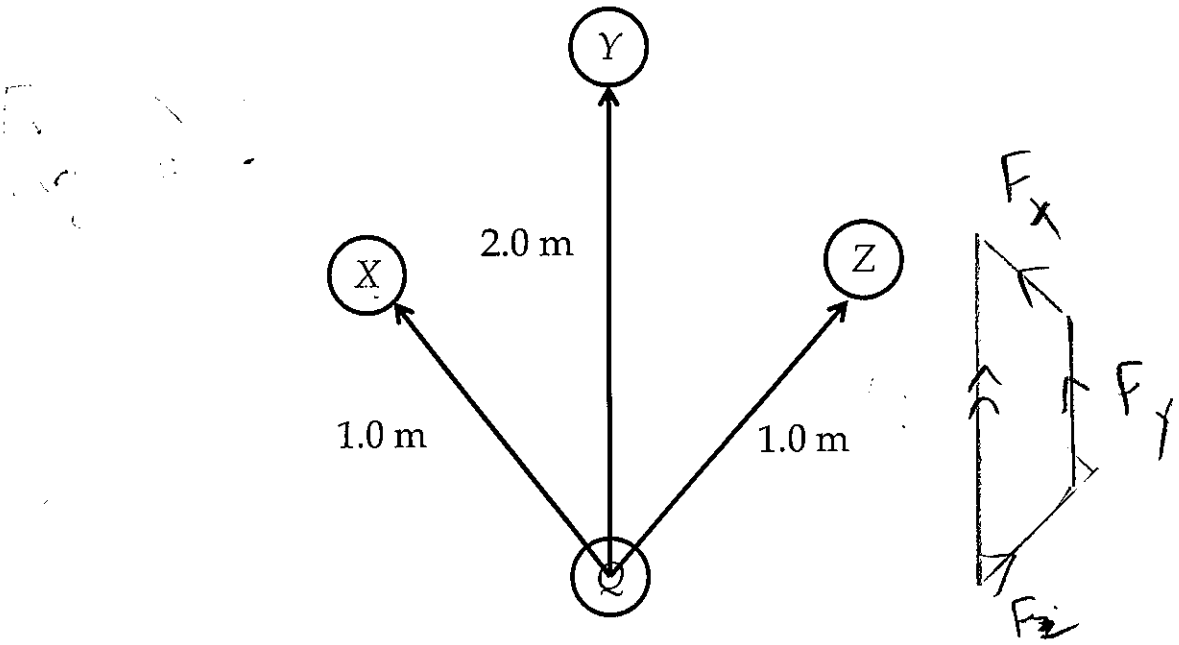
(C) Two billiard (pool) balls colliding

(D) A cricket ball bouncing on a concrete floor

In all other collisions energy is converted into other forms such as heat and sound.

In a elastic collision, kinetic energy is conserved between the 2 bodies.

11 The diagram below shows the force vectors experienced by charge Q due to charges X, Y and Z.

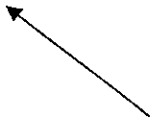


$< xqy = < zqy = 35^0$

Which vector diagram most correctly represents the resultant force felt by q?

(A) 

(C) 

(B) 

(D)

12 What quantity is best defined as the product of the resultant force experienced by an object and its total displacement?

Work = $Fs\,//$

(A) Work

(B) Momentum

(C) Acceleration

(D) Kinetic Energy

13 A loud speaker is set up at the front of the room at ear level. Which of the following statement best describes the sound waves that pass through the room towards you?

(A) The air molecules vibrate vertically up and down.

(B) The air molecules vibrate horizontally backwards and forwards.

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longitudinal wave

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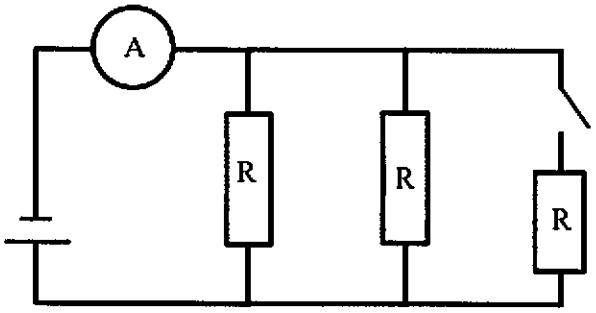


What would be the current through any resister if the current on the ammeter is I?

(A) $\frac{1}{3}I$

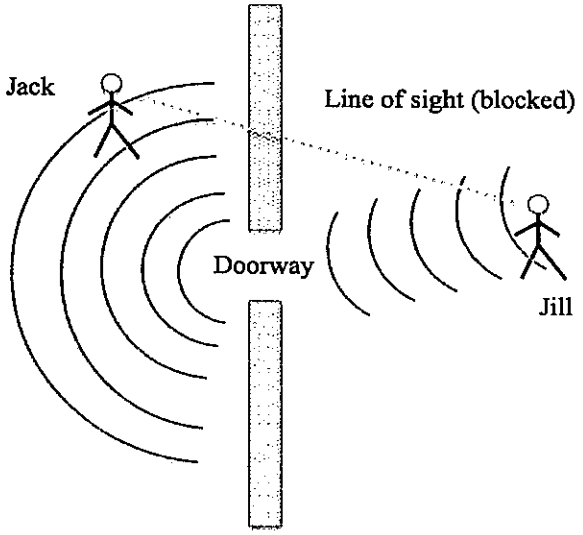
(B) $\frac{3}{2}I$

(C) I

(D) $3I$

I divides based on resistance. As R is same the current divides by 3.

15 In the situation depicted below, Jill is talking to Jack.



What is the property of sound waves that makes it possible for Jack to hear Jill?

(A) Beats

(B) Diffraction

(C) Dispersion

(D) Interference

– the wave bends as it passes through an opening

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Student ID: _____

2018 YEAR 11 YEARLY EXAMINATION

Physics

Section II
Answer Booklet

55 marks
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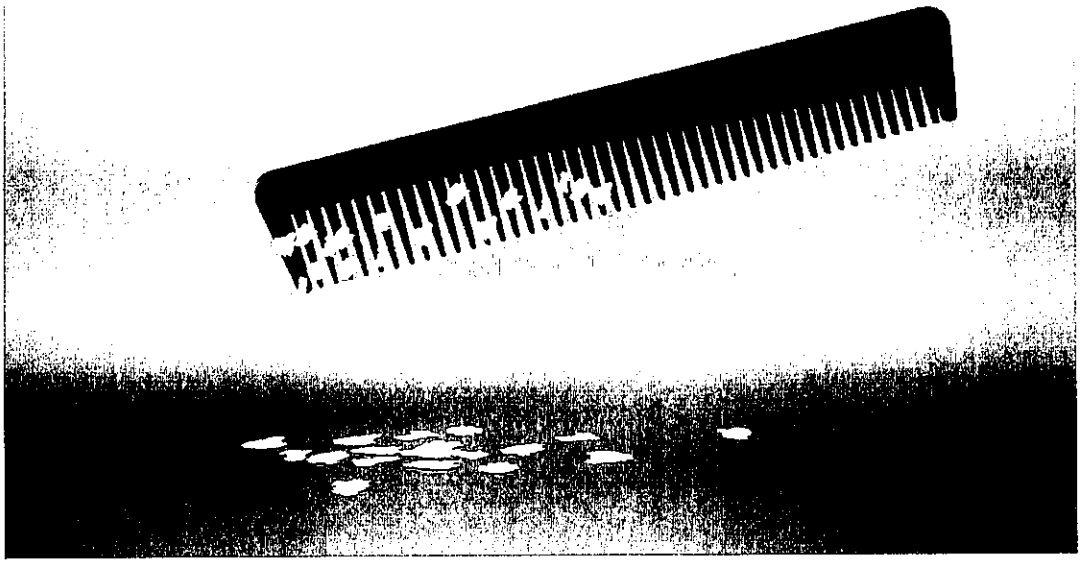
Question 16 (3 marks)

The diagram shows small pieces of paper clinging to a plastic comb that has just been used to comb hair.

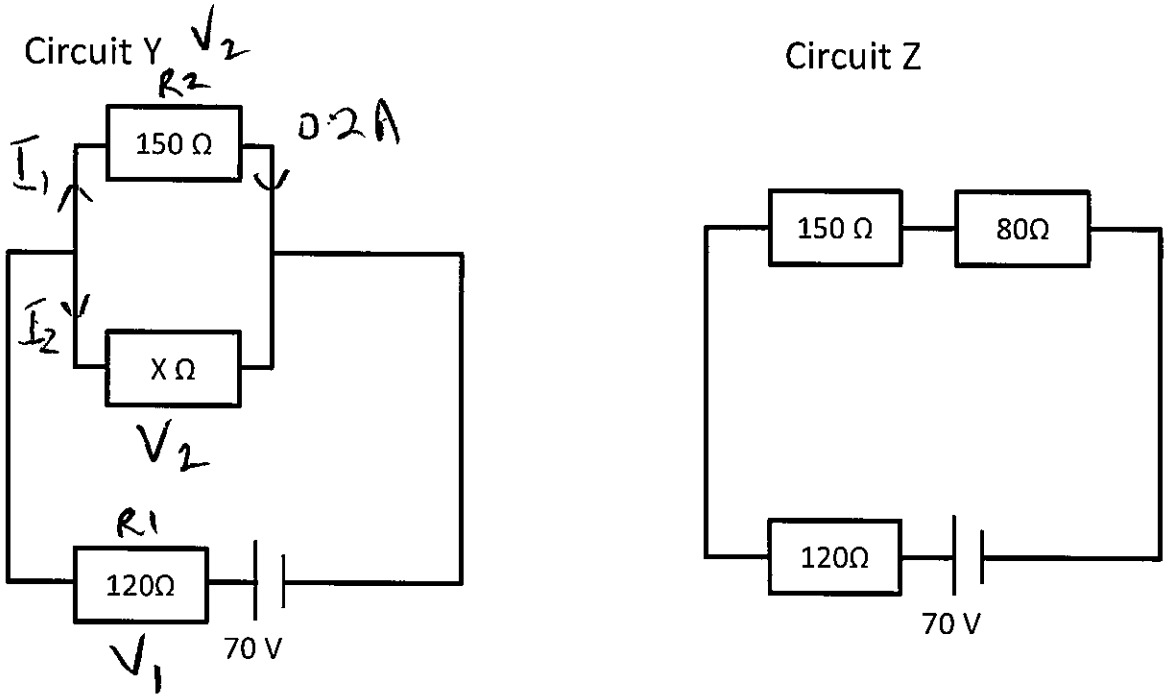


Explain what is happening, in terms of the scientific principles involved. 3

- the comb is charged by contact with the hair
- the electrons in the paper experience a force from the charged comb and the paper is polarised
- the side of the paper closest to the comb has opposite charge so it is attracted to the comb.

Question 17 (6 marks)

Consider the following two electric circuits, Y and Z:



The current flowing through the 150 Ω resistor in each circuit is the same.

(a) Calculate the current flowing in Circuit Z. 1

$V = IR \quad I = \frac{V_{total}}{R_{total}} = \frac{70}{150+80+120} = \frac{70}{350} = 0.2\ A$

(b) Calculate the potential difference across the 80 Ω resistor in Circuit Y. 2

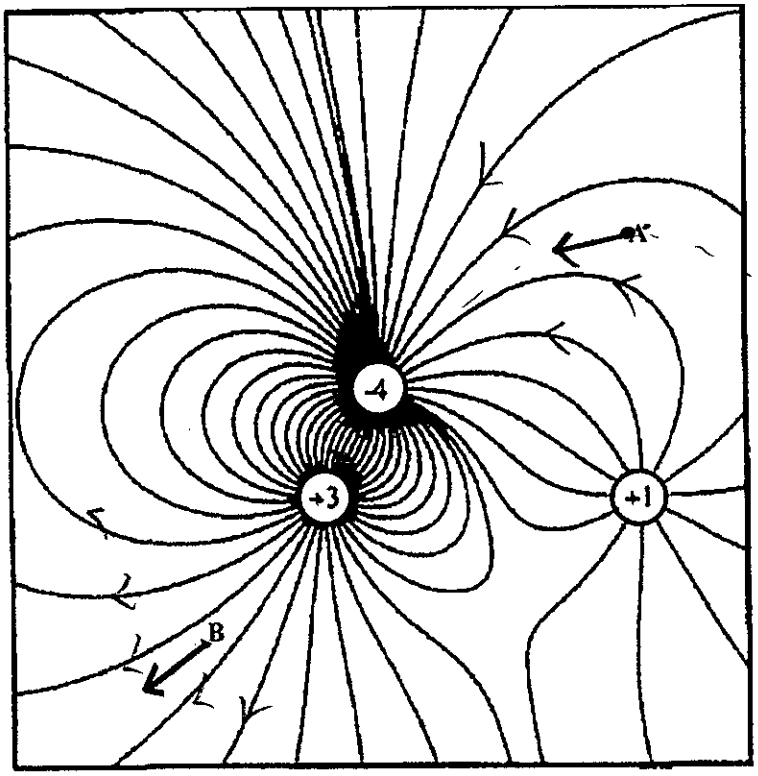
$V = IR$
$= 0.2 \times 80$
$= 16\ V$

(c) Determine the value of Resistor X in Circuit Y. 3

$V_2 = I_1 R_2 = 150 \times 0.2 = 30\ V$
$V_1 = 70 - 30 = 40\ V$
$I_{total} = V_1 / R_1 = 40/120 = 0.33\ A$
$I_{tot} = I_1 + I_2$
$0.33 = 0.2 + I_2$
$I_2 = 0.13\ A$
$R_X = \frac{V_2}{I_2} = \frac{30}{0.13} = 225\ \Omega$

Question 18 (5 marks)

The following diagram shows the electric field produced by three charges, +3 C, +1 C, and -4 C.



(a) Draw arrows on the diagram above to show the direction of the electric field at A and at B. **2**

(b) Is the electric field strength greater at Point A or Point B? Justify your answer. **2**

B. The field lines are closer together.

(c) A +2 C charge is placed at Point A and it experiences a 5 N force. **1**

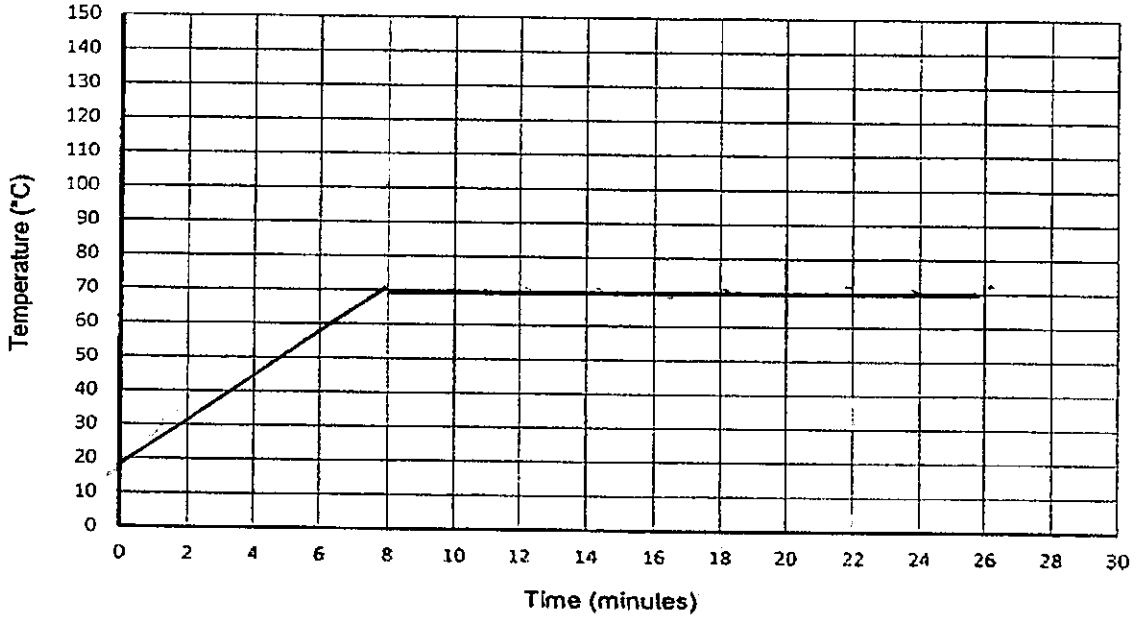
Calculate the magnitude of the electric field at Point A.

$F = Eq$ $\quad E = \frac{F}{q} = \frac{5}{2} = 2.5 = 3\ NC^{-1}$

Question 19 (6 marks)

Some students provided constant heat at a rate of 2700 joules per minute to 100 grams of liquid. The initial temperature of the liquid was 18 °C. The liquid took 8 minutes to reach its boiling point of 70 °C and after a further 18 minutes, the students stopped heating before all the liquid had evaporated.

(a) Plot the data and draw a graph to show the temperature–time relationship for this experiment. **2**



(b) Explain the shape of the graph. **2**

0 – 8 minutes liquid phase is absorbing heat and temperature rises and particles gain K.E.
8 – 26 minutes the temperature is constant as the phase changes. The energy is used to break the bonds from liquid to gas.

(c) Calculate the specific heat of the liquid in appropriate units. **2**

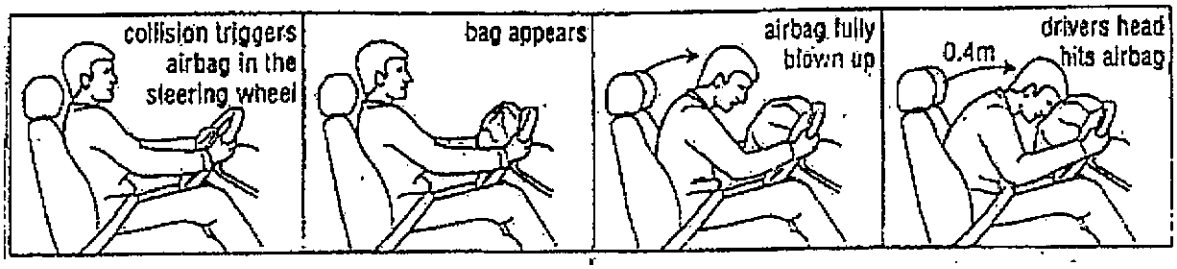
$\Delta Q = mc\Delta T$ $\quad \Delta T = 70 - 18 = 52°$ $\quad m = 100\,g$

$\Delta Q = 2700 \times 8 = 21600$

$c = \frac{\Delta Q}{m\Delta T} = \frac{21600}{100 \times 52} = 4.2\ J.g^{-1}$

Question 20 (7 marks)

The diagrams below show an airbag inflating during a car collision.



A car of mass 840 kg was travelling at 50 kmh^{-1} when it hit a tree, with no chance to brake.

(a) Calculate the amount of force that the car experiences if it came to a complete stop after 0.35 second. **2**

$u = 50/3.6 = 13.9\ ms^{-1}$ $v = 0$

$F = ma = m\frac{(v-u)}{t} = 840\left(\frac{-13.9}{0.35}\right) = 33333\ N$

$= 3.3 \times 10^4\ N$

(b) Is mechanical energy conserved during this collision? Justify your answer. **3**

No. The kinetic energy after the collision is zero. All the kinetic energy has been converted into other forms, mainly work done in deforming the car and the tree

(c) Explain, using precise terminology and reference to physical laws, how an airbag reduces the injury of the driver. **2**

Air bag increases stopping time, therefore reduces force according to:

$F = ma$ (Newton's 2nd Law) where $a = \frac{v-u}{t}$

When t is larger, for the same change in velocity, the acceleration is less, therefore the force is less.

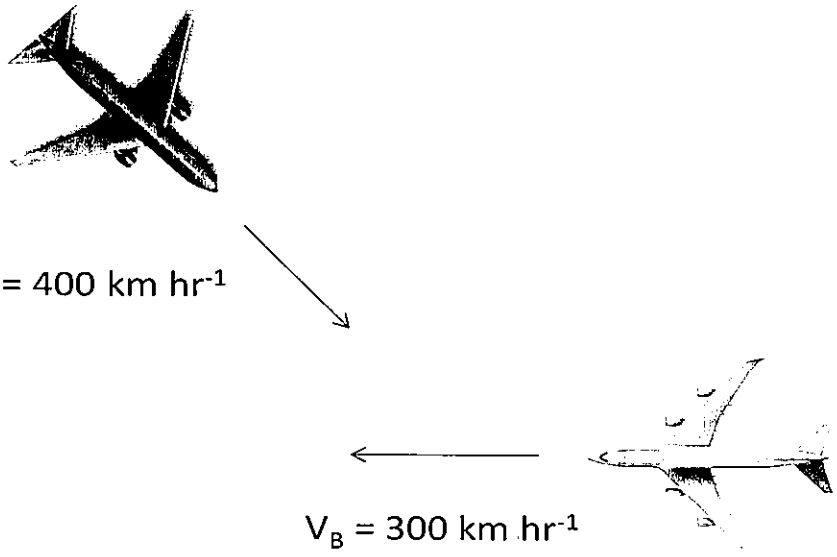
Less force = less injury.

Please write student number here

Student Number.....

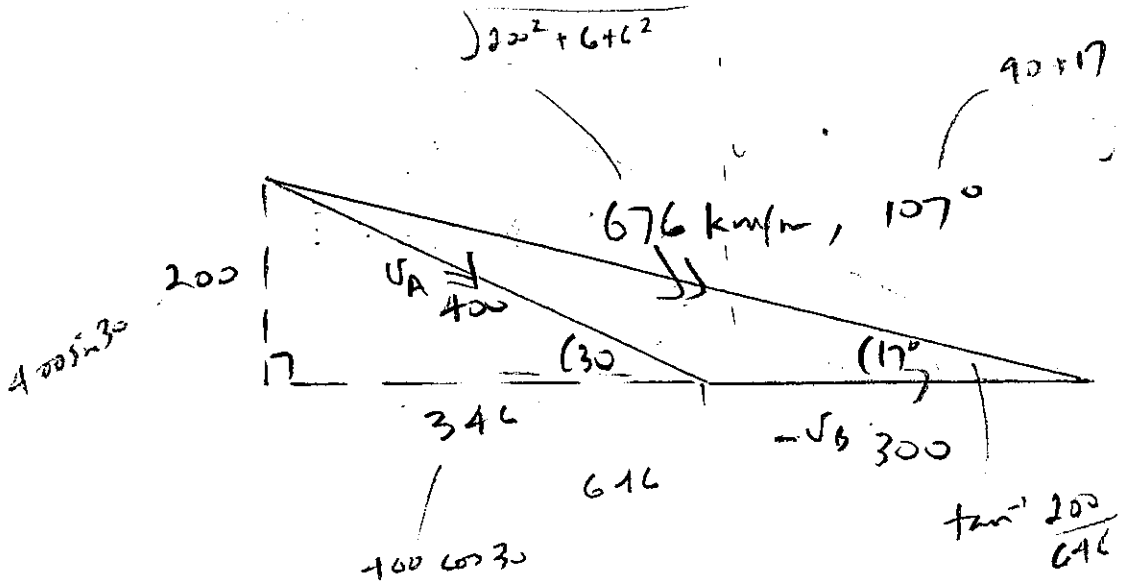
Question 21 (3 marks)

Two planes A and B fly at the same height and constant velocities. A is flying on a bearing of 120° at 400 km hr^{-1} relative to the ground, while B is flying due West ° at 300 km hr^{-1} .



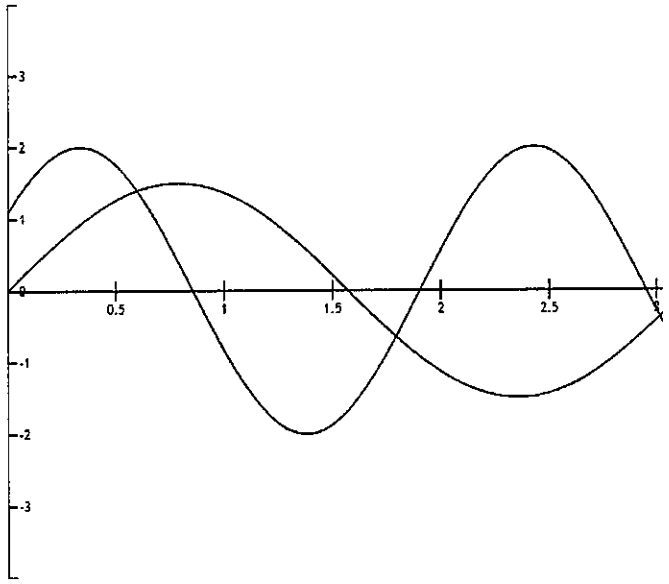
Use vector analysis to determine the velocity of A relative to B. 3

$\vec{v}_A$ rel v_B = $\vec{v}_A - \vec{v}_B$

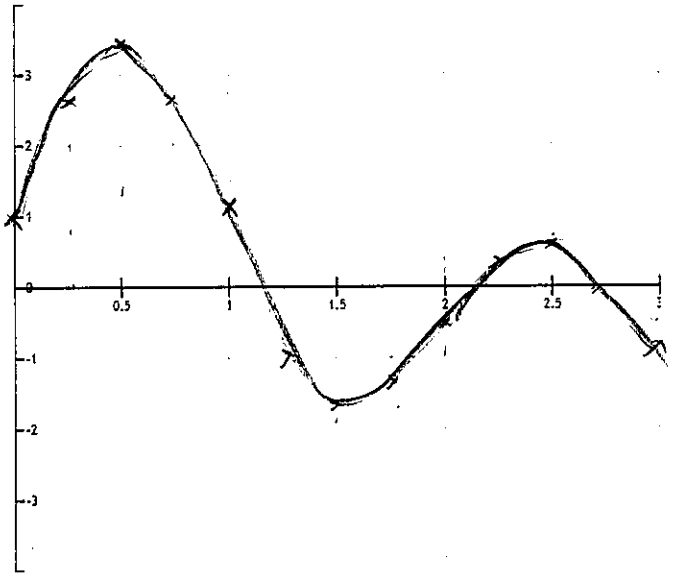


Question 22 (4 marks)

The following two sound waves were detected separately by a microphone during a simple scientific experiment and displayed on an oscilloscope screen.



(a) The oscilloscope is capable of a superimposing these two waves. Draw the resultant wave on the graph axes below. **2**



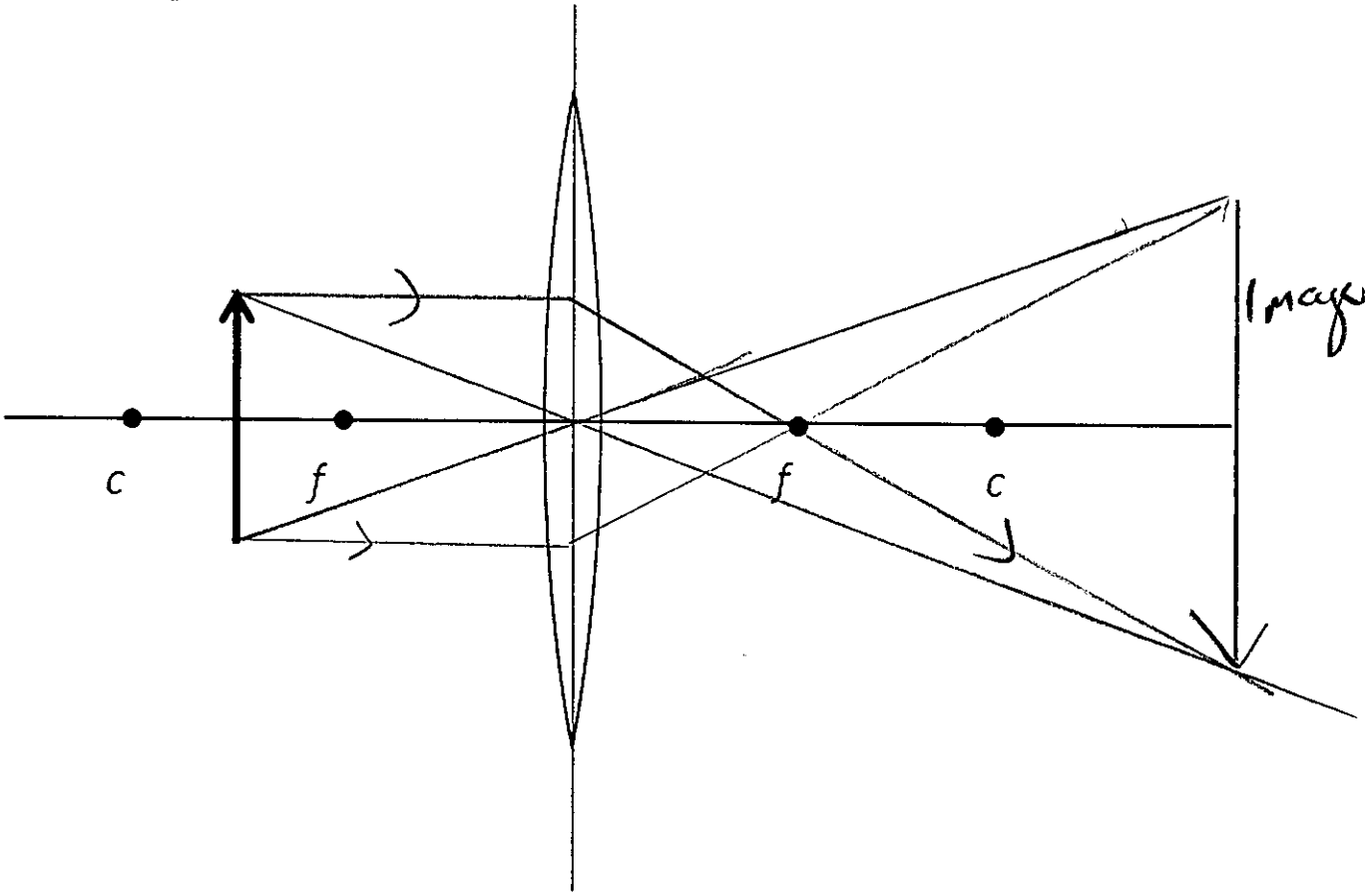
(b) With reference to their physical properties, outline why electromagnetic waves, and not mechanical waves, are generally used for long-distance communication. **2**

Can travel through a vacuum so can travel in space, travel at speed of light so communication has a small time gap.

Question 23 (4 marks)

A biconvex lens is set up on a bench as shown below.

f is the focal point and c is the centre of curvature of the lens



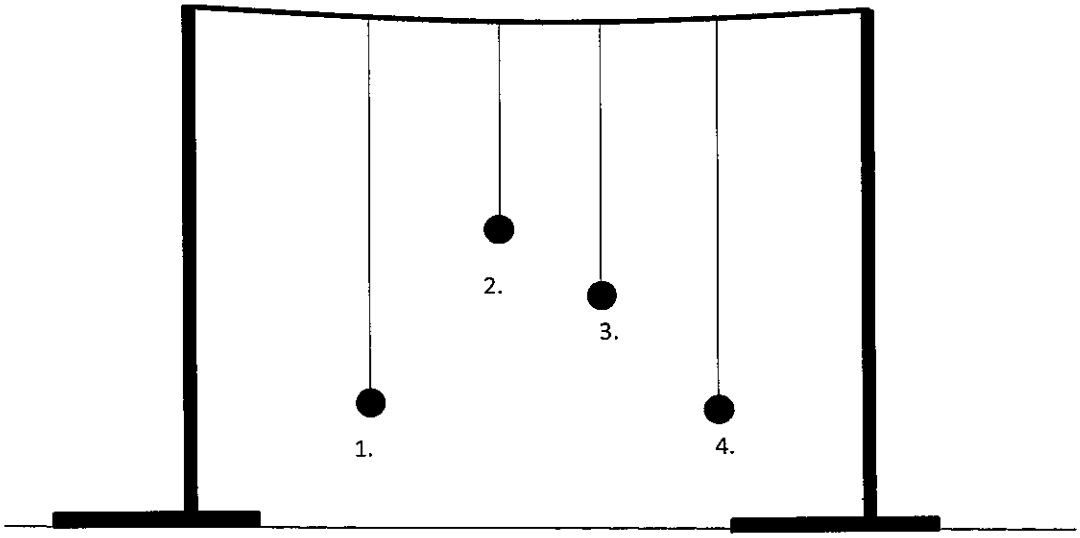
(a) On the diagram, construct relevant rays to show where an image would form on the right-hand side of the lens. **2**

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

Real, magnified + inverted

Question 24 (4 marks)

Four pendulums were attached to a string stretched between two retort stands as shown in the diagram.



Pendulum 1 was pulled back and allowed to swing freely. It was noted that after a short while pendulum 4 started to swing with the same frequency as pendulum 1, while the other two pendulums just vibrated a little bit.

Explain these observations. 4

This is an example of resonance. Pend 1 + Pend 4 are the same length so they have the same natural frequency of oscillation. When Pend 1 swings, it provides a driving frequency to Pend 4. This makes Pend 4 resonate and swing at its natural frequency. Pend 2 + 3 have different length + therefore different natural frequencies so they do not resonate.

Question 25 (8marks)

A practical investigation was conducted to analyse the strength of the magnetic field around a straight current-carrying conductor while varying the current and distance from the wire. Because the magnetic field is very weak a bundle of 2500 insulated wires was used instead of a single conductor.

Run	Numbers of conductors	Current in each conductor (A)	Distance of point from conductor (cm)	Magnetic field at point (x 10^{-2} T)
1	2500	1.0	5	1.0
2	2500	2.0	5	2.0
3	2500	3.0	5	3.0
4	2500	4.0	5	4.0
5	2500	5.0	5	5.0
6	2500	5.0	10	2.5
7	2500	5.0	15	1.7
8	2500	5.0	20	1.3
9	2500	5.0	25	1.0
10	2500	5.0	30	0.8

Students want to determine the relationship between the distance of a point from the conductor and the magnetic field at that point.

(a) Which runs should they use? IV = distance DV = field strength **1**

∴ CV = current need to use runs where current is constant + d is changed 5 - 10

(b) For the runs selected for part (a), identify the dependent, independent, and controlled variables. **2**

IV = distance

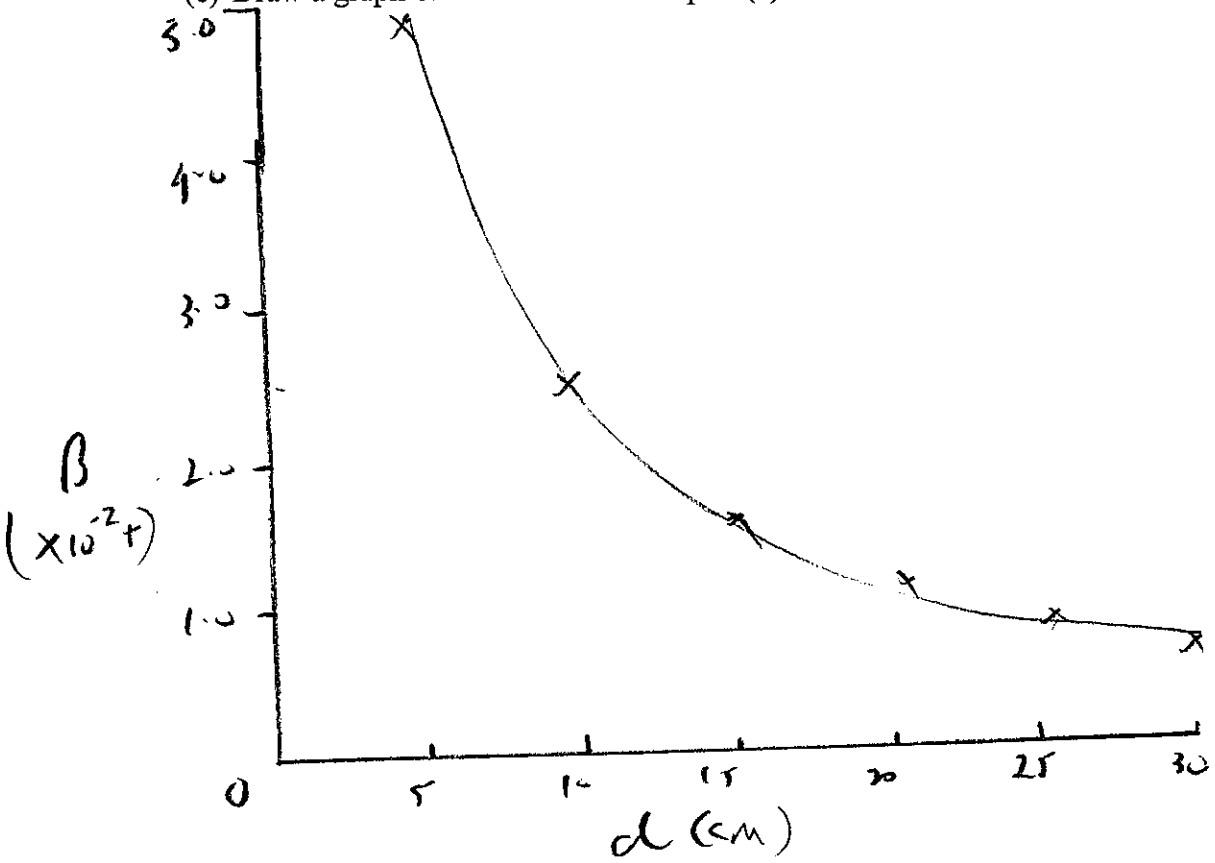
DV = field strength

CV = current + number of conductors

Question continues on next page

Question 2 5continued

(c) Draw a graph of these results from part (a) above. **4**



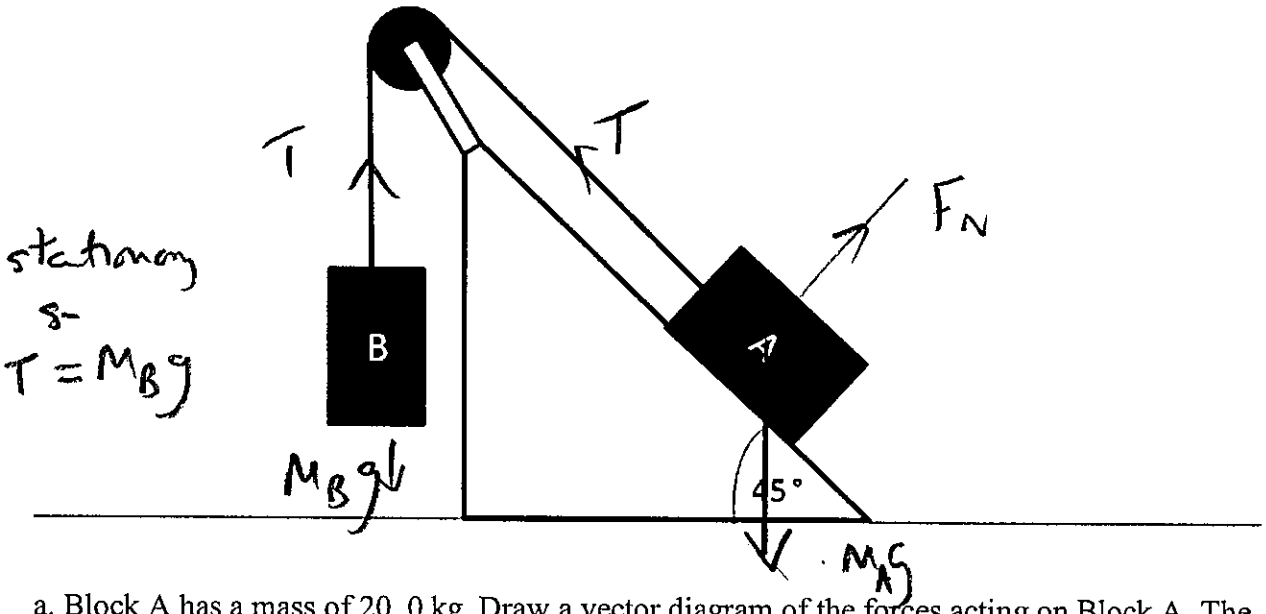
(d) Describe the relationship from the graph. **1**

$B \propto \frac{1}{d}$

B is inversely proportional to the distance

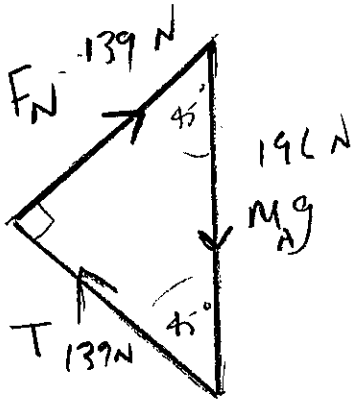
Question 26 (5 marks)

Block A is held motionless on a frictionless inclined plane by Block B suspended over a pulley as shown.



stationary
$T = M_B g$

a. Block A has a mass of 20 .0 kg. Draw a vector diagram of the forces acting on Block A. The diagram must be labelled but does not need to be drawn to scale. (3)



$F_N = M_A g \cos\theta$
$= 20 \times 9.8 \times \cos 45$
$= 139\,N$

$Mg = 20 \times 9.8$
$= 196\,N$

$T = M_A g \sin\theta$
$= 20 \times 9.8 \times \sin 45$
$= 139\,N$

b. What is the mass of Block B? (2)

$M_B g = T = M_A g \sin\theta$

$M_B = M_A \sin\theta$

$= 20.0 \sin 45 \quad = 14.0\,kg$

Section I Part B -- extra writing space

If you use this space, clearly indicate which question you are answering.