



2023
Higher School Certificate
Year 11 Yearly Examination

Physics

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Board approved calculators may be used
- Write using black pen
- A data sheet, formulae sheets and periodic table are provided
- Draw diagrams using pencil
- A ruler is required

Write your NESA number in the spaces provided in the written section of the paper

Total marks – 75

Section I – Pages 3-12 **20 marks**

Attempt Questions 1–20

Allow 35 minutes for this section

Write your answers on the multiple choice grid on page 13 of writing booklet

Section II – Pages 13– 28 **55 marks**

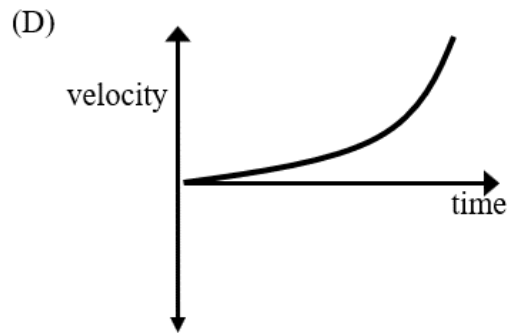
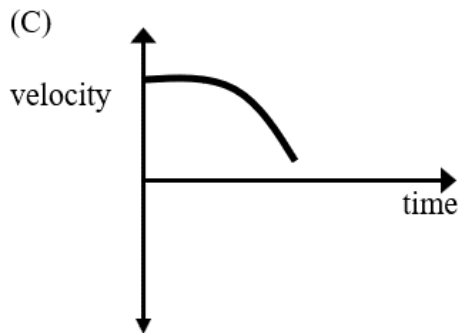
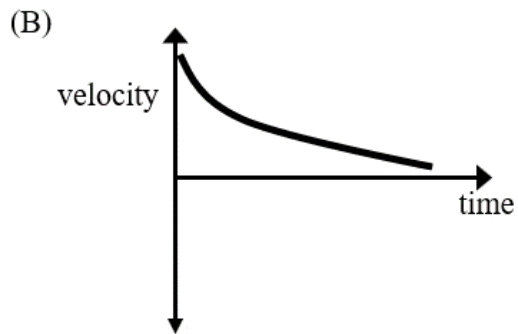
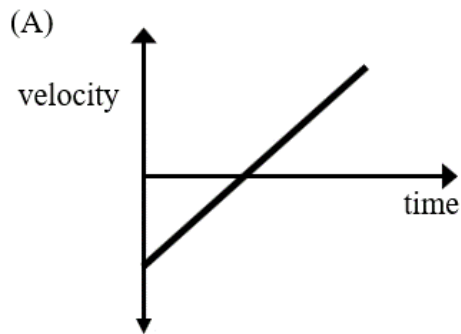
Attempt Questions 21–35

Allow 1 hour and 25 minutes for this section

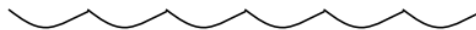
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1. Which graph represents the motion of a car moving in a positive direction with an acceleration which is increasing?



2. A scuba diver is hovering motionless at a depth of 8.0 m below the surface.

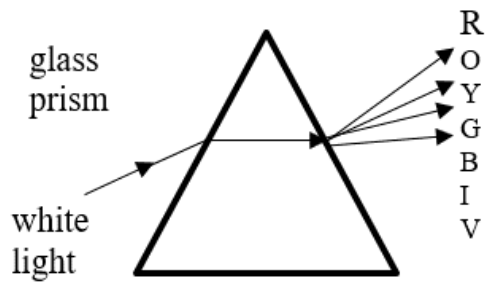


At this point in time, it would be correct to say that:

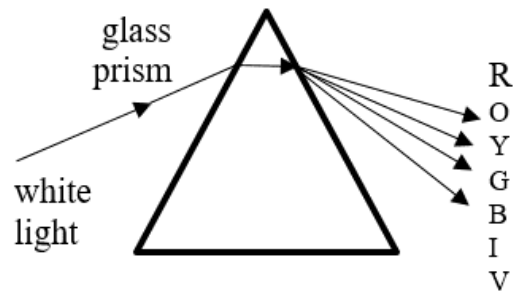
- (A) there are no forces acting on the diver.
- (B) the net force on the diver is zero.
- (C) there is an overall downwards force on the diver to keep underwater.
- (D) the diver's weight is zero.

3. Which diagram correctly depicts an investigation into the dispersion of light?

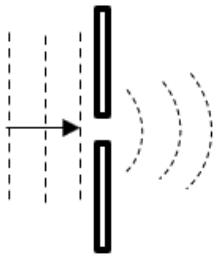
(A)



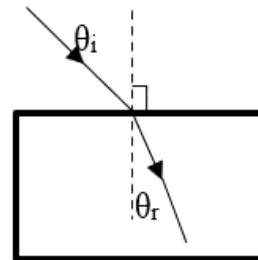
(B)



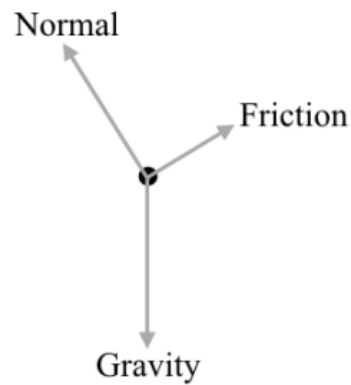
(C)



(D)



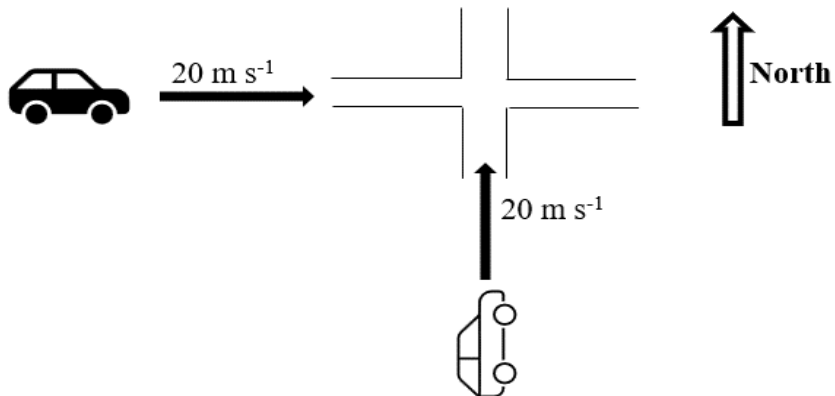
4. Below is a free body diagram of an object.



Which of the following descriptions could match the diagram?

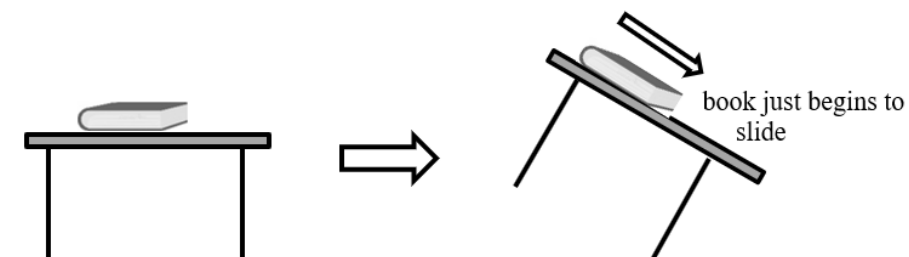
- (A) A ball rolling down an incline
- (B) A car accelerating down a hill
- (C) A flying paper airplane
- (D) A car parked on a slope

5. A black car is travelling east at 20 m s^{-1} towards an intersection at the same time as a white car moving north at 20 m s^{-1} , as shown.



An occupant of the white car would observe the direction of the velocity of the black car relative to them to be closest to:

- (A) north-east
 - (B) south-east
 - (C) north-west
 - (D) south-west
6. A book rests on a desk. The desk is gradually tilted until the book just begins to slide, at which point the desk is kept at that angle.

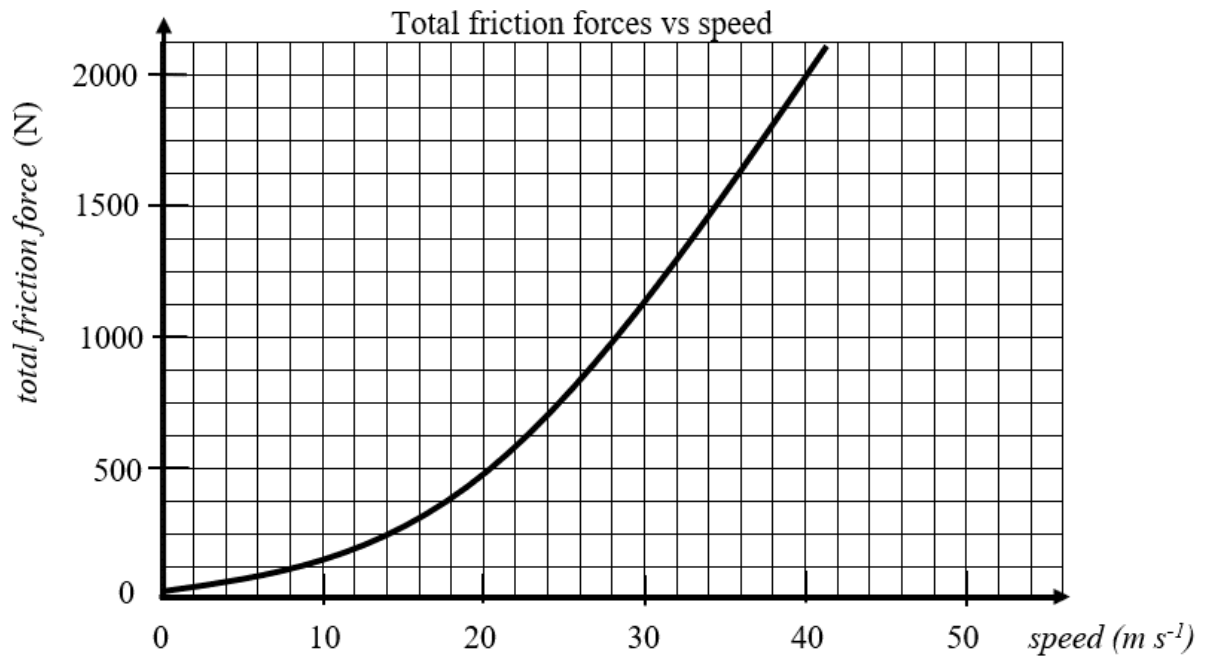


Which term best describes the book's motion as it slides down the tilted desk?

- (A) accelerating
- (B) decelerating
- (C) zero acceleration
- (D) increasing acceleration

7. The effective maximum power output of a small car's engine is 80 kW.

A graph of the total frictional forces acting against the car's motion versus the car's speed is given below.

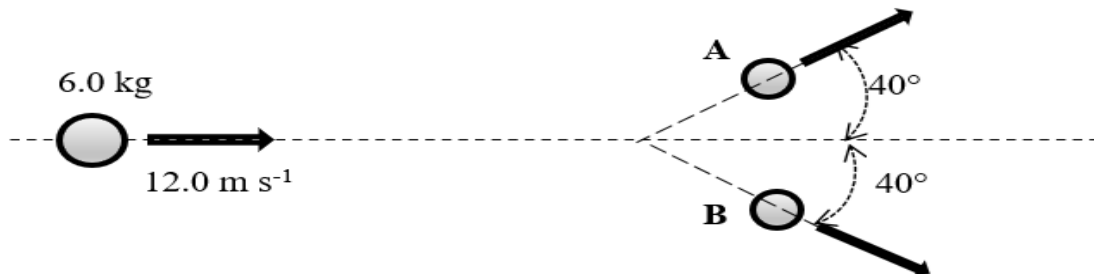


Based on this information, what is the car's maximum speed on a horizontal road?

- (A) 20 m s⁻¹
- (B) 72 km h⁻¹
- (C) 144 km h⁻¹
- (D) 160 m s⁻¹

Questions 8 refers to the following

A ball with mass 6.0 kg is moving to the east at 12.0 m s^{-1} . Due to an internal explosion the ball divides into two equal halves labelled **A** and **B** as shown.



8. The speed of the two halves of the ball, **A** and **B** is:
- (A) 12.0 m s^{-1}
 - (B) 6.0 m s^{-1}
 - (C) 31.4 m s^{-1}
 - (D) 15.7 m s^{-1}
9. If the radius of an electron's orbit around a proton is $5.3 \times 10^{-11} \text{ m}$, what is the strength of the electric field acting on the electron during its orbit?
- (A) 27 N C^{-1}
 - (B) 54 N C^{-1}
 - (C) $5.1 \times 10^{11} \text{ N C}^{-1}$
 - (D) $1.0 \times 10^{12} \text{ N C}^{-1}$
10. A 2.0 kg ball is held at rest in the air above a flat surface, giving the ball 14.7 J of gravitational potential energy. How far above the flat surface is the ball being held?
- (A) 7.5 m
 - (B) 29 m
 - (C) 75 cm
 - (D) 90 cm

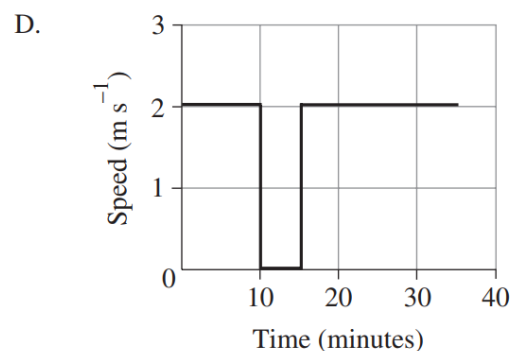
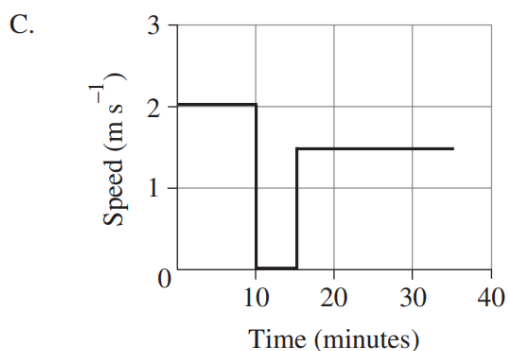
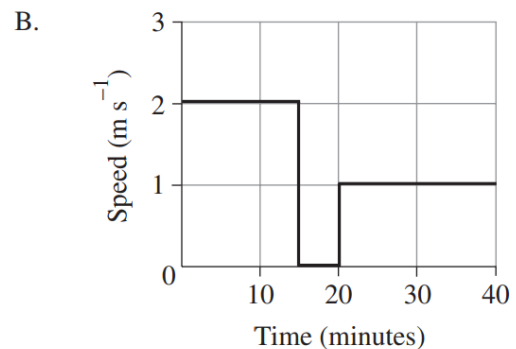
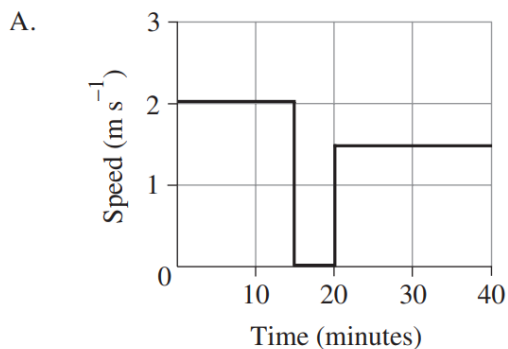
11. Waves are moving across the surface of the ocean with a frequency of 0.10 Hz and a wavelength of 180 m.

A boat floating stationary on the surface will experience what motion?

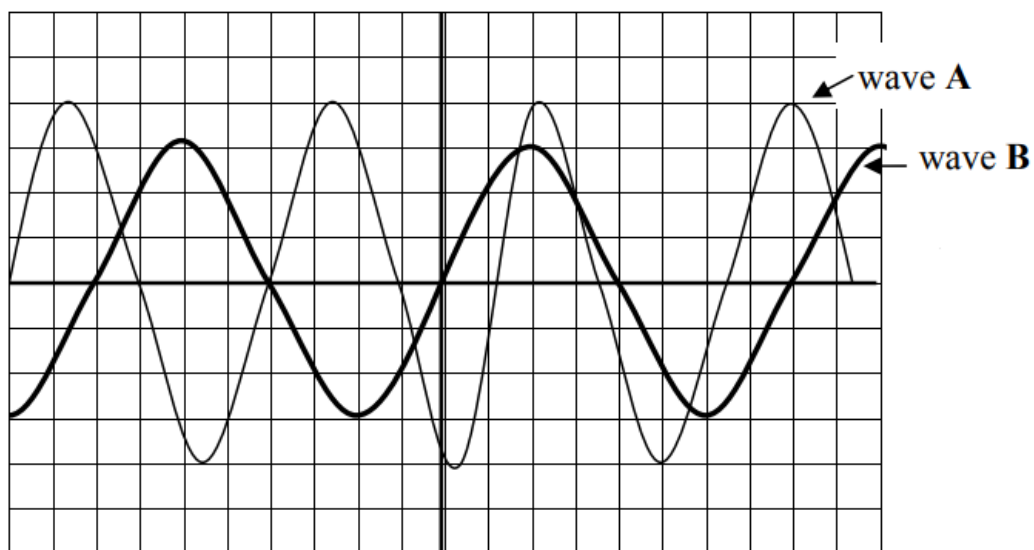
- (A) Back and forth 10 times each second.
- (B) Up and down 6 times each minute.
- (C) Back and forth 6 times each minute.
- (D) Up and down 10 times each second.

12. Sam decided to visit a local park that was 1.8 km away from her home. She left her home and walked at a consistent speed of 2 m s^{-1} until she reached the park. When she arrived, she sat down on a bench for 5 minutes before walking back home at a constant speed and arriving 20 minutes later.

Which of the following graphs shows Sam's journey?



13. Two sound waves are analysed using a CRO as shown.



When both sounds are heard, wave A, when compared to wave B will have a:

- (A) lower pitch and be louder.
 - (B) higher pitch and be louder.
 - (C) lower pitch and be not as loud.
 - (D) higher pitch and be not as loud.
14. A sound emitted from a jet plane is observed to have a frequency of 500 Hz when the observer is standing in front of the stationary plane.

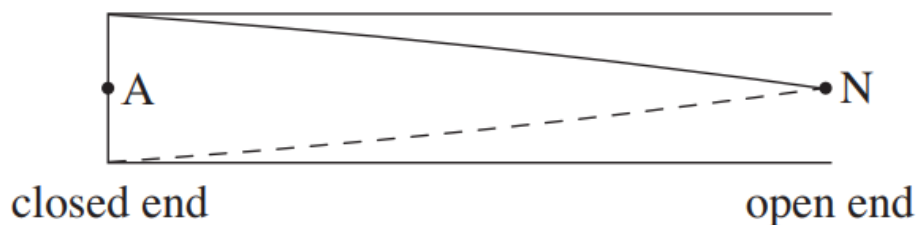


Which situation would cause the same sound to be observed to have a frequency of 1000 Hz?

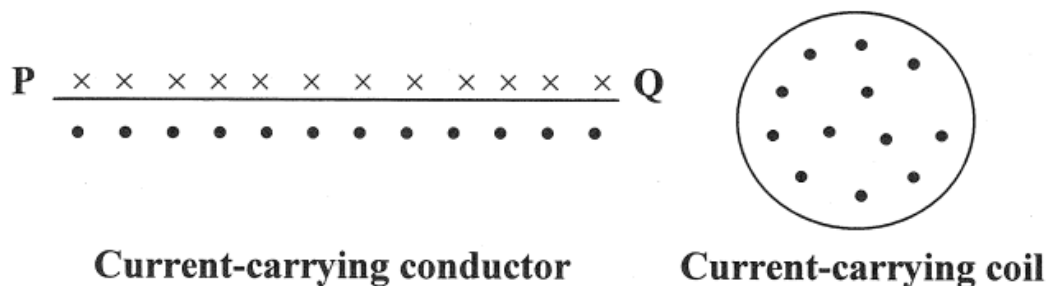
- (A) The plane moving towards the observer at 340 m s^{-1} .
- (B) The plane moving away from the observer at 340 m s^{-1} .
- (C) The plane moving towards the observer at 170 m s^{-1} .
- (D) The plane moving away from the observer at 170 m s^{-1} .

15. The first harmonic for a pipe that is closed at one end, such as a didgeridoo, will have one pressure node (N) and one pressure antinode (A), as shown in the diagram.

How many pressure nodes must there be for the third harmonic?



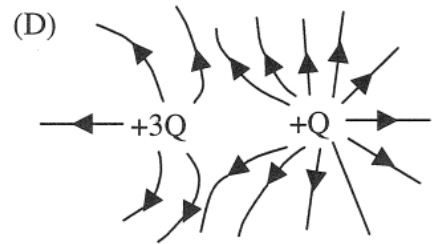
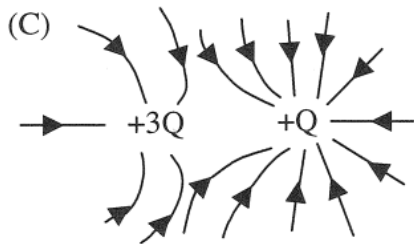
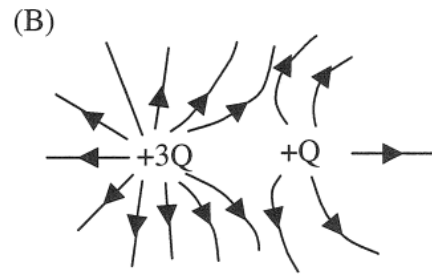
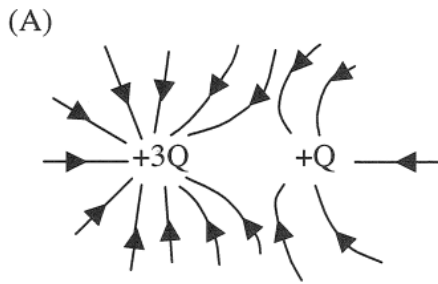
- (A) 1
 (B) 2
 (C) 3
 (D) 4
16. The diagrams show the magnetic field around straight current-carrying conductor PQ, and inside current-carrying coil.



Which choice correctly identifies the direction of the currents in the wire and the coil?

	In wire	In coil
(A)	from P to Q	anticlockwise
(B)	from P to Q	clockwise
(C)	from Q to P	anticlockwise
(D)	from Q to P	clockwise

17. Which of the following diagrams, A, B, C or D, best records the shape and direction of the electric field around two point charges $+3Q$ and $+Q$?

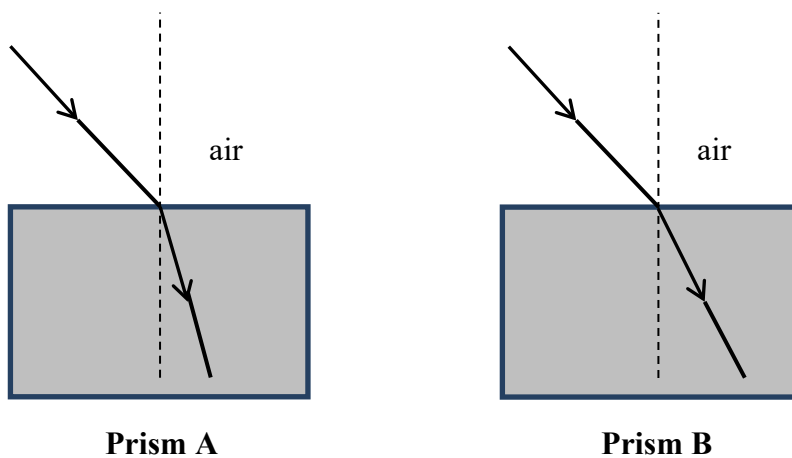


18. A hairdryer is rated as 720 W and is plugged into a 240 V power supply.

This means that:

- (A) 3 coulombs of charge flow through the hairdryer each second.
- (B) the hairdryer draws 720 amps of current.
- (C) 720 coulombs of charge flow through the hairdryer each second.
- (D) The current is 0.33 amps through the hairdryer.

- 19 A laser light source with a wavelength of 621 nm was directed into two different clear prisms with the same incident angle, as shown.



Which statement about the laser light's wavelength is correct?

- (A) λ in air $<$ λ in prism A $<$ λ in prism B
 (B) λ in prism A $<$ λ in prism B $<$ λ in air
 (C) λ in air $<$ λ in prism B $<$ λ in prism A
 (D) λ is the same in all three mediums
20. A solenoid is 280 mm long, has 500 turns of wire and a current of 2.5 A flowing through the turns.

Such a solenoid can be used as an electromagnet. To make an electromagnet magnetically twice as strong, which combination of changes is required?

	length (mm)	number of turns	current (A)
(A)	280	1000	1.25
(B)	560	500	2.5
(C)	140	500	2.5
(D)	280	250	2.5

Section I

20 marks

Attempt Questions 1–20

Allow about 35 minutes for this section

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
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10				

	A	B	C	D
11				
12				
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18				
19				
20				

Outcome	Questions	Mark
Knowledge and Understanding	MCQ(20), Q26b(3), Q29(4), Q30(4), Q31(4), Q35(3)	$\frac{\square}{38}$
Working Scientifically	Q21(3), Q22(3), Q23(4), Q24(3), Q25(5), Q26a(2), Q27(3), Q28(2), Q32(3), Q33(4), Q34(5)	$\frac{\square}{37}$
TOTAL		$\frac{\square}{75}$

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Section II

55 marks

Attempt Questions 21–35

Allow about 1 hour and 25 minutes for this section

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Show all relevant working in questions involving calculations.

Question 21 (3 marks)

Marks

Delivery vans owned by Australia Post have a thick wire mesh protection screen installed behind the driver's seat.



By referring to Newton's Laws of Motion, explain the reasons why this protection is now added to all similar commercial delivery vans.

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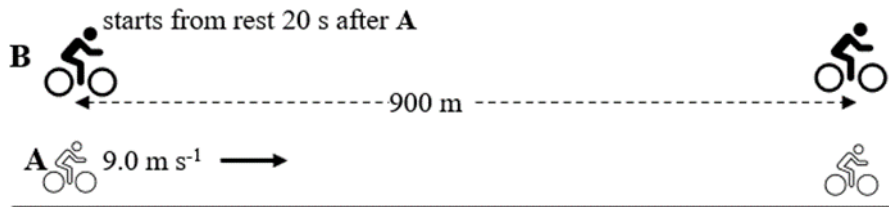
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Question 22 (3 marks)

Marks

The bicycle rider A commences her ride along a straight road, riding at a constant 9.0 m s^{-1} all the way. The second rider, B commences his ride from the same place as A did, but 20.0 s later than A.



Starting from rest, what constant acceleration must rider B have in order to catch up to rider A exactly 900 m from the start position?

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Set out your working clearly:

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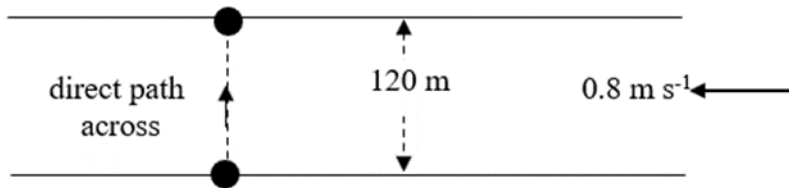
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Question 23 (4 marks)

Marks

A person can swim at 1.50 m s^{-1} through water.

They wish to swim directly across a river which is flowing at 0.80 m s^{-1} and is 120m wide.



- (a) Using a diagram, find the angle that the swimmer must head so that the path taken is directly across the river.

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- (b) How long will it take the swimmer to cross the river?

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Question 24 (3 marks)

Marks

A plane is flying through the air at 200 m s^{-1} . It is gaining altitude by flying at an angle θ to the horizontal ground below, as shown.



The pilot wishes to gain 2000 m of altitude in 100 s. What angle must the plane make with the ground? Include a vector diagram in your response to support your answer.

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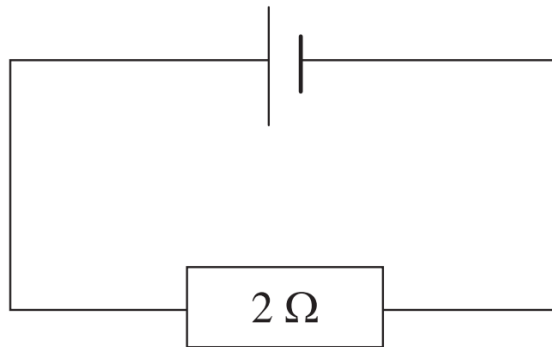
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Question 25 (5 marks)

Marks

A student set up a simple electric circuit to determine the relationship between current and voltage in ohmic resistors. They began with the circuit shown in the diagram, and also had access to a voltmeter, ammeter, a $4\ \Omega$ resistor and a $6\ \Omega$ resistor.



Describe how the student could investigate the relationship between current and voltage in ohmic resistors with this equipment.

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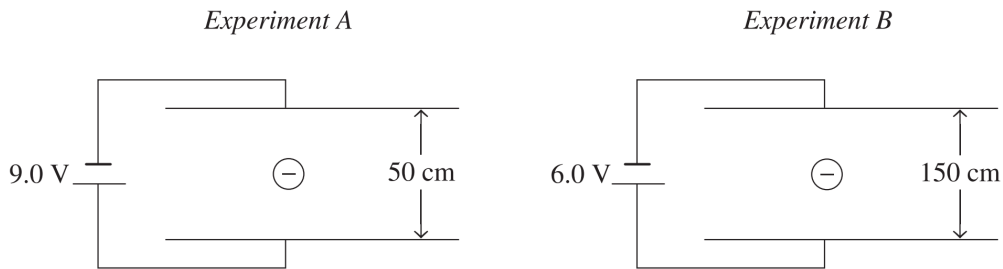
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Question 26 (5 marks)

Marks

In two experiments, A and B, identical charged particles were released from rest at the midway point between two charged parallel plates as shown.



NOT TO SCALE

(a) Calculate the electric field strength in each experiment

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(b) Compare the work done on the particles in each experiment.

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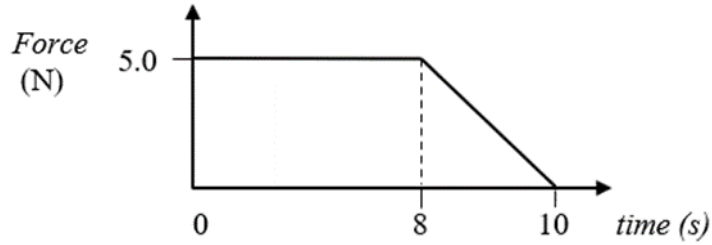
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Question 27 (3 marks)

Marks

The force applied to a 0.500 kg ball, initially at rest, is shown in the graph below



(a) What quantity does the area under the graph represent?

1

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(b) What speed will the ball have 10 s after the force was first applied?

2

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Question 28 (2 marks)

Marks

A crane is designed to lift heavy objects with a vertical speed of 1.50 m s^{-1} .



What is the maximum mass the crane can lift at this speed if its maximum power output is 25.0 kW ?

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Question 29 (4 marks)

Marks

Using labelled diagrams, compare the motion of the medium when transverse and longitudinal waves propagate. Use specific examples of both types of waves.

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Question 30 (4 marks)

Marks

Explain the phenomenon of beating by referring to the superposition of waves. A diagram should be used to illustrate your answer.

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Question 31 (4 marks)

Marks

Total internal reflection is used in many applications including optical fibres.

- (a) Outline the conditions necessary for the total internal reflection of light.

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- (b) Find the critical angle for a ray of light travelling in water ($n=1.33$) moving into air.

2

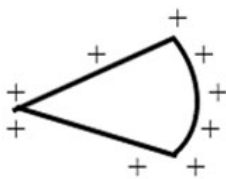
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Question 32 (3 marks)

Marks

Sketch lines of equipotential around the charged objects shown below.

3



positively charged object

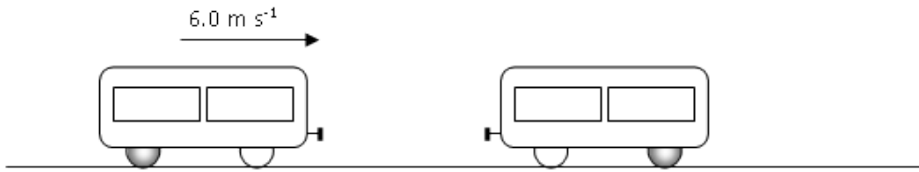


positive and negative parallel charged plates

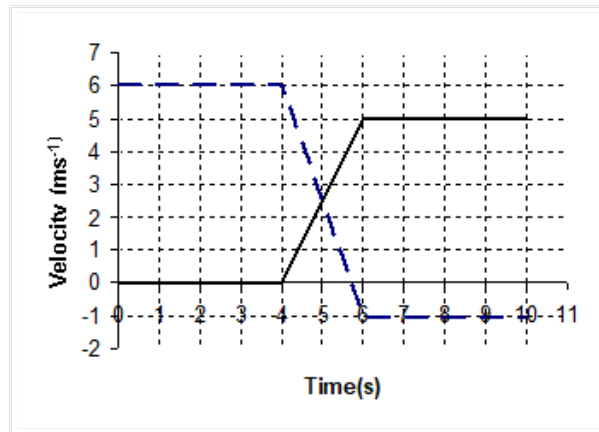
Question 33 (4 marks)

Marks

A train carriage, *P*, of mass 500 kg, is moving horizontally at 6.0 m s^{-1} to the right. It collides with another carriage, *Q*, of mass 700 kg, which is at rest.



The graph shows the variation of the velocities of the two carriages with time before, during and after the collision.



- (a) Show that *momentum* is conserved in this collision. 2

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- (b) Is this an elastic collision (is energy conserved)? Show working 2

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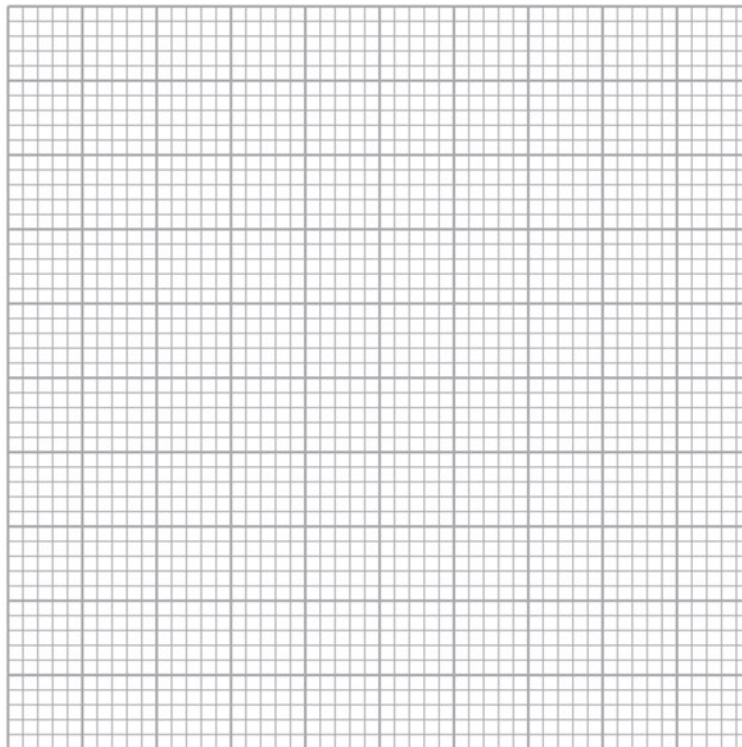
Question 34 (5 marks)

Marks

A student performs an experiment to measure the intensity of light at specific distances away from a point light source. Data from the experiment is shown in the table.

Distance from light source (cm)	Light Intensity (Wm^{-2})	
15	570.1	
20	346.0	
50	79.5	
100	47.2	

- (a) Complete the table so that a graph can be constructed that would allow a straight line to be drawn on a graph 2
- (b) Plot the data points on the axes provided. Include a trendline. 3

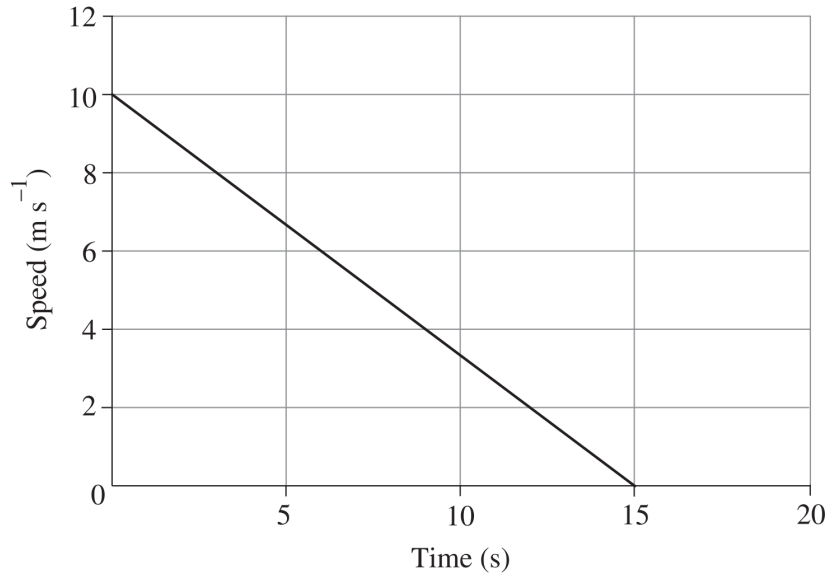


Question 35 on next page...

Question 35 (3 marks)

Marks

A 1.2 kg mass slides along a rough horizontal surface and comes to rest after 15 seconds. The graph shows the mass's journey.



Calculate the magnitude of the friction force acting on the mass

3

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END OF EXAMINATION

Marking Criteria Year 11 Yearly Examination 2023

Multiple Choice

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D	B	B	D	B	A	C	D	C	C	B	A	B	C	B	C	B	A	B	C

Question 21

Marking Criteria	Marks
Response displays a thorough understanding of the physics involved, including the incorporation of Newton's laws, (at least two)	3
Response displays a good understanding of the physics involved, including at least one of Newton's laws	2
Some physics included in response; limited or no reference to Newton's laws.	1

In the event of a crash, parcels in the van will continue to move forward due to their inertia (Newton's First Law), possibly striking the driver's head causing injury. They will only be stopped by having a force applied to them, causing deceleration ($F=ma$, Newton's Second Law). The wire mesh can exert this force on the parcels, rather than the driver's head or the windscreen of the van.

NB the parcels DO NOT accelerate towards the driver when the van stops. The airborne parcels are not experiencing a force forward.

Question 22

Marking Criteria	Marks
<ul style="list-style-type: none">All necessary calculations performed correctlyWorking is set out clearlyFinal answer provided is correct	3
<ul style="list-style-type: none">All necessary calculations attempted but an error made or omission exists e.g. missing direction	2
<ul style="list-style-type: none">Basic calculation attempted or one correct step made	1

Sample Answer

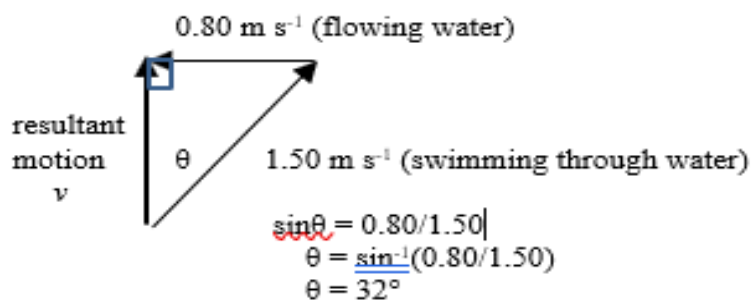
Time to catch up = $900 \text{ m} / 9.0 \text{ m s}^{-1} = 100 \text{ s}$ but starting time for **B** is 20.0 s later, so $t = 80 \text{ s}$

Use: $u=0$, $s=900 \text{ m}$, $t=80 \text{ s}$: Find a : $s = ut + \frac{1}{2}at^2$
 $900 = 0 + \frac{1}{2}a \times 80^2$
 $a = 1800/6400$
 $a = 0.28 \text{ m s}^{-2}$

Question 23

a.

Marking Criteria	Marks
<ul style="list-style-type: none"> • Correct angle calculated • Diagram used is clear and correct 	2
<ul style="list-style-type: none"> • Correct angle found without diagram shown OR • Angle found with an error made but diagram is correct 	1



b.

Marking Criteria	Marks
<ul style="list-style-type: none"> • Correct answer provided (carry-over from (a)) 	2
<ul style="list-style-type: none"> • Appropriate data used but with an error 	1

Sample Answer

Using either trigonometry or Pythagoras to find v from the above diagram: $v^2 + 0.80^2 = 1.50^2$
 $v = 1.27 \text{ m s}^{-1}$

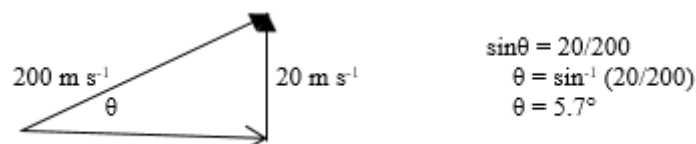
time = distance/speed = $120 \text{ m} / 1.27 \text{ m s}^{-1} = 94.5 \text{ s}$

Question 24

Marking Criteria	Marks
<ul style="list-style-type: none"> • Correct calculations with correct answer provided and correct vector diagram 	3
<ul style="list-style-type: none"> • Answer provided but with an error made 	2
<ul style="list-style-type: none"> • A correct step towards the answer is provided 	1

Sample Answer

To gain 2000 m altitude in 100 s the vertical speed must be $2000 \text{ m} / 100 \text{ s} = 20 \text{ m s}^{-1}$ up.



Question 25

Marking Criteria	Marks
<ul style="list-style-type: none"> • Describes how current should be measured • Describes how voltage should be measured • Describes how 2Ω, 4Ω and 6Ω resistors should be used (use the resistors to replicate the experiment OR change the current) • Identifies how the relationship between current and voltage in ohmic resistors will be determined (increase V and measure I, analyse graph) • Identifies relevant controlled variables 	5
• Any FOUR of the above points	4
• Any THREE of the above points	3
• Any TWO of the above points	2
• Any ONE of the above points	1

The student should place the ammeter in series with the circuit to measure the current flowing through the circuit and therefore through the resistor.

They should place the voltmeter in parallel with the resistor to measure the voltage drop across the resistor.

After switching on the power supply at a set voltage, the student should measure and record the voltage and current through the 2Ω resistor. The student should then vary the voltage provided by the power supply, measuring and recording the voltage and current through the resistor each time the power supply voltage is changed. The temperature of the wires would need to be kept constant, that can be achieved by switching off the power supply between each measurement.

The student should then repeat these steps using the 4Ω and 6Ω resistors and plot their results in a voltage versus current graph. The relationship between current and voltage in ohmic resistors can then be determined by analysing the trendlines for each resistor.

Question 26

a.

Marking Criteria	Marks
• Calculates electric field strength for each experiment (mark not deducted for incorrect units)	2
• Provides some correct working	1

Experiment A: Experiment B:

$$E = \frac{V}{d}$$

$$= \frac{9.0}{0.50}$$

$$= 18 \text{ V m}^{-1}$$

$$E = \frac{V}{d}$$

$$= \frac{6.0}{1.50}$$

$$= 4 \text{ V m}^{-1}$$

b.

Marking Criteria	Marks
<ul style="list-style-type: none"> Provides similarity and a difference with correct supporting calculations 	3
<ul style="list-style-type: none"> One of the above missing 	2
<ul style="list-style-type: none"> Some relevant information 	1

Similarity

Work is done on the charge by the field for both charges.

Both particles are displaced in the same direction

Difference

Work done on particle A is 1.5 times greater than the work done on particle B.

$$W \propto \Delta V$$

Experiment A:

$$\Delta V = 4.5 \text{ V}$$

Experiment B:

$$\Delta V = 3.0 \text{ V}$$

Therefore, $W_A = 1.5W_B$.

Question 27

a.

Marking Criteria	Marks
<ul style="list-style-type: none"> Quantity correctly identified 	1

Sample Answer

Impulse

OR change in momentum

b.

Marking Criteria	Marks
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<ul style="list-style-type: none">• Area under graph found correctly• Speed of ball subsequently calculated correctly	2
<ul style="list-style-type: none">• As above but with an error or omission	1

Sample Answer

Area under graph = rectangle + triangle = $5 \text{ N} \times 8 \text{ s} + \frac{1}{2} \times 5 \text{ N} \times 2 \text{ s} = 45 \text{ N s}$.

$$I = \Delta p = m\Delta v$$

$$45 = 0.500 \times \Delta v$$

$$\Delta v = 45/0.500$$

$$= 90 \text{ m s}^{-1}$$

Question 28

Marking Criteria	Marks
<ul style="list-style-type: none"> Correct calculation leading to correct answer provided 	2
<ul style="list-style-type: none"> Correct identification of P or $U=mgh$ made (or reference to $W=mg$) 	1

Sample Answer

e.g.
$$P = \frac{\Delta E}{\Delta t}$$

$$= \frac{\Delta U}{\Delta t}$$

$$= \frac{mg\Delta h}{\Delta t}$$

$$25.0 \times 10^3 = (m \times 9.8 \times 1.50)/1$$

$$m = (25.0 \times 10^3)/(9.8 \times 1.50)$$

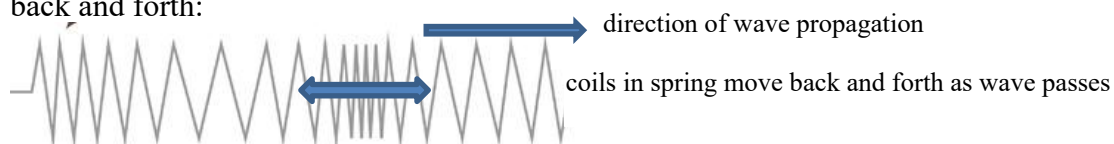
$$m = 1.7 \times 10^3 \text{ kg (2 sig.figs)}$$

Question 29

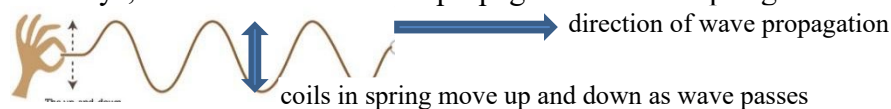
Marking Criteria	Marks
<ul style="list-style-type: none"> Similarities and differences highlighted for the two wave types Diagrams are clear, labelled and referred to or annotated Selected examples are appropriate and aid in clarifying the response 	4
<ul style="list-style-type: none"> Similarities and differences identified for the two wave types Diagrams are used and labelled 	3
<ul style="list-style-type: none"> Comparison between the wave types is made with either a similarity or a difference 	2
<ul style="list-style-type: none"> Some relevant information 	1

Sample Answer

Longitudinal waves involve a back and forth motion of the medium in the direction of the propagation of the wave, such as the coils in a slinky spring when one end is moved rapidly back and forth:



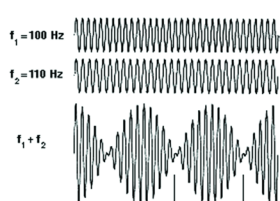
whereas transverse waves have the medium oscillating in a direction perpendicular (transverse) to the wave's direction of propagation. If the end of a slinky spring is shaken sideways, a transverse wave will propagate down the spring:



Similarities between the two include that only the medium oscillates and then returns to its rest position once the wave has passed.

Question 30

Marking Criteria	Marks
<ul style="list-style-type: none"> Explanation is clear and correct Diagram used clearly and shows superposition Reference to the relationship between beat frequency and source frequencies is clear 	4
<ul style="list-style-type: none"> Explanation is provided Diagram is used 	3
<ul style="list-style-type: none"> Several aspects of beating is made Superposition is outlined 	2
<ul style="list-style-type: none"> One relevant aspect of beating is provided 	1



Sample Answer

Beating is a result of two sources of sound with slightly different frequencies. It is a regular variation in the amplitude, hence the volume, of the resultant observed wave as constructive, the destructive and then constructive interference changes the amplitude of the resultant wave. When the waves are heard together, the resultant wave which is the superposition of the two source waves is heard. This resultant wave has a displacement equal to the sum of the displacements of the source waves at that point. This results in “beating” where the volume (amplitude) of the resultant wave varies with a frequency: $f_{beat} = |f_1 - f_2|$ e.g. 2 source waves with frequencies 110 Hz and 100 Hz will produce a resultant wave with a beat frequency of 10 Hz.

The diagram shows superposition of two waves – i.e. the resultant wave having the algebraic sum of the two waves’ displacements at any point in time. (Note: diagram does not need to show beating).

Question 31

a.

Marking Criteria	Marks
<ul style="list-style-type: none"> Two conditions relating to refractive index and angle of incidence outlined 	2
<ul style="list-style-type: none"> One correct condition identified 	1

Sample Answer

For total internal reflection to occur, $n_2 < n_1$ where n_1 is the refractive index of the medium the light is in, and n_2 the refractive index of the medium the light is entering. The angle of incidence, $\theta_i > \theta_c$ where θ_c is the critical angle, i.e. the angle of incidence giving an angle of refraction = 90° .

31 b.

Marking Criteria	Marks
<ul style="list-style-type: none"> Correct answer calculated 	2
<ul style="list-style-type: none"> An answer provided using correct formula but with an error made 	1

Sample Answer

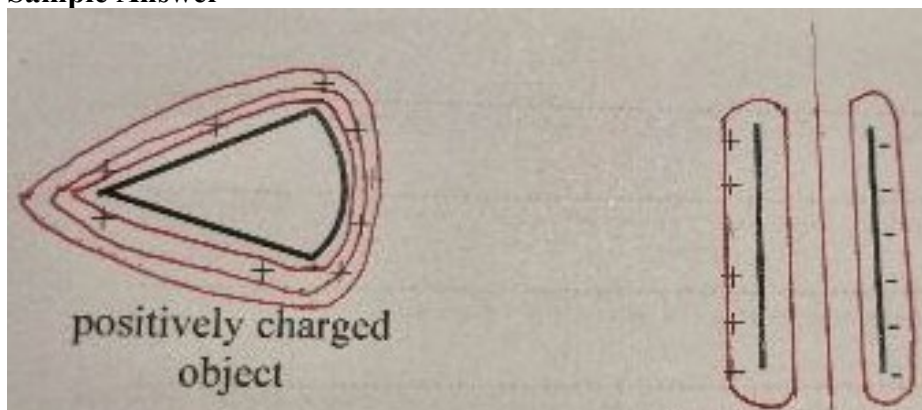
Use : $\sin\theta_c = \frac{n_2}{n_1} = (1.00/1.33)$

$$\theta_c = \sin^{-1}(1.00/1.33) = 49^\circ$$

Question 32

Marking Criteria	Marks
<ul style="list-style-type: none"> All lines are drawn correctly and clearly Relative spacing and shapes correct 	3
<ul style="list-style-type: none"> Lines drawn but with an error made 	2
<ul style="list-style-type: none"> Lines drawn as equipotential lines (not E field) but with errors OR field lines drawn around the objects 	1

Sample Answer



(example of acceptable student response)

Question 33

a.

Marking Criteria	Marks
<ul style="list-style-type: none"> Calculates momentum before and after showing that these are equal in size and direction. 	2
<ul style="list-style-type: none"> Calculates momentum before or after with units. 	1

Sample answer: Initial momentum = mass of carriage P x velocity carriage P
 $= 500 \times 6 = 3000 \text{ kg m s}^{-1}$ to right
 Final momentum = sum of momenta of each carriage
 $= 500 \times (-1) + 700 \times 5 = 3000 \text{ kg m s}^{-1}$ to right
 Therefore, momentum is conserved.

b.

Marking Criteria	Marks
<ul style="list-style-type: none"> Identifies that the collision is elastic with correct supporting calculation 	2
<ul style="list-style-type: none"> Some correct working or identification that collision is elastic 	1

$$\frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2 = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$$

$$\frac{1}{2} 500 \times 6^2 + 0 = \frac{1}{2} 500 \times (-1)^2 + \frac{1}{2} 700 \times 5^2$$

$$9000 = 9000$$

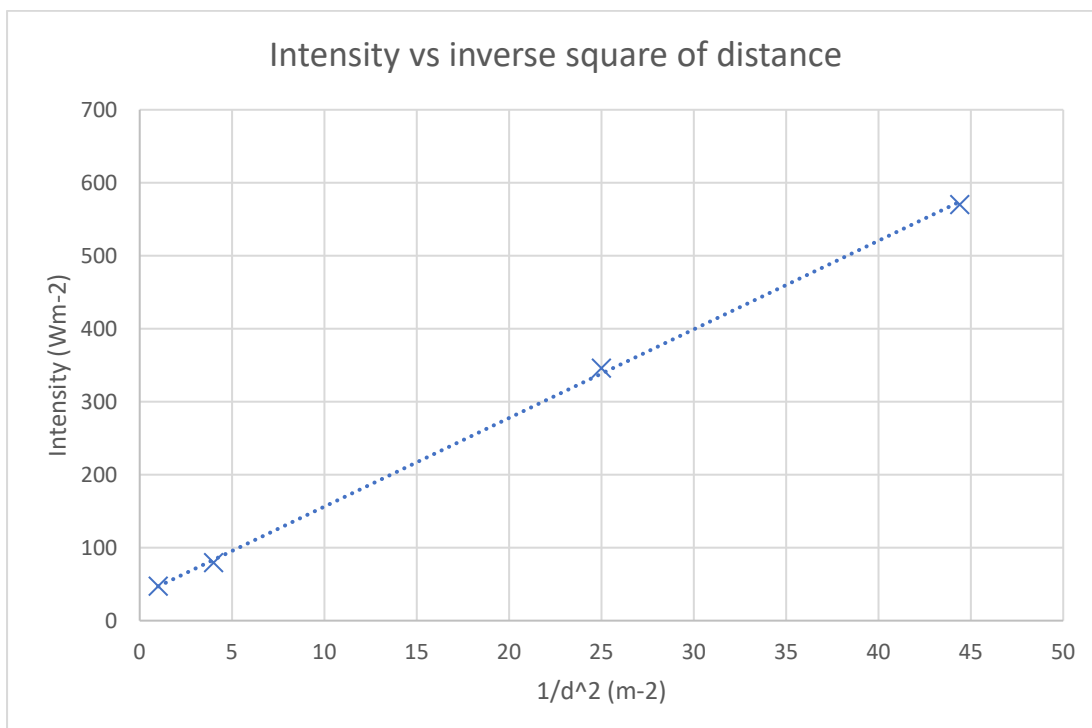
The collision is elastic

Question 34

Marking Criteria	Marks
<ul style="list-style-type: none"> • Correct heading and values in column 	2
<ul style="list-style-type: none"> • Correct heading OR correct values in table 	1

Distance from light source (cm)	Light Intensity (Wm^{-2})	$\frac{1}{d^2}$ (m^{-2})
15	570.1	44.4
20	346.0	25
50	79.5	4
100	47.2	1

Marking Criteria	Marks
<ul style="list-style-type: none"> • Correct plotting of points, correct trendline, correct axes labels 	3
<ul style="list-style-type: none"> • All of the above with one mistake 	2
<ul style="list-style-type: none"> • Some correct graphing features 	1



Question 35

Marking Criteria	Marks
• Calculates the magnitude of the friction force	3
• Calculates acceleration	2
• Provides some relevant working	1

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

$$= \frac{0 - 10}{15}$$

$$= -0.6667 \text{ m s}^{-2}$$

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$= 1.2 \times 0.6667$$

$$= 0.80 \text{ N}$$