



Annual Examinations for Secondary Schools 2022

YEAR 11 PHYSICS TIME: 2 hours

Name: _____

Class: _____

Answer ALL questions in the spaces provided on the Examination Paper.

All working must be shown. The use of a calculator is allowed.

Where necessary take the acceleration due to gravity $g = 10 \text{ m/s}^2$.

Density	$m = \rho V$
Pressure	$P = \rho g h$ $F = P A$
Moments	Moment = $F \times \text{perpendicular distance}$
Energy	$PE = m g h$ $KE = \frac{1}{2}mv^2$ Work Done = $F s$
	Work Done = Energy Converted $E = P t$
Force	$F = m a$ $W = m g$
Motion	Average Speed = $\frac{\text{total distance}}{\text{total time}}$ $s = \frac{(u + v) t}{2}$ $s = ut + \frac{1}{2}at^2$
	$v = u + at$ $v^2 = u^2 + 2as$ Momentum = $m v$
Electricity	$Q = I t$ $V = I R$ $E = Q V$
	$P = I V$ $R \propto \frac{L}{A}$ $E = I V t$
	$R_T = R_1 + R_2 + R_3$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$
Electromagnetism	$\frac{N_1}{N_2} = \frac{V_1}{V_2}$
Heat	$\Delta Q = m c \Delta \theta$
Waves	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$ $\eta = \frac{\text{the speed of light in air}}{\text{the speed of light in medium}}$
	$v = f \lambda$ $m = \frac{h_i}{h_o} = \frac{\text{image distance}}{\text{object distance}}$ $f = \frac{1}{T}$
Radioactivity	$A = Z + N$

Question	1	2	3	4	5	6	7	8	9	10	11	Theory	Multiply by 0.68	Prac	Final Mark
Mark	10	10	10	10	10	10	10	10	15	15	15	125	85	15	100
Score															

SECTION A

This section has 8 questions. Each question carries 10 marks.

1. The energy used to power homes around Malta comes from different sources. Some sources are renewable, while others are non-renewable.

a) Define renewable and non-renewable energy sources.

_____ [2]

b) Write the following energy sources in the correct column. [2]

Hydroelectric; Nuclear; Wind; Geothermal.

Renewable sources of energy	Non-Renewable sources of energy

c) Name ONE type of renewable energy source that could be used more often in Malta.

_____ [1]

d) Give ONE advantage and ONE disadvantage of the source you mentioned in part c).

Advantage: _____ [1]

Disadvantage: _____ [1]

e) One of the main units which operates in the Delimara power station to generate electricity is a natural gas fired system. Figure 1 shows the energy conversion which takes place from the power station until electricity reaches our homes. Fill in the missing spaces to indicate the type of energy present. [3]

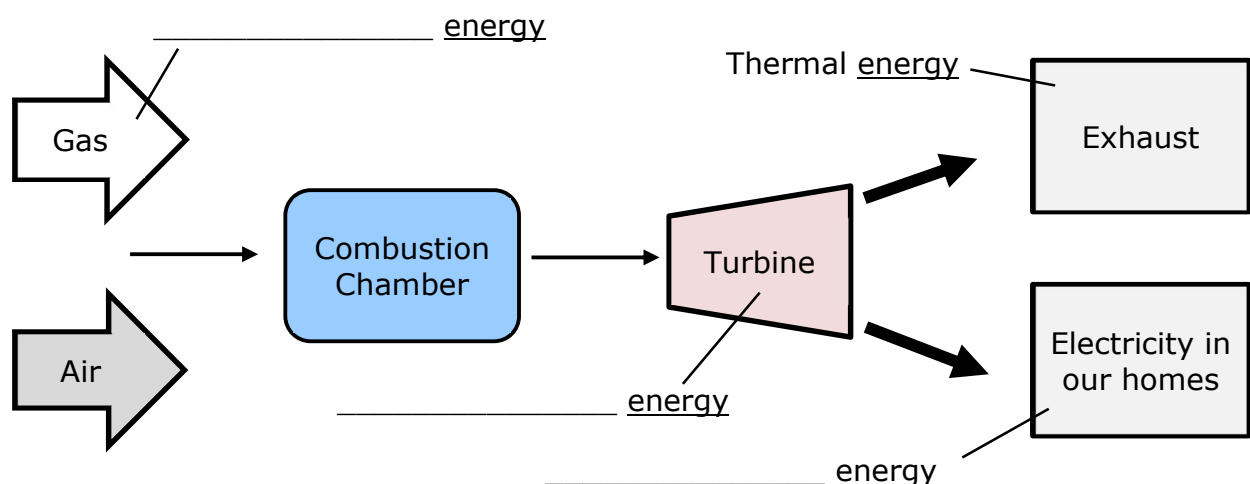


Figure 1

2. Luke and Thea perform an experiment to verify Hooke's Law.

a) State Hooke's Law.

_____ [2]

b) Luke sets up the apparatus shown in Figure 2.

Label the apparatus. [2]

c) Mention ONE precaution they should take to ensure accurate readings when measuring the length of the spring.

 _____ [1]

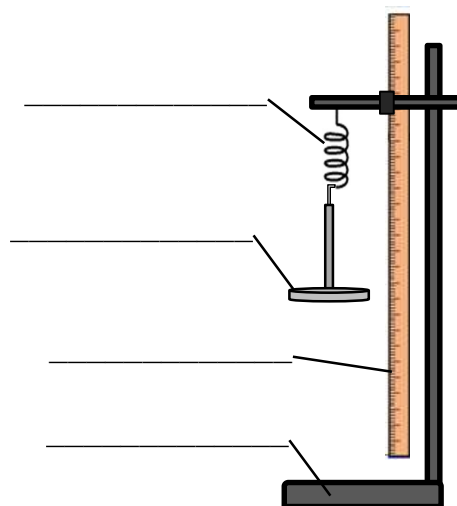


Figure 2

d) The table shows the readings taken by Luke and Thea.

Load (N)	0	1	2	3	4	5	6
Length of Spring (cm)	2.0	2.4	2.8	3.2	3.6	4.2	5.1
Extension (cm)							

i) Calculate the extension for each reading and fill in the table above. [1]

ii) State the original length of the spring: _____m. [1]

iii) The spring will have a permanent extension after a load of _____ N is attached to it. [1]

e) Thea found graphs of Extension against Load of three different materials in her textbook, as shown in Figure 3. State which graph:

i) shows that the material being stretched does not obey Hooke's law.

_____ [1]

ii) is of the least stiff material.

_____ [1]

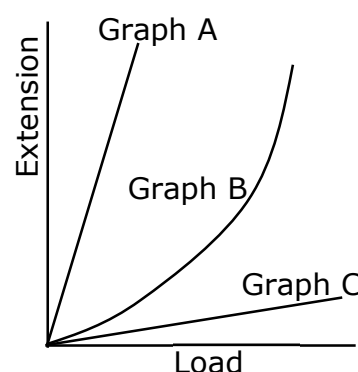


Figure 3

3. In Figure 4, the lines represent wavefronts of straight waves in a ripple tank.

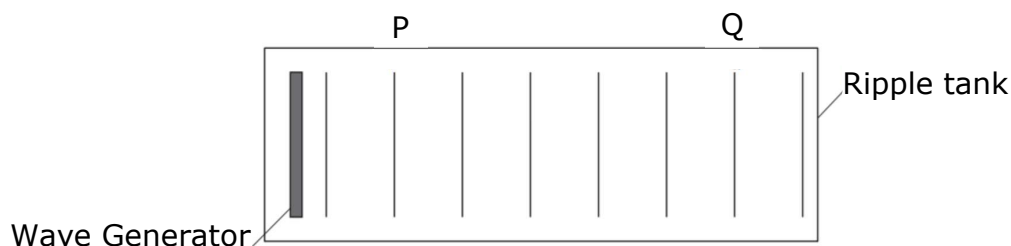


Figure 4

- a) The distance from P to Q is 10 cm.
- Name the distance between two consecutive wavefronts.
_____ [1]
 - Calculate the distance mentioned in a) i).
_____ [2]
- b) A crest takes 2 s to travel from P to Q.
- Find the periodic time of the waves.
_____ [1]
 - Determine the frequency of the wave.
_____ [1]
- c) Water in the ripple tank is reduced. This causes the water to become less deep. State how this change affects, if any, the following properties:
- speed: _____ [1]
 - wavelength: _____ [1]
 - frequency: _____ [1]
- d) Figure 5 shows a cross-section of the water in the ripple tank.

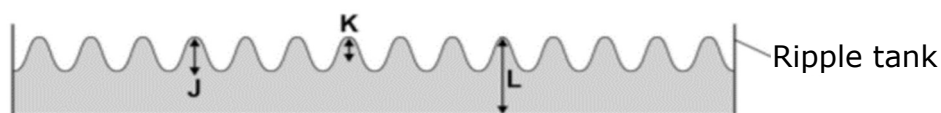


Figure 5

- Define the term amplitude.

_____ [1]
- State which letter represents the amplitude of the water wave: _____ [1]

4. Miles wants to investigate the speed of sound in air using the apparatus shown in Figure 6.

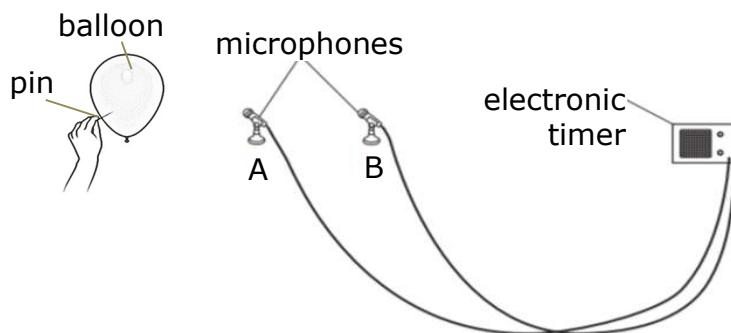


Figure 6

- a) Using the timer, he found that sound takes 0.0024 s to travel from A to B.

- i) Describe briefly how he should find the speed of sound in air.

_____ [3]

- ii) State ONE precaution to obtain more accurate results.

_____ [1]

- iii) If the distance between A and B is 82 cm. Calculate the speed of sound in air.

_____ [2]

- b) His friend Elisa wants to find the speed of sound in air using the echo method. She stands 480 m away from a large wall and strikes rapidly two pieces of wood every time she hears the echo as shown in Figure 7. Miles helps her to record the time of multiple strikes.

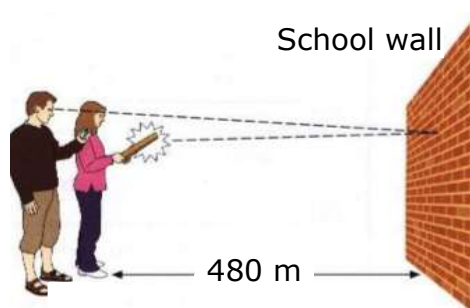


Figure 7

- i) Define the term 'echo'.

_____ [1]

- ii) Given that the time between a strike and its echo is 3 s, calculate the speed of sound using Elisa's method.

_____ [2]

- iii) Miles' method is found to be more accurate. Give a reason.

_____ [1]

5. A uniform metre rule is balanced by a 5 N weight as shown in Figure 8.

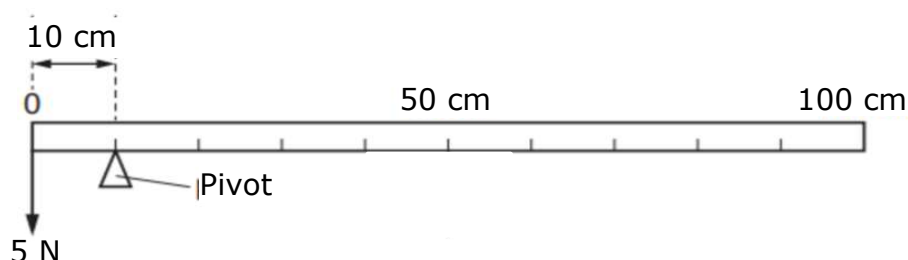


Figure 8

- a) Mention TWO conditions for the rule to be balanced.

_____ [2]

- b) Using Figure 8:

- i) Draw and label the weight of the metre rule. [1]
ii) Calculate the weight of the metre rule.

_____ [2]

- iii) Calculate the reaction force of the pivot on the rule.

_____ [1]

- iv) The pivot is moved under the 20 cm mark. State the direction the rule will turn.

_____ [1]

- c) Nik is playing billiards with his friends. He notices that the cue (stick) is not uniform as it is tapered at one end.

- i) Using only a pivot, describe how he can find the centre of gravity of the cue.



_____ [2]

- ii) Define the term 'centre of gravity'.

_____ [1]

6. Kim noticed that a nail at the bottom of a beaker appears to be closer to the surface as shown in Figure 9.

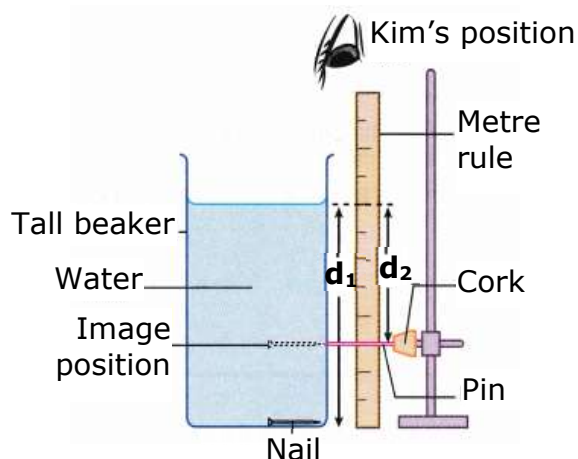


Figure 9

a) In Figure 9:

- Distance d_1 is known as the _____ depth [1]
- Distance d_2 is known as the _____ depth [1]
- Name the type of image formed at d_2 . [1]

- If d_1 is 19.5 cm and d_2 is 15 cm, calculate the refractive index of water. [2]

b) On Figure 10 continue the rays of light to find the position of the image formed. Your diagram should include the normals. [3]

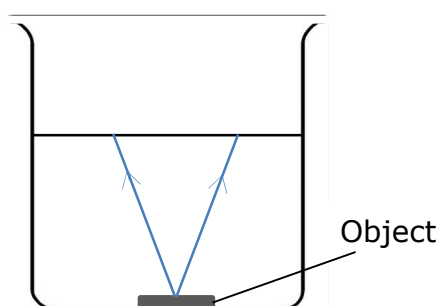


Figure 10

- c) When diving, sometimes one can see one's own reflection underneath the water surface. Explain.

_____ [2]

7. The circuit shown in Figure 11 is connected to a 12 V supply. R is an unknown resistor.

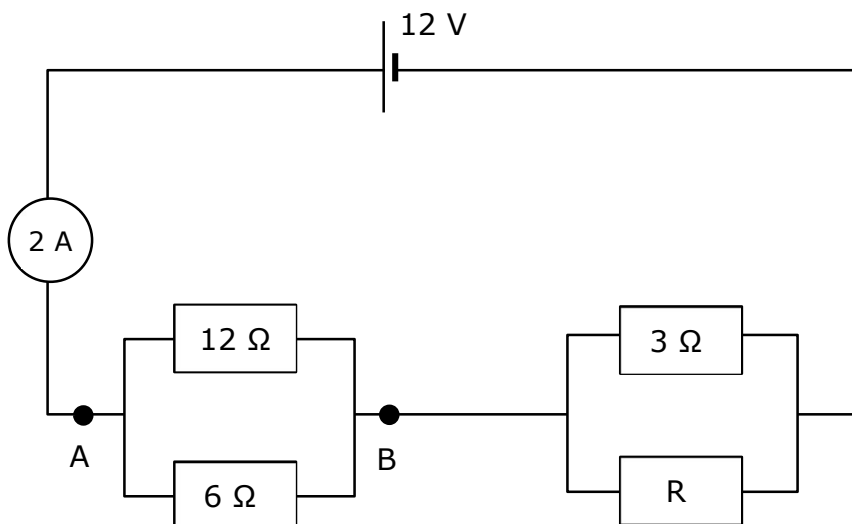


Figure 11

Calculate:

- a) the total resistance between points A and B.

_____ [2]

- b) the potential difference across AB.

_____ [2]

- c) the potential difference across the $3\ \Omega$ resistor.

_____ [1]

- d) the current flowing through the $3\ \Omega$ resistor.

_____ [2]

- e) the current through the unknown resistor R.

_____ [1]

- f) the resistance of the unknown resistor R.

_____. [2]

8. Jessica decides to go on a two-week (14 days) holiday. To keep burglars away, she leaves two 100 W light bulbs switched on while she is away.

- a) Calculate the total energy in kWh used by the two bulbs during the holiday.

_____. [3]

- b) If 1 kWh costs 13 cents, calculate the cost of electricity for keeping the two bulbs switched on for two weeks.

_____. [2]

- c) Jessica's friend suggests that she should add an LDR to the circuit with the two bulbs.

- i) LDR stands for _____ [1]

- ii) Draw the circuit symbol of an LDR in the space below. [1]

- iii) Explain the advantage of adding an LDR to the circuit.

_____. [1]

- iv) Mention ONE other use of the LDR.

_____. [1]

- v) The LDR is a non-ohmic conductor. Explain the term 'non-ohmic'.

_____. [1]

SECTION B

This section has 3 questions. Each question carries 15 marks.

9. Figure 12 shows an offshore oil platform that is used to extract crude oil from under the sea. A safety valve is placed in connection with the well to provide a reliable control valve which can be opened and closed as needed.

- a) The density of seawater is 1020 kg/m^3 , and the depth of the safety valve is 500 m.

- i) Calculate the pressure exerted on the safety valve due to the sea water only.

_____ [2]

- ii) Given that the atmospheric pressure is 101 kPa, calculate the total pressure exerted on the safety valve in Pa.

_____ [2]

- iii) A standard oil barrel extracted from this well contains 0.16 m^3 of oil. Calculate the density of crude oil if the mass of an oil barrel is 130 kg.

_____ [2]

- iv) Underline the correct word.

When oil leaks out it (rises to the surface, sinks to the bottom). This happens because the density of oil is (larger than, smaller than, the same as) that of water. [2]

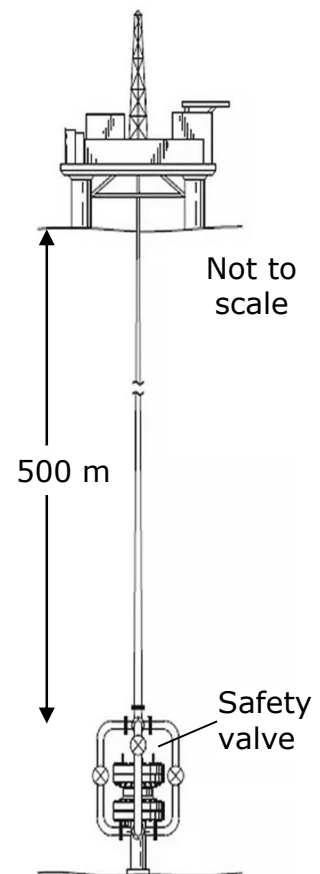


Figure 12

- b) Figure 13 shows a hydraulic lift that is used by workers on the oil rig. To go up, the pump creates a pressure by pumping oil.

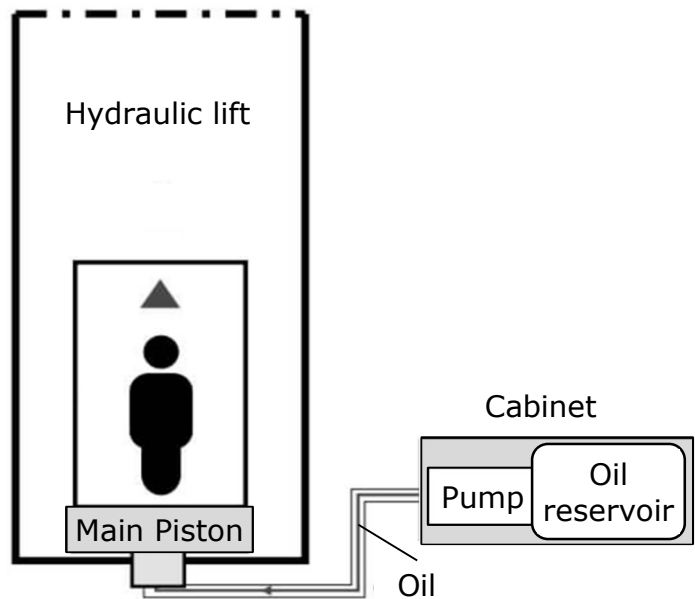


Figure 13

- i) Give ONE reason why a liquid is used by the pump in these lifts.
- _____
- _____ [1]
- ii) The pressure exerted by the pump is 25 000 Pa. Calculate the force applied by the pump on an area of 0.01 m².
- _____
- _____ [2]
- iii) Underline:
- The pressure exerted on the main piston is (greater than, equal to, smaller than) 25 000 Pa. The resulting force on the main piston is (greater than, equal to, smaller than) in b(ii). [2]
- iv) If some air is trapped in the oil pipe, state whether the oil pressure increases, decreases or stays the same. Explain your answer.
- _____
- _____ [2]

10. Jake owns a pizza takeaway shop. He designs a system (Figure 14) where pizza boxes are delivered to the shop's counter using an adjustable ramp and a trolley.

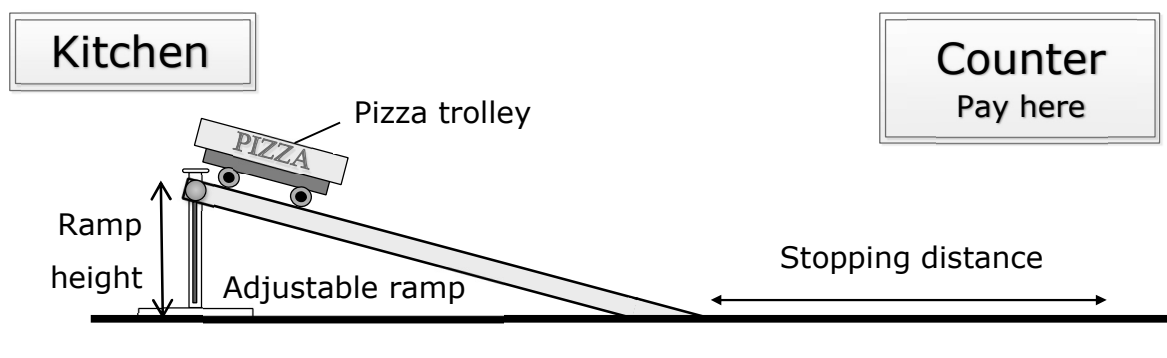


Figure 14

- a) Jake wants to investigate how the ramp height affects the stopping distance of the pizza trolley from the base of the ramp.
- i) Place the following statements in order by using numbers from 2 to 4 to describe the method Jake should use to carry the investigation. The first one is done for you.

Use a measuring tape to measure the distance from the bottom of the ramp till the point where the trolley stops	
Adjust the ramp to a particular height and use a ruler to measure the height.	1
Repeat the experiment at different heights and tabulate your results.	
Place the pizza trolley at the top of the ramp and release the trolley.	

[3]

- ii) Describe ONE precaution Jake should take during the experiment.

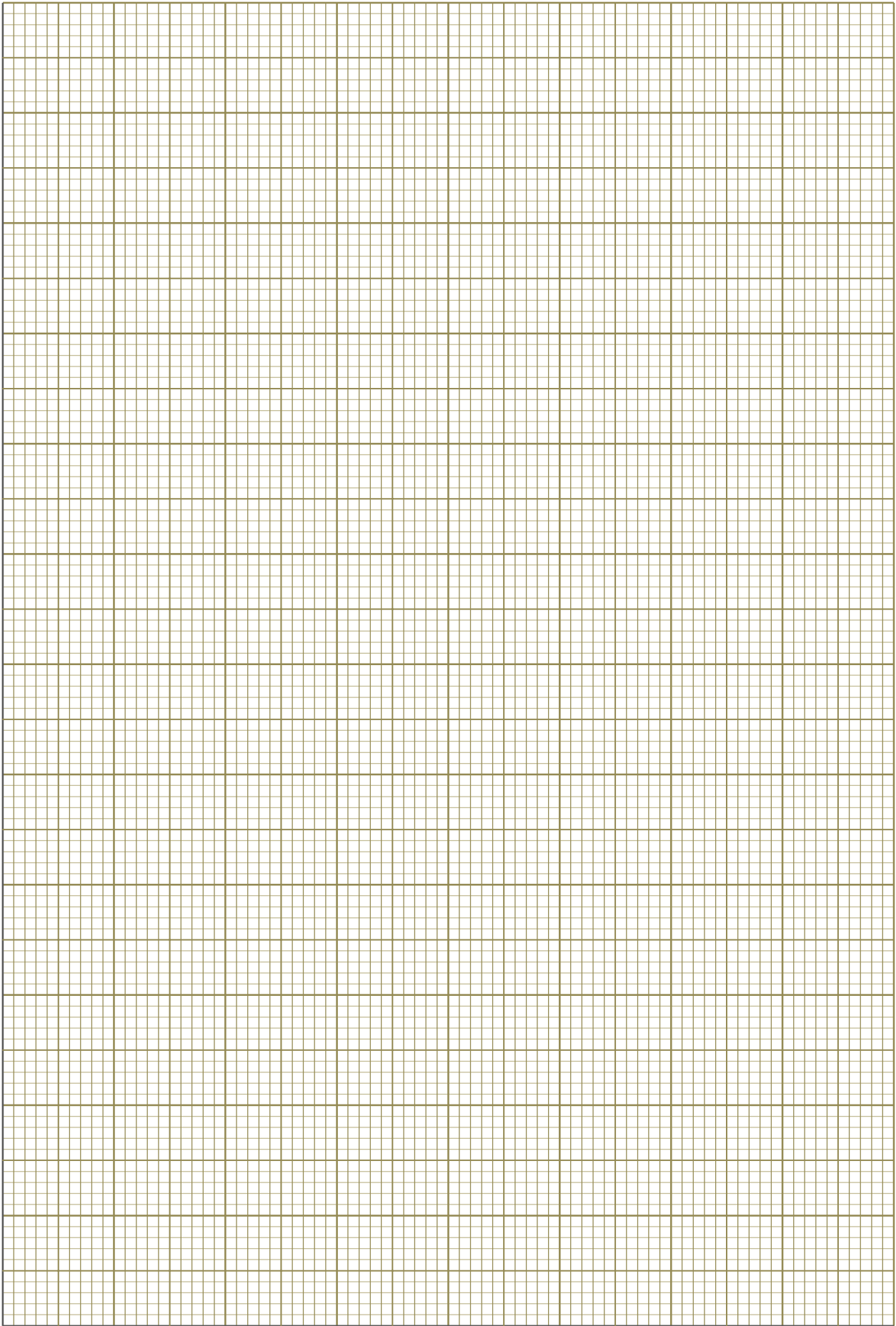
[1]

- b) The table below shows the results Jake obtained during the investigation.

Ramp Height (m)	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Stopping Distance (m)	0.20	0.36	0.53	0.70	0.87	1.04	1.20

- i) Plot a graph of Stopping Distance (m) on the y-axis against Ramp Height (m) on the x-axis. Draw the best straight line through the points. [5]
- ii) Jake wants the trolley to stop at a stopping distance of 0.95 m from the bottom of the ramp. Use the graph to find the height of the ramp he should use.

[1]



- c) Jake thinks that someone at the shop might increase the height of the ramp excessively, so he placed a stopper at the end of the counter (Figure 15). When he installed the ramp, Jake noticed that although the trolley stopped suddenly with the stopper, the pizza boxes kept moving forward and fell off the counter.

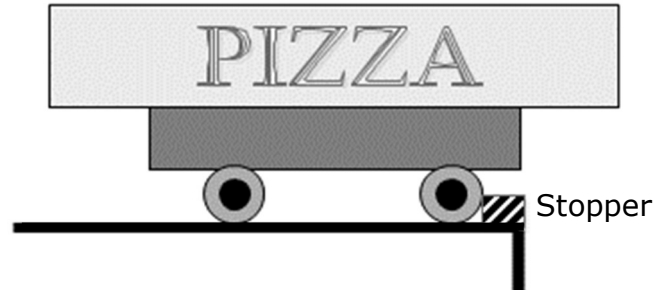


Figure 15

- i) Underline:
Newton's (1st, 2nd, 3rd) law suggests that unless acted upon by a resultant force, an object in motion keeps moving forward and an object at rest (keeps moving, has no mass, stays at rest). [2]
- ii) Calculate the time it takes for the pizza box to fall a height of 1.28 m assuming there is no air resistance.
-
-
- [2]

- iii) Underline:
In reality, the box takes (more, less) time to fall than the value calculated in c (ii) due to the air resistance that acts on the box on its way down. [1]

11. Electromagnetism has many applications in everyday life.

- a) The circuit breaker shown in Figure 16 is designed to switch off a circuit when the current flowing becomes too high. The current enters through A, passes through the springy metal strip, the iron armature BC and leaves at D.

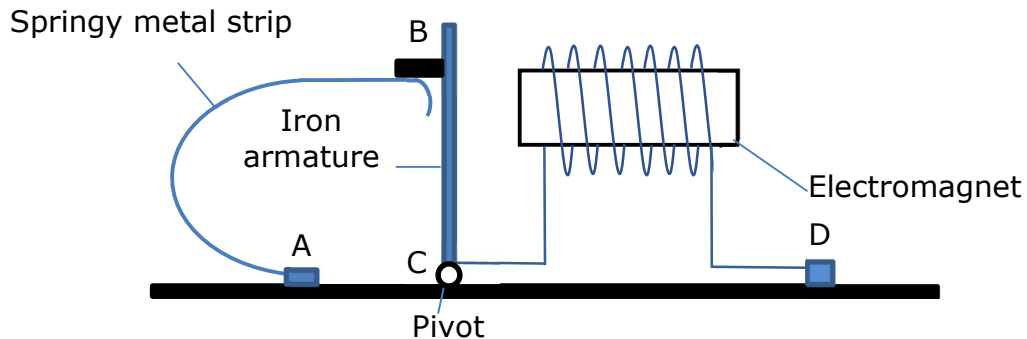


Figure 16

- i) A high current causes the electromagnet to become magnetised. On Figure 16, draw the magnetic field around the electromagnet and label the magnetic poles at each end. [3]
- ii) Underline:
When the electromagnet is magnetised, (an opposite, a like) pole is induced in the iron armature. As a result, the iron armature is (attracted to, repelled by) the electromagnet and the springy metal strip is released. The circuit becomes (complete, incomplete). [3]
- iii) Explain why the iron armature cannot be made of copper or aluminium.
- iv) State TWO changes that would enable the circuit breaker to cut off the circuit at a lower current.

[1]

[2]

- b) Another application of electromagnetism is the moving coil loudspeaker shown below in Figure 17.

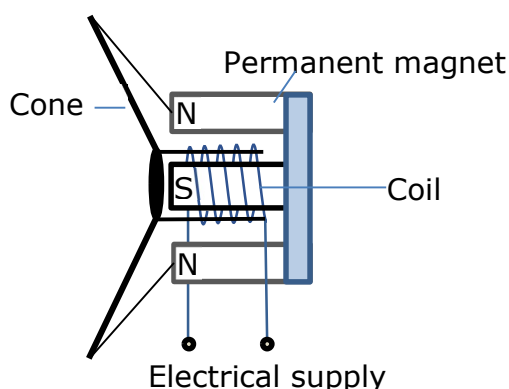


Figure 17

- i) Underline:

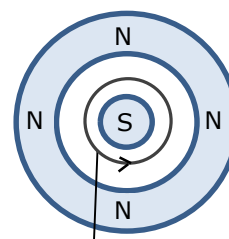
An electrical conductor which carries a current and which is (parallel, perpendicular) to a magnetic field experiences a catapult force. In the case of a moving coil loudspeaker, the coil is forced to vibrate forwards and backwards because the catapult force (changes, does not change) direction. The vibrations of the cone of the loudspeaker are larger if a (lower, higher) current and a (smaller, larger) number of turns of coil are used.

[4]

- ii) Figure 18 shows a front view of the loudspeaker with current flowing through the coil in an anti-clockwise direction.

State whether the cone moves inwards or outwards.

_____ [1]



Current flowing through coil

Figure 18

- iii) Name the rule used to predict the direction in which the cone moves.

_____ [1]