DEPARTMENT FOR CURRICULUM,
LIFELONG LEARNING AND EMPLOYABILITY
Directorate for Learning and Assessment Programmes
Educational Assessment Unit

Track 3

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 $g = 10\ m/s^2$.

Density	$m = \rho V$		
Pressure	$P = \rho g h$	$F = P A$	
Moments	Moment $=$ F $\times$ 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	$\text{Average Speed} = \frac{\text{total distance}}{\text{total time}}$	$s = \frac{(u + v) t}{2}$	$s = ut + \frac{1}{2}at^2$
	$v = u + at$	$v^2 = u^2 + 2as$	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	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$	$\eta = \frac{\text{the speed of light in air}}{\text{the speed of light in medium}}$	
	$v = f \lambda$ $f = \frac{1}{T}$	$m = \frac{h_i}{h_o} = \frac{\text{image distance}}{\text{object distance}}$	
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 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]

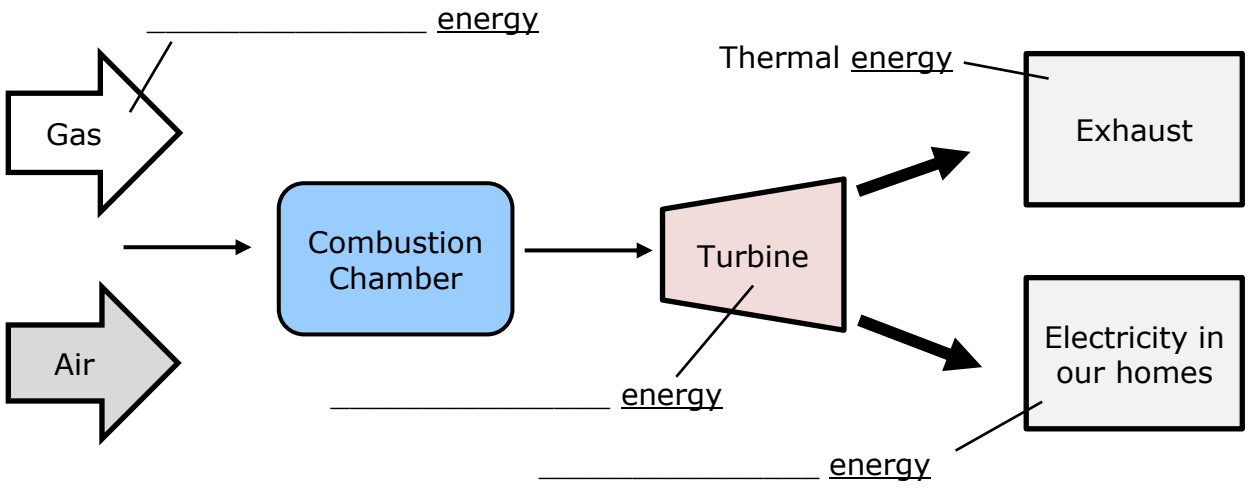


Figure 1

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]

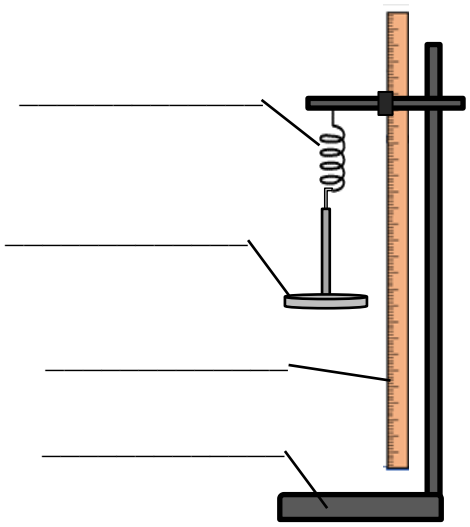


Figure 2

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]

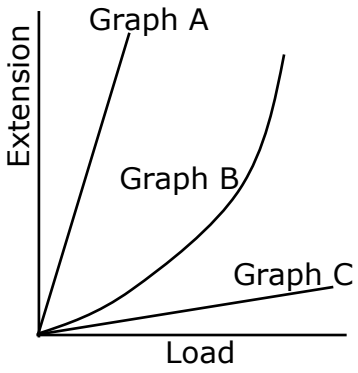


Figure 3

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

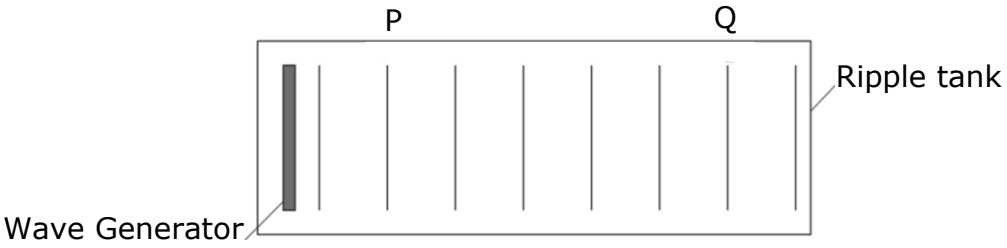


Figure 4

a) The distance from P to Q is 10 cm.

i) Name the distance between two consecutive wavefronts.

_____ [1]

ii) Calculate the distance mentioned in a) i).

_____ [2]

b) A crest takes 2 s to travel from P to Q.

i) Find the periodic time of the waves.

_____ [1]

ii) 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:

i) speed: _____ [1]

ii) wavelength:_____ [1]

iii) frequency: _____ [1]

d) Figure 5 shows a cross-section of the water in the ripple tank.

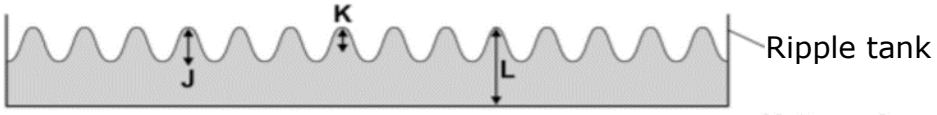


Figure 5

i) Define the term amplitude.

_____

_____ [1]

ii) 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.

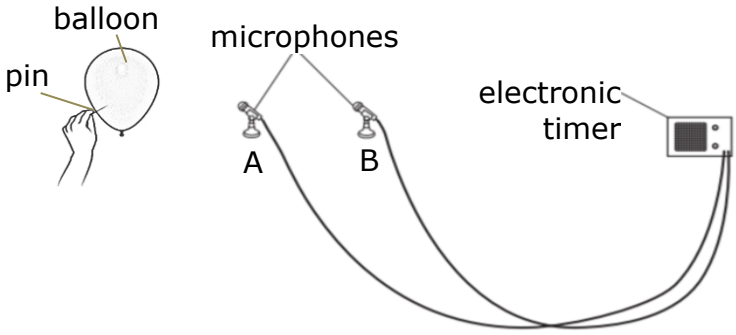


Figure 6

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.

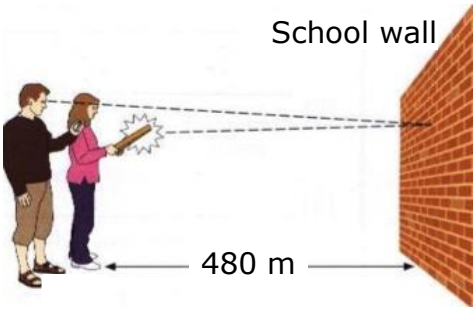


Figure 7

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.

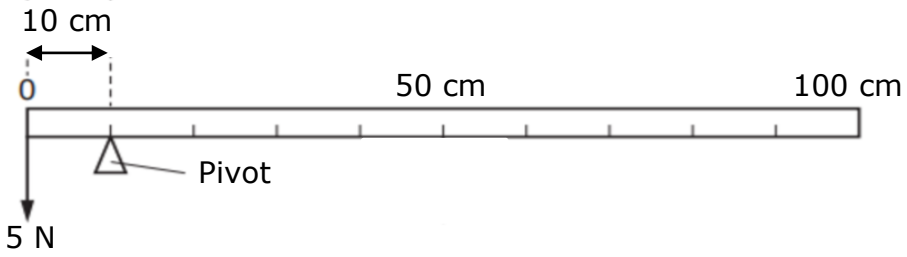


Figure 8

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.

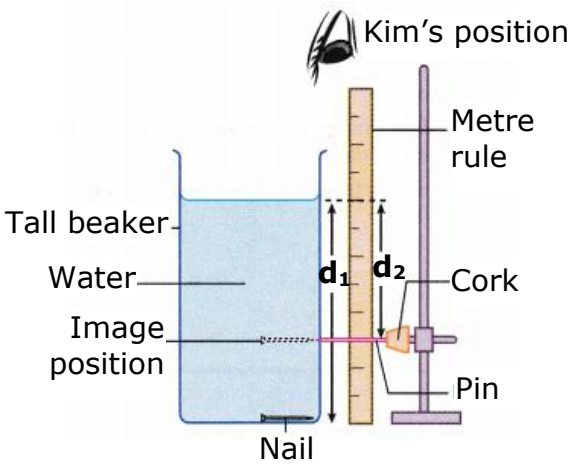


Figure 9

a) In Figure 9:

i) Distance $\mathbf{d_1}$ is known as the _____ depth [1]

ii) Distance $\mathbf{d_2}$ is known as the _____ depth [1]

iii) Name the type of image formed at d_2.

_____ [1]

iv) If $\mathbf{d_1}$ is 19.5 cm and $\mathbf{d_2}$ 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]

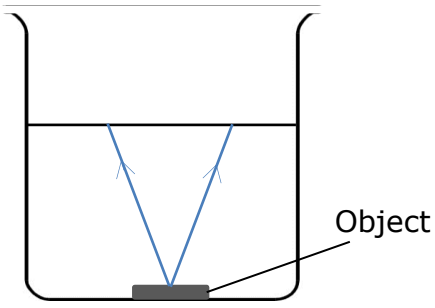


Figure 10

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.

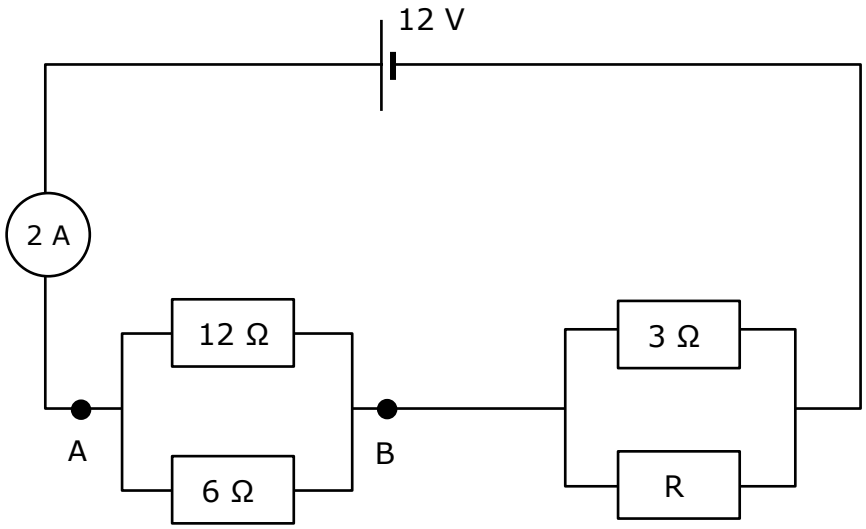


Figure 11

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 Ω resistor.

_____ [1]

d) the current flowing through the 3 Ω 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 used to extract crude oil and gas from deep sea. A safety valve is placed in connection with the well to provide a reliable control valve which can be opened, closed and re-opened as needed.

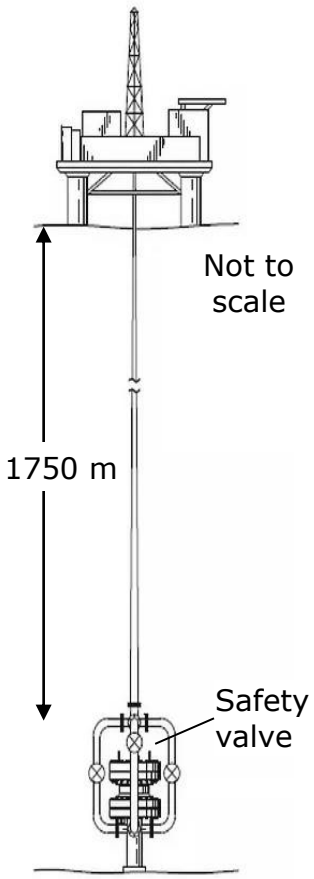


Figure 12

a) The depth of the safety valve is 1750 m and the density of seawater is 1020 kg/m^3.

i) Calculate the pressure on the valve due to the seawater only, at the depth shown in Figure 12.

_____

_____ [2]

ii) Give a reason why the actual pressure exerted on the safety valve is larger than the one calculated in a(i).

_____

_____ [1]

iii) A standard crude oil barrel contains 1.59 × 10^5 cm^3. Calculate the volume of an oil barrel in m^3.

_____ [1]

iv) If the mass of 10 oil barrels is 1300 kg, calculate the density of crude oil.

_____

_____ [2]

v) Some oil leaks from the well and rises to the surface. Explain why this happens.

_____

_____ [1]

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

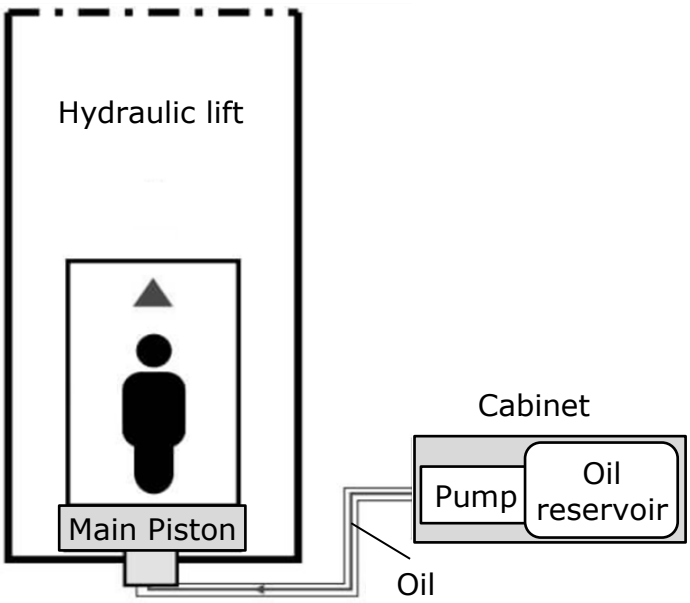


Figure 13

i) Give TWO reasons why a liquid is used by the pump in these lifts.

_____

_____ [2]

ii) The pump piston applies a force of 250 N on an area of 0.01 m^2. Calculate the pressure exerted by this pump.

_____

_____ [2]

iii) Calculate the pressure transmitted to the main piston.

_____ [1]

iv) If the main piston has an area of 0.2 m^2, calculate the maximum force that is produced on the lift.

_____

_____ [2]

v) State the function of the oil reservoir.

_____

_____ [1]

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.

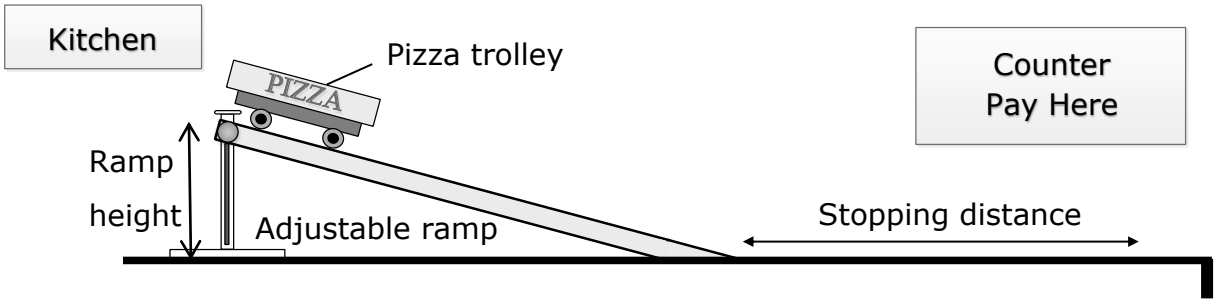


Figure 14

a) Jake wants to investigate how the ramp height determines the stopping distance of the pizza trolley from the base of the ramp.

i) Describe how the investigation can be carried out. Mention any additional apparatus used.

_____

_____

_____

_____ [3]

ii) Name ONE factor that should be kept constant during the investigation.

_____ [1]

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

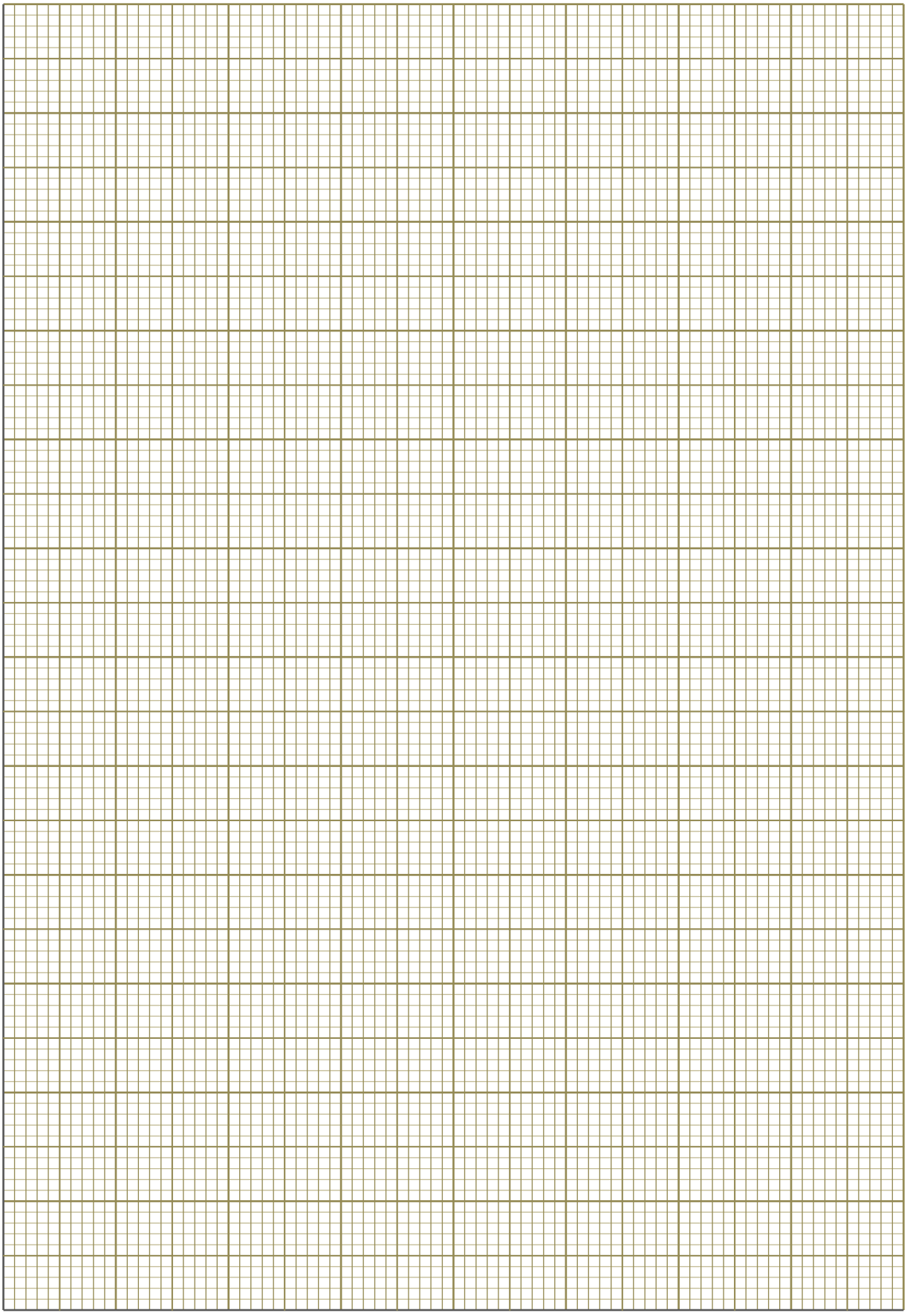
Ramp Height (m)	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Stopping Distance (m) Reading 1	0.19	0.40	0.53	0.75	0.87	1.07	1.18
Stopping Distance (m) Reading 2	0.19	0.33	0.52	0.68	0.87	1.04	1.19
Stopping Distance (m) Reading 3	0.22	0.35	0.54	0.67	0.87	1.01	1.23
Average Stopping Distance (m)	0.20		0.53	0.70	0.87		1.20

i) Work out the missing values of the Average Stopping Distance. [1]

ii) Plot a graph of Average Stopping Distance (m) on the y-axis against Ramp Height (m) on the x-axis. Draw the best straight line through the points.[5]

iii) The graph shows that the ramp height is not directly proportional to the average stopping distance. Explain.

_____ [1]



c) Jake noticed 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 from the counter.

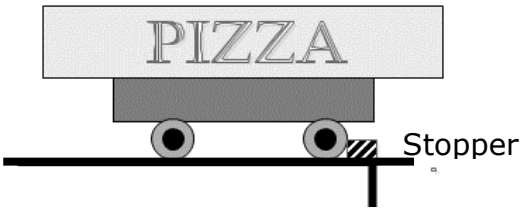


Figure 15

i) Name the law that explains why the box keeps moving forward when the trolley stops suddenly.

_____ [1]

ii) The pizza box has a mass of 400 g. As the box falls, the value of the air resistance acting on the box is 1 N. Calculate the acceleration of the box as it falls.

_____

_____ [3]

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.

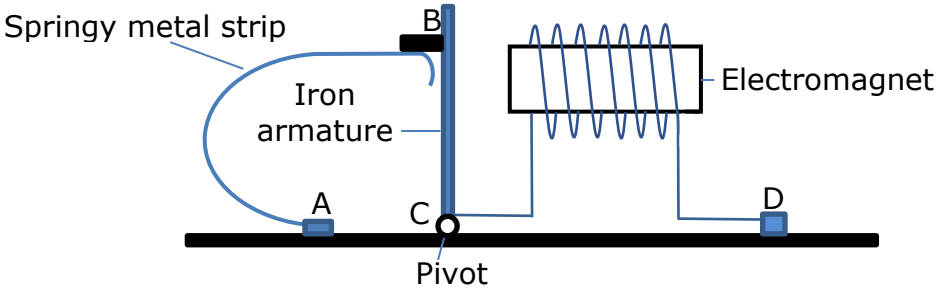


Figure 16

i) Explain briefly how the circuit breaker works.

_____

_____ [2]

ii) The number of turns of the coil around the electromagnet are increased. State how would this affect the way the circuit breaker works.

_____ [1]

b) An electric bell is connected to a battery and a switch as shown in Figure 17.

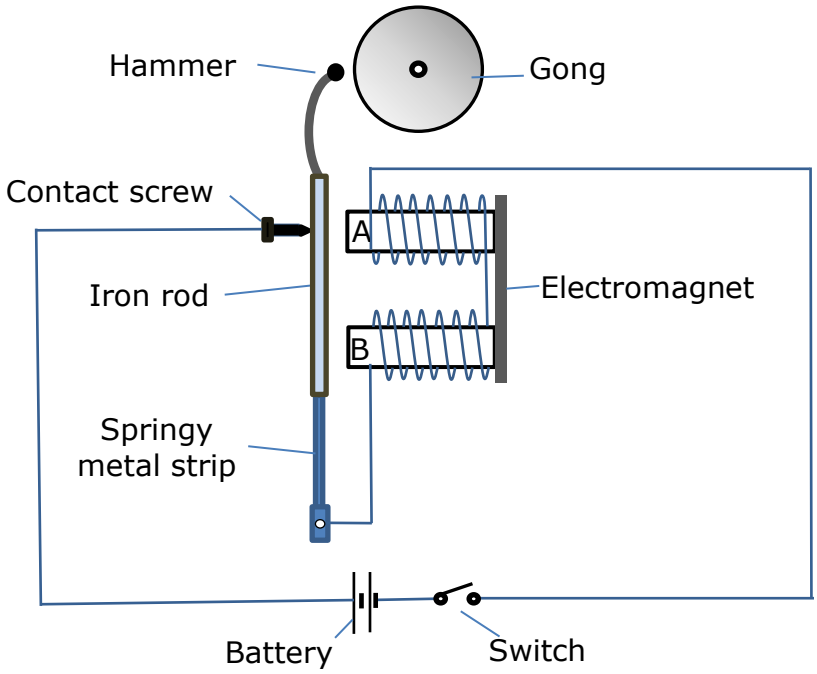


Figure 17

i) The switch is closed. State the polarity at ends A and B of the electromagnet.

A _____ B _____ [1]

ii) Name the rule used to determine the poles formed at A and B.

_____ [1]

iii) Explain why the hammer hits the gong repeatedly as long as the switch is kept closed.

_____

_____

_____

_____

_____ [4]

c) Another application of electromagnetism is the moving coil loudspeaker shown below in Figure 18.

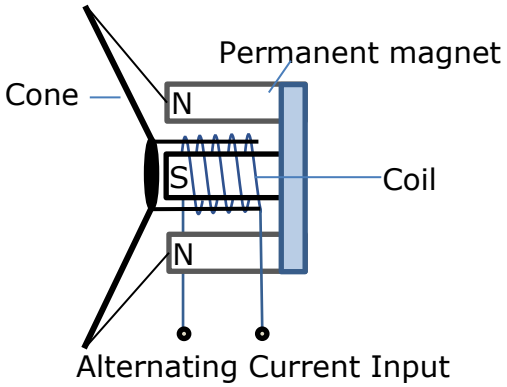


Figure 18

i) Electric currents flow through the coil in different directions. Explain why this causes the coil, and hence the cone, to vibrate.

_____

_____

_____

_____ [3]

ii) Figure 19 shows a front view of the loudspeaker with current flowing through the coil in an anti-clockwise direction.

State whether the cone moves in or out of the plane of the paper.

_____ [1]

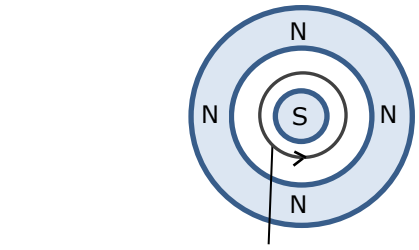


Figure 19

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

_____ [1]

iv) State ONE way to increase the force acting on the cone.

_____ [1]