Model Exam Question Booklet Combined Science

This booklet is split into 3 parts.

Part 1
A selection of short response questions and answers that are likely to come in the exam paper. Spend time learning the answers to these questions, for example you could produce flash cards. You should self quiz yourself on these questions regularly!

Part 2
Selection of extended response questions (4 to 6 marks) that are likely to be on your paper this year, either because they have not been assessed in the last couple of years, or because they come up most years in exams. Prepare and practice your responses to these questions.

Part 3
Required practical section. In this section you will find step by step guidance for each practical. This is followed by a page of short response questions and answers to learn for each of the practicals. There are also some extended response questions (4 to 6 marks).

Physics Paper 2	
Topics in the Paper:	
P8	Forces
P9	Motion
P10	Forces and Motion
P12	Waves
P13	Electromagnetic Waves
P15	Electromagnetism
RP18	Force and Extension
RP19	Acceleration
RP20	Waves
RP21	Infrared Radiation

Part 1
Short Response Questions

P8: Forces

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1. What is the difference between scalar and vector quantities?
2. How can a vector quantity be represented?
3. What is a force?
4. What are examples of contact forces?
5. What are examples of non-contact forces?
6. What type of quantity is force?
7. What is weight?
8. What causes the force of gravity close to Earth?
9. What does the weight of an object depend on?
10. What is the equation that links gravitational field strength, mass and weight?
11. What is the unit for weight?
12. What is the unit for mass?
13. What is the unit for gravitational field strength?
14. What is an objects centre of mass?
15. What is weight measured with?
16. What is the resultant force?
17. When is work done on an object?
18. What is the equation that links distance, force and work done?
19. What is the unit for work done?
20. What is the unit for force?
21. What is the unit for distance?
22. How many newton-metres is 1 joule?
23. What is the relationship between the extension of an elastic object and the force applied?
24. What is the equation that links extension, force and spring constant?
25. What is the unit for spring constant?
26. What is the unit for extension?
27. What happens when a force squashes a spring?
28. What is the turning effect of a force otherwise known as?
29. What is the equation that links distance, force and moment of a force?
30. What is the unit for moment of a force?
31. What can a simple lever and a simple gear system be used to do?

1. Scalar quantities have magnitude only, vector quantities have magnitude and direction.
2. An arrow.
3. A push or pull that acts on an object due to the interaction with another object.
4. Friction, air resistance, tension, normal contact forces.
5. Gravitational force, electrostatic force and magnetic force.
6. Vector
7. The force acting on an object due to gravity.
8. The gravitational field around the Earth.
9. The gravitational field strength at the point where the object is at.
10. Weight = Mass x Gravitational Field Strength
11. Newtons, N
12. Kilograms, kg
13. Gravitational Field Strength, N/kg
14. The point at which the weight of an object acts through.
15. A Newtonmeter
16. It is a single force that is the result of all the different forces acting on the object.
17. When a force causes a displacement of an object.
18. Work Done = Force x Distance
19. Joules, J
20. Newtons, N
21. Metres, m
22. 1 newton-metre
23. It is directly proportional, provided the limit of proportionality is not exceeded.
24. Force = Spring Constant x Extension
25. Newtons per metre, N/m
26. Metres, m
27. Work is done and elastic potential energy is stored in the spring.

Separate Science Only

28. Moment of the force.
29. Moment of a Force = Force x Distance
30. Newton-Metres, Nm
31. Transmit the rotational effects of forces.

P9: Motion

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1. What is the equation that links distance travelled, speed and time?	1. Distance Travelled = Speed x Time
2. Why is speed a scalar quantity?	2. It does not involve direction.
3. What can the speed a person walks, runs or cycles at depend on?	3. Age, terrain, fitness and distance travelled.
4. What is a typical walking speed?	4. 1.5 m/s
5. What is a typical running speed?	5. 3 m/s
6. What is a typical cycling speed?	6. 6 m/s
7. What is the typical speed of sound?	7. 330 m/s or 3.3×10^2 m/s
8. What is the unit for distance?	8. m
9. What is the unit for speed?	9. m/s
10. What is the unit for time?	10. s
11. What is velocity?	11. It is speed in a given direction.
12. Why is velocity a vector?	12. It has direction.
13. How is velocity different from speed?	13. Velocity has direction, speed doesn't.
14. When can a distance travelled be represented by a distance time graph?	14. When the object moves along a straight line.
15. How can the speed of an object be calculated from using a distance time graph?	15. Calculating the gradient of the line on the distance-time graph.
16. How can you tell on a distance-time graph when an object is travelling the fastest?	16. It would have the steepest line going up.
17. What is the equation that links acceleration, change in velocity and time?	17. Acceleration = Change in Velocity / Time
18. What is the unit for acceleration?	18. m/s^2
19. What is the unit for change in velocity?	19. m/s
20. How can acceleration be calculated using a velocity-time graph?	20. Calculating the gradient of the line on the velocity-time graph.
21. If an object is falling near the Earth's surface freely under gravity what would its acceleration be?	21. $9.8 m/s^2$
22. What happens to an object as it falls through a fluid such as air or water?	22. The object initially accelerates due to the force of gravity. As it increases in speed resistance acting in the opposite direction increases. Eventually the force due to gravity and force due to resistance are equal and the object reaches terminal velocity.
23. What is displacement?	23. This is the distance travelled in a given direction.
24. What is deceleration?	24. It is negative acceleration when an object slows down.

P10: Force and Motion

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1. What is the equation that links acceleration, change in velocity and time taken?	1. Acceleration = Change in Velocity / Time Taken
2. What is the unit for acceleration?	2. Metres, pre second squared ,m/s^2
3. What is the unit for change in velocity?	3. Metres per second, m/s
4. What is the unit for time?	4. Seconds, s
5. What is deceleration?	5. An object slowing down.
6. What is the unit for distance?	6. Metres, m
7. What is the acceleration of an object falling freely under gravity near the Earth?	7. 9.8 m/s^2
8. If the resultant force is 0 on a stationary object what happens to the motion of the object?	8. The object remains stationary.
9. If the resultant force is 0 on a moving object what happens to the motion of the object?	9. The object continues to move at the same velocity.
10. What happens if a resultant force is acting on an object?	10. The velocity of the object will change. This means that speed and/or direction could change.
11. What does Newtons second law state?	11. The acceleration of an object is proportional to the resultant force acting on the object, and inversely proportional to the mass.
12. What is the equation that links acceleration, mass and resultant force?	12. Resultant Force = Mass x Acceleration
13. What is the unit for force?	13. Newtons, N
14. What is the unit for mass?	14. Kilograms, kg
15. What is inertial mass? (HT Only)	15. The ration of force over acceleration.
16. What is the symbol for an approximate value?	16. ~
17. What does Newtons third law state?	17. Whenever two objects interact, the forces they exert on each other are equal and opposite.
18. What is stopping distance?	18. The sum of the thinking distance and braking distance.
19. What is thinking distance?	19. The distance a vehicle travels during the driver's reaction time.
20. What is braking distance?	20. The distance a vehicle travels under a braking force to stop.
21. What is the typical reaction time of a person?	21. Between 0.2 and 0.9 seconds.
22. What can a driver's reaction time be affected by?	22. Tiredness, drugs, alcohol and distractions.
23. What can the braking distance of a vehicle be affected by?	23. Adverse weather conditions and poor condition of the vehicle.
24. What are examples of adverse road conditions?	24. Wet or icy conditions.
25. What are examples of poor vehicle condition?	25. Poor conditions of the brakes and tyres.
26. What happens when a force is applied to the breaks?	26. Work is done by the friction force between the brakes and the wheel to reduce kinetic energy of the vehicle. The temperature of the brakes increase.
27. What happens to the braking force required when speed is increased?	27. It needs to increase
28. What problems can large decelerations cause?	28. Brakes overheating and loss of control.
29. What is the equation that links mass, momentum and velocity?	29. Momentum = Mass x Velocity

P12: Wave Properties

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1. What type of wave are ripples on a water surface?
2. What type of wave are sound waves?
3. What is amplitude?
4. What is wavelength?
5. What is frequency?
6. What is the unit for period?
7. What is the unit for frequency?
8. What is wave speed?
9. What is the equation that links frequency, wavelength and wave speed?
10. What is the unit for speed?
11. What is the unit for wavelength?

1. Transverse
2. Longitudinal waves
3. The maximum displacement of a point on a wave away from its disturbed position.
4. The distance from a point on one wave to the equivalent point on the adjacent wave.
5. The number of waves passing a point each second.
6. Seconds, s
7. Hertz, Hz
8. The speed at which the energy is transferred through the medium.
9. Wave Speed = Frequency x Wavelength
10. Metres per second, m/s
11. Metres, m

P13: Electromagnetic Waves

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1. What are electromagnetic waves?
2. How are waves of the EM spectrum grouped?
3. What is the order of the EM spectrum from long to short wavelengths?
4. What do our eyes detect?
5. How can Radiowaves be produced? (HT Only)
6. What is radiation dose?
7. What harm can UV light cause?
8. What harm can X-Rays cause?
9. What harm can gamma rays cause?
10. What uses do we have for radio waves?
11. What uses do we have for microwaves?
12. What uses do we have for infrared?
13. What uses do we have for visible light?
14. What uses to we have for ultraviolet?
15. What uses do we have for X-Rays?
16. What uses do we have for gamma rays?

1. Transverse waves that transfer energy from the source of the waves to an absorber.
2. In terms of their wavelengths.
3. Radiowaves → Microwaves → Infrared → Visible Light → Ultraviolet → X-Rays → Gamma Rays
4. Visible light.
5. Oscillations in electrical circuits.
6. It is a measure of the risk of harm resulting from the exposure of the body to the radiation.
7. Can cause skin to age prematurely and increase the risk of skin cancer due to it being ionising.
8. Ionising radiation can cause the mutation of genes and cancer.
9. Ionising radiation can cause the mutation of genes and cancer.
10. Television and radio.
11. Satellite communication and cooking food.
12. Electrical heaters, cooking food and infrared cameras.
13. Fibre optic communications
14. Energy efficient lamps and sun tanning
15. Medical imaging and treatments
16. Medical imaging and treatments

P15: Electromagnetism

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1. What are the poles of a magnet?
2. What happens when two magnets are brought close together?
3. What happens when two like poles are brought together?
4. What happens when two unlike poles are brought together?
5. What type of force is attraction and repulsion between magnetic poles?
6. What is a permanent magnet?
7. What is an induced magnet?
8. What happens when an induced magnet is removed from a magnetic field?
9. What is a magnetic field?
10. What is the force between a magnet and magnetic material?
11. What does the strength of a magnetic field depend on?
12. Where is a magnetic field strongest?
13. What is the direction of a magnetic field?
14. What happens when a current flows through a wire?
15. How can the strength of a magnetic field created by a current through a wire be increased?
16. How can we increase the strength of the magnetic field of a solenoid?
17. What is the motor effect (HT Only)
18. What is the unit for force?
19. What is the unit for the magnetic flux density?
20. What is the unit for current?
21. What is the unit for length?

1. The places where the magnetic forces are strongest.
2. They exert a force on each other.
3. They repel
4. They attract
5. Non-Contact
6. A magnet that produces its own magnetic field.
7. A material that becomes magnetic when placed in a magnetic field.
8. The magnet loses most/all of its magnetism quickly.
9. The region around a magnet where a force acts on another magnet or on a magnetic material.
10. Attraction
11. The distance from the magnet
12. At the poles of the magnet.
13. North seeking pole to south seeking pole.
14. A magnetic field is produced.
15. Shaping the wire to make a solenoid.
16. Add an iron core.
17. When a conductor carrying a current is placed in a magnetic field the magnet producing the field and the conductor exert a force on each other.
18. Newtons
19. Tesla, T
20. Amperes, A
21. Metres, m

Part 2 Extended Response Questions

Topic	P8 Forces in Balance
Qu	1. Explain you would determine the centre of mass of a piece of card. 2. Explain how you could check that the centre of mass point is accurate. 3. Explain when an object will topple over.
Info	At least one of these questions is likely to come up. The examiner is going to be looking for a clear answer written in a logical sequence.
Top Tip	Be careful that you use key words/phrases accurately (these are in bold in your model answers below).
Model Answer	**Explain how you would determine the centre of mass of a piece of card.** Place three **holes** in the card, with each hole in a different place and close to the edge of the card. Then place a **pin** through the first hole and hold the pin in place using a boss in a clamp stand to suspend the card. Tie a **weigh**t to a piece of **string** and suspend this string from the same pin. This is a **plumb line**. Draw a line on the card marking where the string was. Repeat this for the two other holes. The point the lines **intersect** is the centre of mass.
Model Answer	**Explain how you could check that the centre of mass point is accurate.** Put another **hole** in the card near to the edge. **Suspend** it using a pin and use a string on a weight to create a **plumb line**. Draw a line of the card marking where the string was. If this line **intersects** the **centre of mass** then the centre of mass is accurate.
Model Answer	**Explain when an object will topple over.** **Centre of mass** is the point at which the **weight** of an object acts through. An object will topple over when the centre of mass falls **outside the base** of the object.
Practice	1. Learn and practice the model answers above.

Topic	P9 Motion
Qu	Explain how you use a distance time graph to find velocity at a certain time. Compare velocity and speed. Explain how you use a velocity time graph to find acceleration at a certain time.
Info	At least one of these questions is likely to come up. The examiner is going to be looking for a clear answer written in a logical sequence.
Top Tip	Be careful that you use key words/phrases accurately (these are in bold in your model answers below).
Model Answer	**Explain how you use a distance time graph to find velocity at a certain time.** To find **velocity** at a given time you would draw a **tangent** at this time. A tangent is a straight line drawn to touch a point on a curve so it has the same gradient as the curve at that point. You would then determine the **gradient** of this tangent by dividing the change in **distance** of the tangent by the change in **time.**
Model Answer	**Compare velocity and speed.** Both velocity and speed can be calculated by dividing the distance an object travelled by the time that it took. Velocity and speed also have the same unit which is **m/s**. However velocity is a **vector** and has **direction**, while speed is a **scalar** and does not have **direction**.
Model Answer	**Explain how you use a velocity time graph to find acceleration at a certain time.** To find **acceleration** at a given time you would draw a **tangent** at this time. A tangent is a straight line drawn to touch a point on a curve so it has the same gradient as the curve at that point. You would then determine the **gradient** of this tangent by dividing the **change in velocity** of the tangent by the change in **time taken**.
Practice	1. Learn and practice the model answers above.

Topic	P10 Force and Motion
Qu	Describe what can affect the stopping distance of a _____.
Info	You could be asked describe what can affect the stopping distance of different vehicles including boats, cars, trucks, bicycles. The question may also give you a description of what the driving conditions are like. To answer this question, you will need to: 1. State that the overall stopping distance is a combination of thinking distance and braking distance 2. Describe as many factors as possible that would affect thinking distance. 3. Describe as many factors as possible that would affect braking distance.
Top Tip	The factors that affect thinking distance should be the same for all the different scenarios that could be given. Most of the factors that affect braking distance should also be the same but do read the question carefully to look for some hints of what the driving conditions are like.
Model Answer	Describe what can affect the stopping distance of a lorry. *1. The overall stopping distance is a combination of thinking distance and braking distance.* *2. Some of the factors that would affect thinking distance include the tiredness of the driver, how distracted the driver is, if the driver has had any alcohol and if the driver is on any medication that can cause tiredness.* *3. Some of the factors that would affect braking distance include the condition of the lorry, if it has worn tyres and brakes braking distance will increase. Also, if the road conditions are wet and icy there is reduced friction which would increase the braking distance also. Finally, the speed and mass of the lorry will affect braking distance. If it is very heavy and travelling fast then the braking distance will be higher.*
Practice	1. Learn and practice the model answers above. 2. Prepare and learn model answers to describe what would affect the stopping distance of a boat, car and train. 3. Explain why a lorry may have a larger stopping distance than a car travelling at the same speed.

Topic	P10 Forces and Motion
Qu	Explain how a _____ works.
Info	You could be asked to explain how different safety features work in terms of momentum. Some examples that could come up include: • A seat belt • Air bags • A gym crash mat • Cycled helmets • Cushioned areas in playgrounds • Eggs dropped into polystyrene foam. To answer this question, you will need to: 1. Identify that the safety feature increases the time taken to stop. 2. Identify that this decreases the rate of change in momentum. 3. Identify that this decreases the forces acting on the object.
Top Tip	. **Key phases to use include:** **Time to Stop, Forces, Momentum and Rate of Change.**
Model Answer	**Explain how an egg dropped into polystyrene foam prevents the egg from breaking.** *The soft foam increases the time that it takes for the egg to come to a stop. This therefore decreases the rate at which momentum changes which reduces the force on the egg. As the force is reduced the egg does not crack.*
Practice	1. Learn and practice the model answers above. 2. Prepare and learn model answers to explain how a seat belt, air bag, helmet, crash mats and cushioned mats in playgrounds work.

Topic	P10 Force and Motion
Qu	Calculating a value using the equation: Momentum = Mass x Velocity
Info	There is frequently a question in which you will need to use these formulas. Marks vary between 3 and 6 marks depending on how much processing of the information you need to do. If you need to use both formulas to answer the question this will usually be worth 6 marks. To answer this question, you will need to do the following: 1. Check for any unit conversions you may need to do. 2. Write down the formula you will be using. 3. Substitute in the values. 4. Rearrange. 5. Do the calculation. 6. Round to the correct number of significant figures. 7. Add units.
Top Tip	**Always write down the formula you are using, substitute numbers and then rearrange. Avoid writing a rearranged formula as its easy to make mistakes and can lose you marks.**
Model Answer	**Calculate the mass of a bowling ball that has a momentum of 26kgm/s and a velocity of 5.0m/s**

-	Check for unit conversions.
Momentum = Mass x Velocity	Formula to be used.
26 = Mass x 5.0	Substitute values.
26 / 5.0 = Mass	Rearrange.
Mass = 5.2	Do the calculation
-	Round to correct number of sig fig.
5.2kg	Answer with units

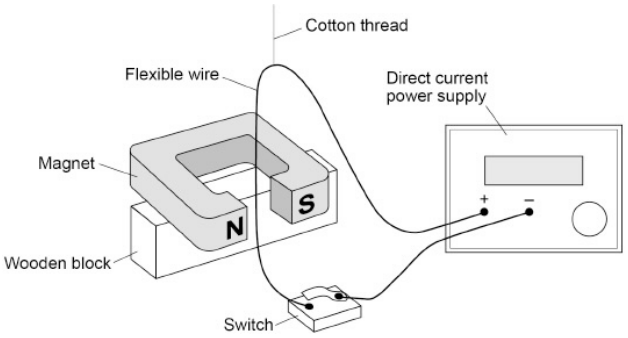
Topic	P10 Force and Motion
Practice	Practice using the formula for momentum by answering the questions below: 1. Determine velocity when momentum is 150kgm/s and mass is 2.5kg 2. Determine velocity when momentum is 12kgm/s and mass is 1.25kg 3. Determine momentum when mass is 1500kg and velocity is 8m/s. 4. Determine momentum when mass is 150kg and velocity is 3m/s 5. A car of mass 1200 kg is travelling with a velocity of 35 m / s. Calculate the momentum of the car. Give the unit. 6. Calculate the momentum of a 175kg motorbike when it travels at 14 m/s. 7. A skater travels with a velocity of 3.2 m/s and has a momentum of 200 kg m/s. Calculate the mass of the skater. 8. A glider has a mass of 0.14 kg and a velocity of 17 cm/s. Calculate the momentum of the glider in kg m/s (3 marks) 9. The gun fires the paintball forwards at a velocity of 90 m / s. The paintball has a mass of 0.0030 kg. Calculate the momentum of the paintball just after the gun is fired in kgm/s.

Topic	P10 Force and Motion
Qu	Explain why _____ when it _____ using the idea of conservation of momentum.
Info	Conservation of momentum is often assessed by asking you to explain what happens to the momentum of two objects during different events. Some examples from exam questions in the past include: • A bowling ball slowing down when it hits a pin. • Bumper cars stopping after they hit into each other face on. • An ice skater bumping into another ice skater from behind. • A person diving from a stationary boat. • A bullet fired from a gun. • An ice skater throwing a bag forwards to a friend. • A skateboard as a skateboarder jumps forward off it To answer this question, you will need to: 1. State that the momentum before = the momentum after 2. Identify what happens to the momentum and velocity of the 1st object. 3. Identify what happens to the momentum and velocity of the 2nd object.
Top Tip	**If the objects were both stationary before the event, then total momentum was 0. This means that if one object moves in one direction, the other object will move in the opposite direction.**
Model Answer	**Explain in terms of conservation of energy what will happen when a person dives from a stationary boat.** *The momentum before will be equal to the momentum after. Before diving the momentum of the boat and diver is 0kgm/s and so after diving the momentum must be 0kgm/s also. After diving the person has a small velocity and small momentum in the forwards direction. Therefore, the boat will have a small momentum and velocity in the opposite direction.*
Practice	1. Learn and practice the model answers above. 2. Prepare and learn model answers to explain what will happen in terms of conservation for the other examples given above.

Topic	P12 Waves
Qu	Compare sound waves and _____
Info	You could be asked to compare sound waves which are a longitudinal wave to any named transverse wave. This means that you could be asked to compare sound waves and any part of the electromagnetic spectrum. To answer this question, you will need to: 1. State that a sound wave is a longitudinal wave, and that the oscillation of the wave is parallel to the direction of energy transfer. 2. State what type of wave the other wave in the question is and state the direction of energy transfer. 3. Compare the ability of each to travel through a vacuum. 4. Compare the speed of each wave. 5. Compare the frequency of each wave.
Top Tip	Make sure that when you have a compare question you use comparative language. Examples of comparative language have been underlined in the model answer below.
Model Answer	**Compare sound waves and X-Rays.** *1. Sound waves are a longitudinal wave. The direction of the oscillation of the wave is parallel to the direction of energy transfer.* *2. However, X-Rays are transverse waves. The direction of the oscillation of the wave is perpendicular to the direction of energy transfer.* *3. Sound waves are unable to travel through a vacuum while X-Rays can.* *4. Compared to X-Rays sound rays travel at a slower speed.* *5. Finally, X-rays have a greater frequency that sound waves.*
Practice	1. Learn and practice the model answers above. 2. Prepare and learn model answers to compare the sound waves and: Radiowaves, microwaves, infrared, visible light, ultraviolet and gamma rays.

Topic	P13 Electromagnetic Waves
Qu	Compare the uses of _____ and _____.
Info	You could be asked to compare the uses for any of the parts of the electromagnetic spectrum including radio waves, microwaves, infrared, visible light, ultraviolet, x-rays and gamma rays: To answer this question, you will need to: 1. Identify the uses for the first named part of the electromagnetic spectrum. 2. Identify the uses for the second named part of the electromagnetic spectrum. 3. Describe the risks of the first named part of the electromagnetic spectrum 4. Describe the risks of the second named part of the electromagnetic spectrum.
Top Tip	Make sure that when you have a compare question you use comparative language. Examples of comparative language have been underlined in the model answer below.
Model Answer	**Compare the uses of X-Rays and Ultraviolet** *1. X-Rays can be used to detect broken bones and to detect dental problems. X-Rays can also be used to kill cancer cells.* *2. In comparison ultraviolet can be used in pre-natal scanning, removing plaque from teeth, removing kidney stones and helping to repair scar damage.* *3. X-Rays are ionising and can mutate DNA and damage cells which can lead to cancer.* *4. Ultraviolet light can also pose a risk and like X-Rays it is also ionising and can mutate DNA damaging cells which can lead to cancer.*
Practice	1. Learn and practice the model answers above. 2. Prepare and learn model answers to compare the uses and risks of: Gamma and X-Rays, Visible Light and Infrared, Microwaves and Radiowaves

Topic	P15 Electromagnetism
Qu	Explain how you could determine if a substance is magnetic or not, or a magnet. Describe how you would plot a magnetic field pattern around a bar magnet Explain why a compass needle moves when placed near the bar magnet.
Info	At least one of these questions is likely to come up. The examiner is going to be looking for a clear answer written in a logical sequence.
Top Tip	Be careful that you use key words/phrases accurately (these are in bold in your model answers below).
Model Answer	**Explain how you could determine if a substance is magnetic, non magnetic or a permanent magnet.** You would use a **permanent magnet**. If the magnet has **no effect** on the material then it is non magnetic. If the magnet **attracts** the material it is magnetic, while if the magnet can be **repelled** by the material then the material is a magnet also.
Model Answer	**Describe how you would plot a magnetic field pattern around a bar magnet** Place the magnet on a piece of paper and draw around the magnet. Mark a **dot** by a pole of the magnet and place the compass on the dot. Make a dot at the tip of the **compass needle** and then move the **compass tail** to the new dot, make a dot at the tip and then repeat until the compass reaches the other **pole of the magnet**. You then draw a line through the dots and add **arrows** to show direction of field line from north to south. You would then repeat for different starting positions at the poles
Model Answer	**Explain why a compass needle moves when placed near the bar magnet.** The compass needle is a small **bar magnet** and so the compass needle and bar magnet **exert a force** on each other. This means the compass needle can be **attracted and repelled** by the bar magnet.
Practice	1. Learn and practice the model answers above.

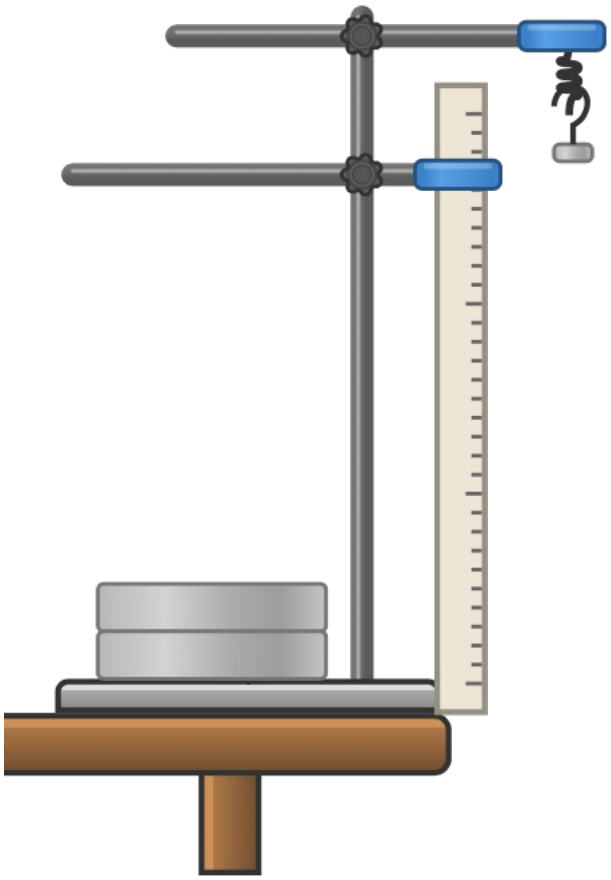
Topic	P15 Electromagnetism
Qu	Explain why the wire moves when the switch is closed. Describe how to build and test an electromagnet. Describe how Fleming's left-hand rule can be used to determine the direction ____will move when the switch is closed.
Info	At least one of these questions is likely to come up. The examiner is going to be looking for a clear answer written in a logical sequence.
Top Tip	Be careful that you use key words/phrases accurately (these are in bold in your model answers below).
Model Answer	 **Explain why the wire moves when the switch is closed.** *When the switch is closed the wire has a **current** in it which causes a **magnetic field** around the wire. This interacts with the **permanent field of the magnet** causing a **force** on the wire which causes it to move.*
Model Answer	**Describe how to build and test an electromagnet.** *To make the electromagnet **wrap a coil of wire around an iron nail**. Connect the wire to the **power supply** using crocodile clips and switch the power supply on. To change the strength of the electromagnet you could change the **number of turns on the coil, change the current** through the coil or **change the separation of the turns**. To test the electromagnet you would suspend **paperclips** from it, the more paperclips attached to the electromagnet the greater its strength.*
Model Answer	**Describe how Fleming's left-hand rule can be used to determine the direction _____will move when the switch is closed.** *The **thumb, index finger and third finger** are to be held mutually at **right angles**. The index finger shows the **direction of the magnetic field** from North to South and the third finger shows the **direction of the current** from positive to negative terminal. The thumb will show the **direction of the force** acting on (the object given in the question) and so it will move (insert direction thumb is pointed towards)*
Practice	1. Learn and practice the model answers above.

Part 3 Required Practical's

RP18 Force and Extension

Investigating the Relationship Between the Weight Hung From a Spring and its Extension

1
Set up equipment as shown in the diagram.



2.
Adjust the ruler so that the zero mark is at the same height as the top of the spring.

3.
Record the length of the spring when no weights are attached.

3.
Hook a 1N weight on the bottom of the spring.

4.
Record the new length of the spring.

5.
Add weights at 1N intervals recording the new length of the spring.

6.
Determine the extension of the spring when each weight is added by subtracting the original length from the recorded lengths.

Force Applied (N)	Length of Spring (cm)	Extension (cm)

RP18: Force and Extension

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1. What is the equation that links extension, force and spring constant?
2. How can the extension of a spring when a weight is added be determined?
3. What piece of equipment will you use to measure the extension of a spring?
4. How will the appearance of a spring change when a weight is added to it?
5. How could you determine the limit of proportionality for a spring?
6. What is the relationship between force and extension of a spring provided the limit of proportionality has not been exceeded.
7. How could you increase the accuracy of the limit of proportionality that you could determine in this experiment?
8. What form of energy is stored in a stretched spring?
9. When force is 0 what should the value of extension be?
10. How could you identify on a graph where the limit of proportionality has been exceeded?
11. What improvement could be made to the investigation to ensure the length of the spring measured is accurate?
12. How could you test after adding weights if the spring is still behaving elastically?
13. What is the unit for weight?
14. What are the risks in the experiment?
15. What are some safety precautions in the experiment?

1. Spring Constant = Force x Extension
2. Measure the start and end length. Subtract the start length away from the length when the weight has been added.
3. Ruler
4. The spring will become longer, thinner and the gaps between each coil will increase.
5. Add weights and measure extension. Plot extension against force and look for where the line is no longer showing a liner relationship.
6. Directly proportional
7. Use smaller intervals.
8. Elastic
9. 0cm
10. When the line starts to curve. This means the relationship is no longer directly proportional.
11. Make sure the spring is stationary before measuring length and use a pointed on the end of the spring to measure length.
12. Remove the weights and see if it is still returning back to its original shape.
13. Newtons (N)
14. Weights falling on feet, clamp stand falling off the desk.
15. Secure clamp stand on desk using G-clamp, place a tray of sand on the floor under the test spring.

Topic	RP18 Force and Extension
Qu	Construct a method to investigate the extension of a spring when a force is applied.
Info	A common question in the exam is a method to investigate the extension of a spring. Some examples include: • Investigating the extension of a spring when a force is applied. • Investigating how the stiffness of a spring effects the extension of a spring when a force is applied. • Determining the limit of proportionality for a spring. To answer this question, you will need to do the following: 1. Describe how to set up the equipment. 2. Identify the measurements you will take. 3. Describe what you will do with your results. 4. Identify how you will determine if the spring is still behaving elastically or not.
Top Tip	**Check your method and make sure you have discussed the dependent, independent and control variables.**
Model Answer	**Construct a method to investigate the extension of a spring when a force is applied.** *1. Set up a clamp stand with a clamp and spring hanging from it.* *2. Use another clamp to fix a ruler alongside the spring.* *3. Record the start length of the spring.* *4. Hang a weight from the bottom of the spring.* *5. Record the new length of the spring.* *6. Calculate the extension of the spring.* *7. Remove the weight and check the spring has returned to its original length.* *8. Repeat by adding more weights in 1N intervals.* *9. Plot a graph of extension against force.*
Practice	1. Learn and practice the model answer above. 2. Prepare and learn a model answer to explain how you could determine the limit of proportionality for a spring.

RP19 Acceleration

Investigating the effect of varying the force on the acceleration of an object.

1

Set up equipment as shown in the diagram and connect 2 light gates to the data logger.

2

Add a 1N weight to the pulley and release the trolley.

3

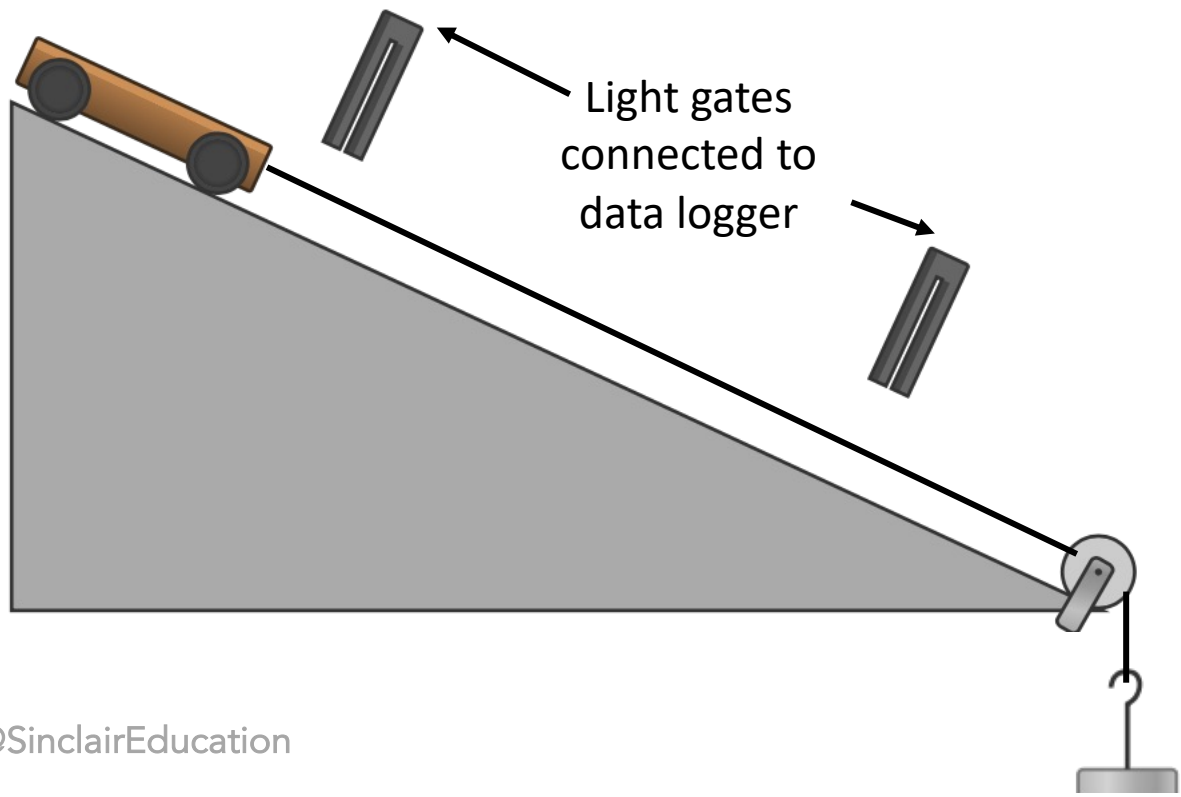
Light gates A and B will determine the velocity at each point and use this to calculate the acceleration between the 2 points.

4

Record the acceleration when 1N is added.

5

Repeat by adding more weights at 1N intervals.



RP19 Acceleration

Investigating the effect of varying the mass of an object on its acceleration

1

Set up equipment as shown in the diagram and connect 2 light gates to the data logger.

2

Add a 1N weight to the trolley and release it.

3

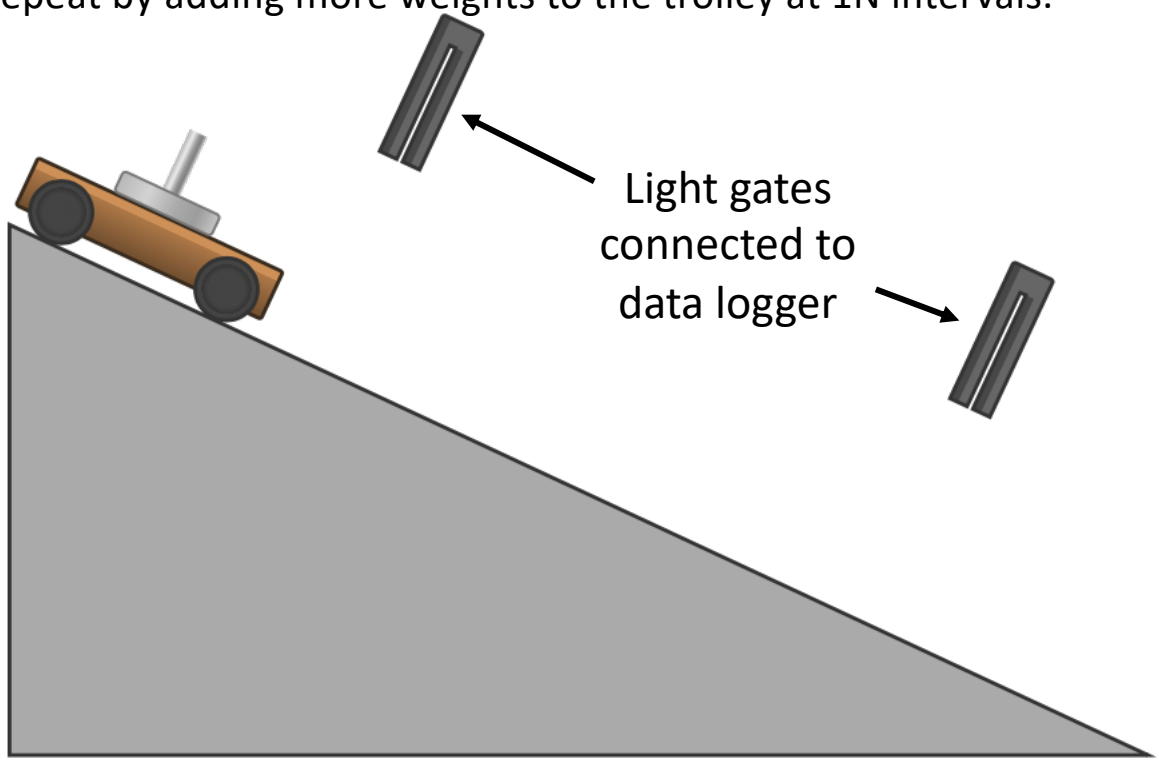
Light gates A and B will determine the velocity at each point and use this to calculate the acceleration between the 2 points.

4

Record the acceleration when 1N is added.

5

Repeat by adding more weights to the trolley at 1N intervals.



RP19: Acceleration

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1. What is the equation that links acceleration, force and mass?
2. What is the unit for acceleration?
3. What is the unit for mass?
4. What is the unit for force?
5. When investigating the effect of the force on acceleration what is the dependent variable?
6. How could the force acting on an object be changed when investigating acceleration?
7. How could you vary the mass of an object when investigating acceleration?
8. What measurements are required to determine acceleration of an object?
9. Why do we use a sloping runway when investigating acceleration?
10. What are the advantages of using a light gate rather than a stopwatch?
11. How could the investigation be improved to reduce the effect of random errors?
12. Why should the same trolley be used in each experiment?
13. What are the possible variables when investigating the acceleration of a trolley on a ramp?
14. Why is it important to not push the trolley when you release it?
15. How can acceleration be calculated using velocity and time?
16. What is the unit for velocity?
17. What is the unit for time?
18. How could the steepness of the ramp be changed?

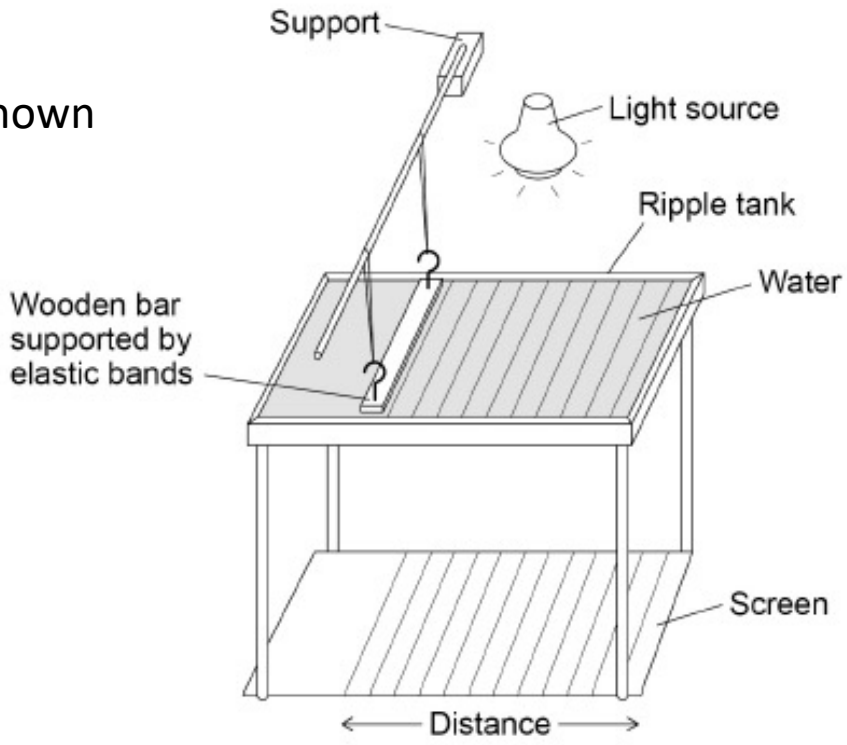
1. Resultant Force = Mass x Acceleration
2. Metres per seconds squared (m/s^2)
3. Kilograms (kg)
4. Newtons (N)
5. The acceleration of the object.
6. Add more weights that are attached to the object.
7. Add extra weights on top of the object.
8. The velocity at each light gate and the time taken to pass from one to the other.
9. To compensate for friction.
10. No reaction time error and results are taken automatically.
11. Do repeats and calculate averages.
12. There should only be one independent variable and so keeping this the same acts as a control.
13. Mass of trolley, force applied to trolley, gradient of ramp, material of ramp
14. So that the same force is applied to each trolley.
15. Determine change in velocity between the two light gates and divide by time.
16. Metres per second (m/s)
17. Seconds (s)
18. Add blocks under the ramp to vary the height.

Topic	RP19 Acceleration
Qu	Construct a method to investigate the effect of _____ on the acceleration of a trolley on a ramp.
Info	You could be asked this question for different variables. For example: • Investigating the effect of <u>height of the ramp</u> on the acceleration of a trolley. • Investigating the effect of <u>mass</u> on the acceleration of a trolley on a ramp • Investigating the effect of <u>force</u> on the acceleration of a trolley on a ramp • Investigating the effect of <u>the material of the surface of the ramp</u> on the acceleration of a trolley. To answer this question, you will need to do the following: 1. Describe how to set up the equipment. 2. Identify the measurements you will take. 3. Describe what you will do with your results.
Top Tip	**Ensure you have a valid method. To do this check your method and make sure you have discussed the dependent, independent and control variables and that you have identified the repeats to be done.**
Model Answer	**Construct a method to investigate the effect of <u>height of the ramp</u> on the acceleration of a trolley.** *1. Place one wooden block under the ramp.* *2. Measure the height of the ramp using a ruler.* *3. Measure the distance travelled using a ruler.* *4. Set up light gates attached to a data logger.* *5. Release the trolley and use the light gates to measure the velocity at each point and the time taken to pass from one light gate to the next to determine acceleration* *6. Repeat twice more at this height, identify outliers and calculate a mean.* *7. Repeat by placing more wooden blocks under the ramp to increase the height.* *8. Release trolley from the same point each time and release with no force.*
Practice	1. Learn and practice the model answer above. 2. Prepare and learn model answers to investigate the effect of mass, force and material of the ramp on acceleration of the trolley.

RP20 Ripple Tank

Measuring the frequency, wavelength and speed of waves in a ripple tank

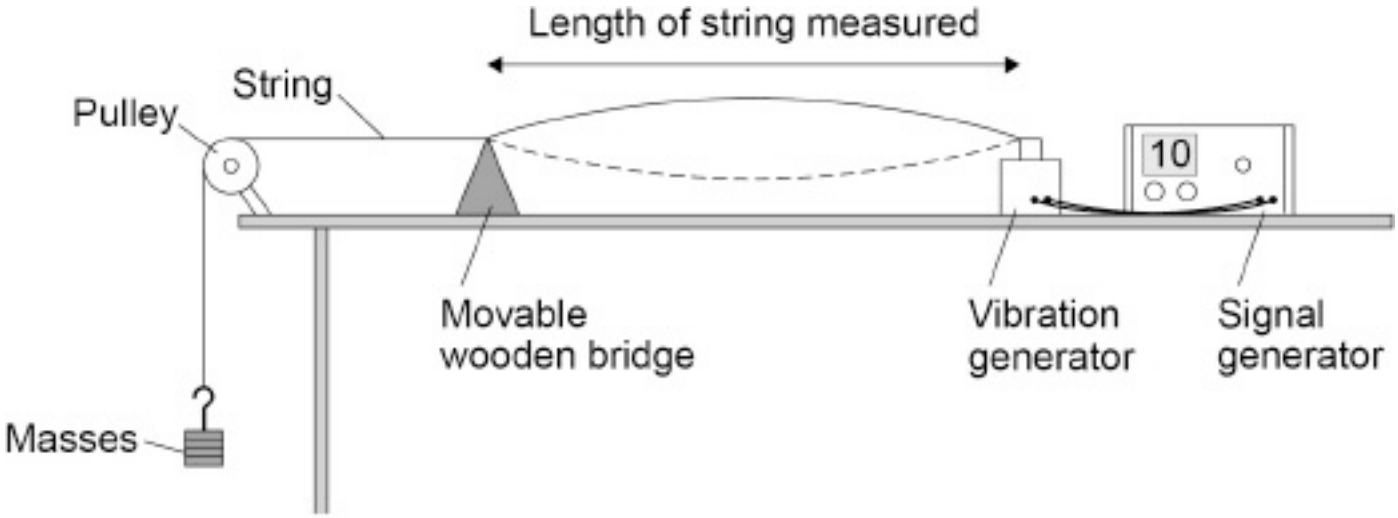
Set up equipment as shown in the diagram.



Frequency	Use a stopwatch and count the number of waves passing a point in a fixed time period. Then divide the time by the number of waves to determine the time for one wave. To then determine frequency use the equation: f = 1/T
Wavelength	Use a camera to freeze the image and use a metre rule to measure the distance between two wavefronts. OR Count the number of wavefronts. To then find the wavelength divide the distance by the number of wavefronts counted.
Velocity	Determine a mean value of frequency and a mean value of wavelength. Use these in the equation wave speed = frequency x wavelength. OR Measure the time it takes one wavefront to travel the length of the screen. Measure the length of the screen and use the equation: speed = distance / time to determine the speed.

RP20 Waves in a Solid

Measuring the frequency, wavelength and speed of waves in a solid.



1. Set up equipment as shown in the diagram.

2. Switch on the signal generator and vibration generator so the string vibrates up and down and move the wooden bridge until a clear wave pattern is formed between the wooden bridge and the vibration generator.

Frequency	Record the frequency of the wave from the signal generator.
Wavelength	Use a meter ruler to measure the distance between the wooden bridge and the vibration generator. Count the number of loops in the wave pattern between the wooden bridge and the signal generator. To determine the wavelength, divide the distance measured by the number of waves counted.
Velocity	Determine a mean value of frequency and a mean value of wavelength. Use these in the equation: wave speed = frequency x wavelength.

Topic	RP20 Waves
Qu	Construct a method to determine the _____ of a wave.
Info	A common exam question that comes up is to be asked how to determine the frequency, wavespeed or wavelength of a wave in a ripple tank or on a string. Examples of questions that have come up in the past include: • Describing how to measure the wavespeed, frequency and wavelength of a water wave in a ripple tank. • Determining the wavelength of a wave in a ripple tank. • Determining the wavespeed of a wave through a string. • Determining the how the tension of a string effects wave speed. To answer this question, you will need to do the following: 1. Describe how to set up the equipment. 2. Identify the measurements you will take. 3. Describe how you will determine wavespeed, wavelength and frequency.
Top Tip	**Have clear sections in your answer. These should include how to determine:** • **Frequency** • **Wavespeed** • **Wavelength**
Model Answer	**Describe how to measure the wavespeed, frequency and wavelength of a water wave in a ripple tank.** ***Frequency*** *Count the number of waves passing a point in a fixed time period. Divide the time by the number of waves counted. Then use the equation:* *Frequency = 1 / time to find the frequency.* ***Wavelength*** *Use a camera to freeze the image and then use a metre ruler to measure the distance between two wave fronts.* ***Wavespeed*** *Time how long it takes for a wave to travel across the ripple tank. Measure the distance it travelled. Divide the distance by time to find the wavespeed.*
Practice	1. Learn and practice the model answer above. 2. Prepare and learn model answers to determine wavespeed, wavelength and frequency in a string. 3. Prepare and learn a model answer to determine how the tension of a string effects the wavespeed.

RP20: Waves

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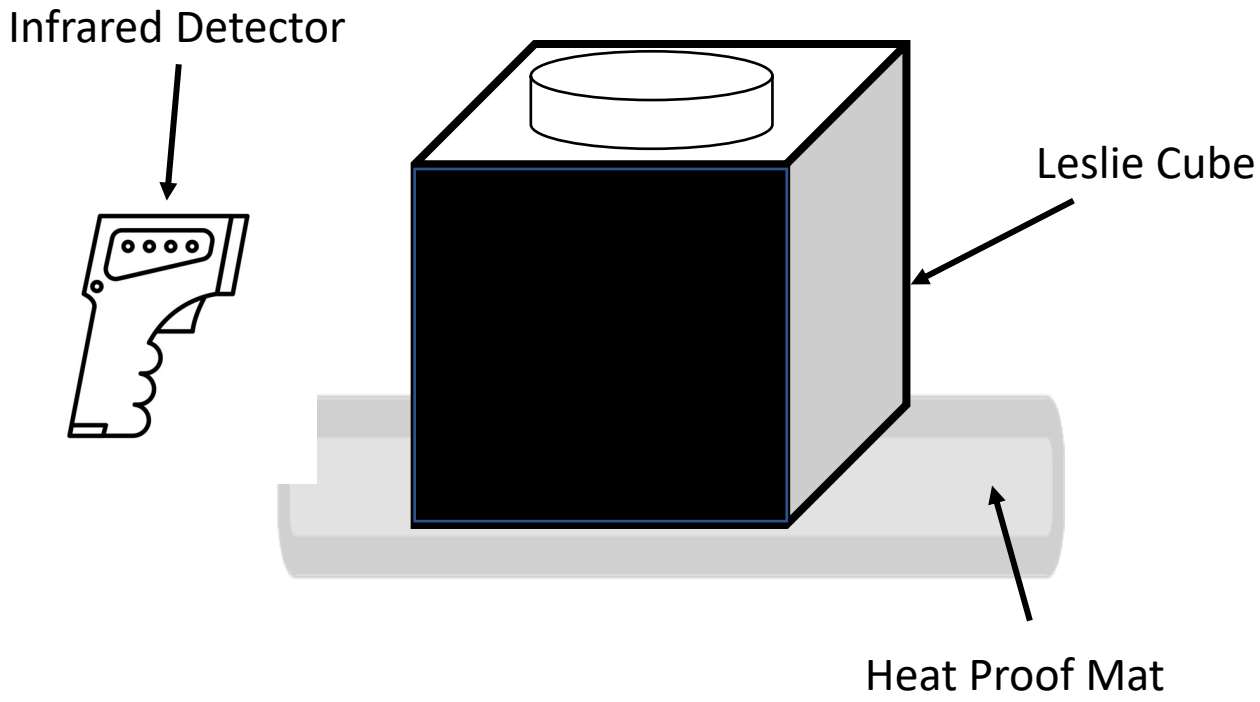
1. What is the equation that links frequency, wavelength and wavespeed.
2. When investigating waves through a string what are the control variables?
3. Why can it be difficult to measure the length of string between the vibration generator and the moveable wooden bridge?
4. How can we determine the frequency of waves in a string?
5. How can you determine the wavelength of a wave through a string?
6. What is the unit for wavelength?
7. What is the unit for frequency?
8. How can you determine the velocity of a wave through a string?
9. What is the unit for wavespeed?
10. What piece of apparatus would you use to measure the distance between the vibration generator and wooden bridge?
11. How could you adjust the experiment set up to show one complete wave through a string?
12. How can the frequency of a water wave in a ripple tank be measured?
13. What is the equation that links frequency and period?
14. What piece of equipment would you use to measure time?
15. How can the speed of a wave in a ripple tank be determined?
16. How can the wavelength of a wave in a ripple tank be determined?

1. Wavespeed = Wavelength x Frequency
2. Number of masses, length of string, type of string.
3. The string is moving, If the distance is greater than 1m then 1 metre ruler would not be long enough.
4. Record the frequency from the signal generator.
5. Measure the distance between the vibration generator and wooden bridge. Count the number of waves present. Divide the distance by the number of waves identified.
6. Metres (m)
7. Hertz (Hz)
8. Find the frequency and wavelength and multiply these values together.
9. Metres per second (m/s)
10. Metre ruler
11. Move the wooden bridge.
12. Count how many waves pass a particular point in a given time. Divide the number of waves counted by the number of seconds the waves were counted for.
13. Period = 1 / Frequency.
14. Stopwatch
15. Measure the distance travelled by a wave and the time it takes for the wave to travel that distance. Divide distance by time to find the speed.
16. Find the frequency and wavelength of the waves. Calculate the wavelength using the equation Wave Speed = Frequency x Wavelength

RP21 Radiation and Absorption

Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.



1

Place the Leslie Cube on a heat proof mat.

2

Fill the Leslie Cube with very hot water and replace the lid.

3

Use an infrared detector to record the amount of radiation from each surface. The detector should be the same distance from each surface.

4

Construct bar chart to display the results.

RP21: Radiation and Absorption

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1. What are the 4 surfaces on a Leslie Cube?
2. What piece of apparatus would you use to measure distance from the surface of the cube?
3. What piece of apparatus would you use to measure the infrared radiation emitted?
4. When investigating radiation and absorption using a Leslie cube what is the independent variable?
5. When investigating radiation and absorption using a Leslie cube what is the dependent variable?
6. When investigating radiation and absorption using a Leslie cube what are the control variables?
7. Which colour surface will emit infrared radiation at the greatest rate?
8. Why should a Leslie cube be placed on a heat proof mat?
9. What should the lid be replaced once the Leslie cube has been filled with water?
10. Are matt or shiny surfaces better emitters?
11. Are matt or shiny surfaces better absorbers?
12. Which colour surface will emit infrared radiation at the slowest rate?
13. Why should you leave the Leslie cube for a minute after placing hot water in it before you take any readings?
14. What is the risk of using hot water?
15. What is a Leslie cube?

1. Matt white, shiny black, matt black and shiny silver.
2. Ruler
3. Infrared detector
4. Type of surface
5. Temperature measured by infrared detector.
6. Distance between the detector and surface of the cube, starting temperature of the water inside the cube, size of the cube, volume of hot water in cube
7. Black
8. To reduce heat loss through the base.
9. To reduce heat loss.
10. Matt
11. Matt
12. White shiny surface
13. To allow the surfaces to heat up to the temperature of the water.
14. Burns and scalds
15. A hollow metal container with painted sides.

Topic	RP21 Radiation and Absorption
Qu	Describe a method to investigate which surface emits infrared radiation at the greatest rate.
Info	You could be asked this question for different surfaces. Some that have come up in the past include: • A mixture of different colours including green, red, blue and black. • Shiny and matt surfaces of the same colour. • A Leslie cube with a matt black surface, a shiny black surface, a shiny silver surface and a matt white surface. To answer this question, you will need to do the following: 1. Describe how to set up the equipment. 2. Identify the dependent and independent variable 3. State that to collect valid results you will have control variables. 4. Identify what the control variables are. 5. Describe what you will do with your results.
Top Tip	**Check your method and make sure you have discussed the dependent, independent and control variables.**
Model Answer	Describe a method to investigate which colour of surface emits infrared radiation at the greatest rate. The test colours are orange, blue, black and white. *1. Paint the 4 sides of a hollow metal cube the 4 test colours.* *2. Place the cube on a heat proof mat, fill with water that has just been boiled and replace the lid.* *3. Wait 1 minute.* *4. Using an infrared detector measure the temperature of each side painted a different colour.* *5. To collect valid data there need to be control variables. Control variables include the thickness of each layer of paint and the distance the detector is from the cubes surface.* *6. Plot a bar chart of results.*
Practice	1. Learn and practice the model answer above. 2. Prepare and learn model answers to explain how you would investigate matt and shiny surfaces. Then construct another model answer to explain how you would investigate radiation and absorption for the surfaces of a Leslie cube.