Physics Paper 2

Model Exam Question Booklet

Physics Paper 2	
Topics in the Paper:	
P8	Forces
P9	Motion
P10	Force and Motion
P13	Electromagnetic Waves
P15	Electromagnetism
RP21	Radiation and Absorption

Essential Content for the Foundation Trilogy Science Exam (HTH/KYO)

This booklet is split into 3 parts:

Part 1
The first part is a selection of short response questions and answers that are likely to come in your Physics exams this summer. 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) that are very likely to be on the exam paper this year.

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?

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.

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 of the object.
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 answer?	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 condition of the vehicle?	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.

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 do gamma rays originate?
6. Which parts of the electromagnetic spectrum can cause harm to the body?
7. What is radiation dose?
8. What is the unit for radiation dose?
9. How many millisieverts are in a sievert?
10. What harm can UV light cause?
11. What harm can X-Rays cause?
12. What harm can gamma rays cause?
13. What uses do we have for radio waves?
14. What uses do we have for microwaves?
15. What uses do we have for infrared?
16. What uses do we have for visible light?
17. What uses to we have for ultraviolet?
18. What uses do we have for X-Rays?
19. 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. Changes in the nucleus of the atom.
6. Ultraviolet, W-rays and gamma rays.
7. It is a measure of the risk of harm resulting from the exposure of the body to the radiation.
8. Sieverts (Sv)
9. 1000
10. Can cause skin to age prematurely and increase the risk of skin cancer due to it being ionising.
11. Ionising radiation can cause the mutation of genes and cancer.
12. Ionising radiation can cause the mutation of genes and cancer.
13. Television and radio.
14. Satellite communication and cooking food.
15. Electrical heaters, cooking food and infrared cameras.
16. Fibre optic communications
17. Energy efficient lamps and sun tanning
18. Medical imaging and treatments
19. 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?

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.

Topic	P8 Forces in Balance
Qu	Explain you would determine the centre of mass of a piece of card. Explain how you could check that the centre of mass point is accurate. 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.

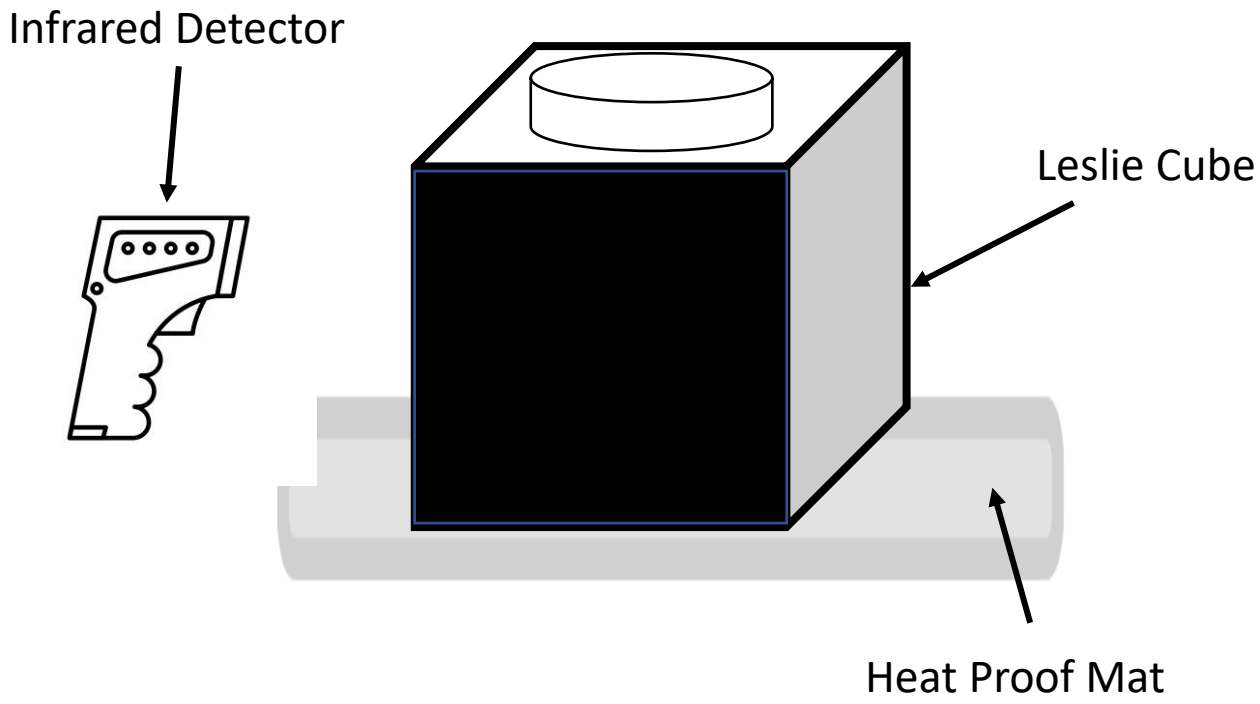
Topic	P10 Force and Motion
Qu	Describe what can affect the stopping distance of a _____.
Info	You could be asked describe what can affect the stopping distance of different vehicles including boats, cars, trucks, bicycles. The question may also give you a description of what the driving conditions are 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	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. <u>In comparison</u> 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 <u>also</u> pose a risk and <u>like</u> X-Rays it is <u>also</u> 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	1. Explain how you could determine if a substance is magnetic or not, or a magnet. 2. Describe how you would plot a magnetic field pattern around a bar magnet 3. 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.

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.