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REVISE EDEXCEL GCSE (9–1)

Physics

REVISION WORKBOOK

Higher

For the 9–1 exams

Pearson

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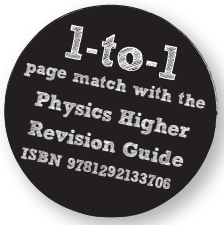


Contents

Edexcel publishes Sample Assessment Material and the Specification on its website. This is the official content and this book should be used in conjunction with it. The questions in *Now try this* have been written to help you practise every topic in the book. Remember: the real exam questions may not look like this.

Key concepts

1 Complete the table for units of physical quantities and their abbreviations.

Guided

ampere	.....	joule	.....	pascal	Pa	coulomb	.....
mole	.....	watt	.....	newton	.....	ohm	.....

(2 marks)

2 Explain the difference between a base unit and a derived unit.

.....

..... **(2 marks)**

3 Convert each quantity.

(a) 750 grams to kilograms

1000 g = 1 kg; 1000 W = 1 kW; 60 s = 1 minute; 1000 mm = 1 m; 1 000 000 J = 1 MJ

..... kg **(1 mark)**

(b) 0.75 kilowatts to watts

..... W **(1 mark)**

(c) 25 minutes to seconds

..... s **(1 mark)**

(d) 30 millimetres to metres

..... m **(1 mark)**

(e) 3 megajoules to joules

..... J **(1 mark)**

4 Write each quantity in the unit shown and then in standard form.

(a) frequency of 2.5 kHz

Guided

Hz: 2.5 kHz = 2500 Hz

standard form: 2.5×10^3 Hz **(2 marks)**

(b) length of 8 nm

m: .....

standard form: ..... **(2 marks)**

5 Calculate the speed of a car that takes 10.5 s to travel 75 m. Give your answer to 5 significant figures.

Look at the number that follows the significant figure you are asked to consider (in this case the 5th one). If it is greater than 5, round the 5th figure up, if it is less then round down, e.g. 1.23076923 would become 1.2308 to 5 significant figures.

speed = ... m/s **(2 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Scalars and vectors

1 (a) Write each quantity in the correct part of the table.

acceleration displacement speed energy temperature mass force velocity momentum distance

A scalar has only a magnitude (size) but a vector has both a magnitude **and** a direction.

Scalars	Vectors

(2 marks)

(b) (i) Give one example of a scalar from your table and explain why it is a scalar.

Guided

..... is a scalar because .....

..... **(2 marks)**

(ii) Give one example of a vector from your table and explain why it is a vector.

..... is a vector because .....

and ..... **(2 marks)**

2 At the swimming pool, two swimmers are practising for a swimming gala. They swim from opposite ends of the pool. The first swimmer dives in from the left side and swims the length of the pool at a velocity of 1.3 m/s. The second swimmer then swims from the right at a velocity of −1.4 m/s.

(a) Explain why the velocity is used in this example instead of the speed.

.....

..... **(2 marks)**

(b) Explain why the second swimmer's velocity has a negative value.

..... **(1 mark)**

3 (a) Which of the following is not a scalar?

☐ **A** energy ☐ **C** mass

☐ **B** temperature ☐ **D** weight **(1 mark)**

(b) Give a reason for your answer to (a).

.....

..... **(1 mark)**

4 An aeroplane flies in a straight line between two airports. The pilot knows that there will be a strong wind blowing at an angle of 60° to the direction in which the aeroplane will be travelling. Explain why it is important that the pilot uses vectors when planning the route the aeroplane will take.

.....

.....

..... **(3 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Paper 1

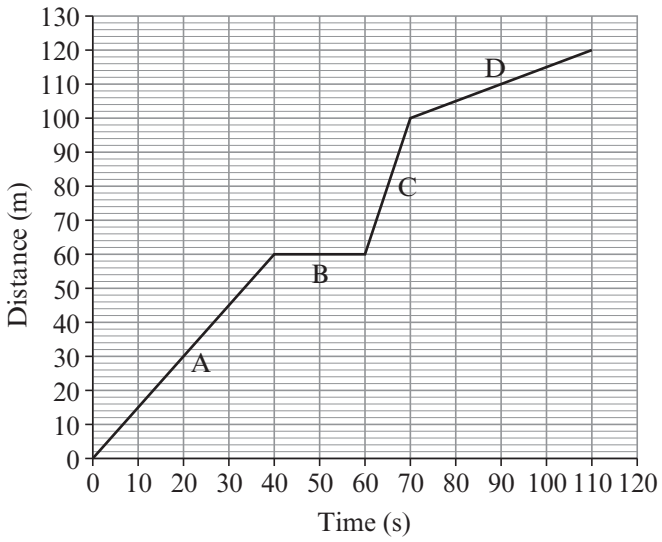
Speed, distance and time

1 The distance/time graph shows a runner's journey from his home to the park.

(a) State the letter that corresponds to the part of the runner's journey where he:

(i) stops ..... **(1 mark)**

(ii) runs fastest. ..... **(1 mark)**



(b) Calculate the runner's speed in part A of his journey.

Guided

In part A, he travels ..... m in ..... s.

speed = distance ÷ .....

speed = ... m/s **(3 marks)**

(c) When the runner arrives at the park his displacement from home is less than the distance he has travelled. Explain this difference.

.....

..... **(2 marks)**

2 The lift in a wind turbine tower takes 24 s to go from the ground to the generator 84 m above.

> Speed = distance ÷ time only.
> Velocity is speed in a given direction.
> For example, speed = 20 m/s but velocity = 20 m/s East

(a) Calculate the speed of the lift. State the unit.

speed = ... unit ..... **(3 marks)**

(b) State the velocity of the lift.

..... **(1 mark)**

3 An athlete runs at a constant speed of 5 m/s around a running track. A complete lap is 400 m.

Calculate the time it takes for the athlete to complete one lap.

time = ... s **(2 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Equations of motion

1 Draw a line from each symbol to its correct description. One has been done for you.

Initial velocity means the velocity when time = 0.

Symbol	Description
v	acceleration
u	time
a	distance
x	final velocity
t	initial velocity

(2 marks)

2 (a) A racing car takes 8 seconds to speed up from 15 m/s to 25 m/s. Calculate its acceleration.

You may find the equation $a = v - u \div t$ useful.

acceleration = ... m/s^2 **(3 marks)**

(b) The racing car now accelerates at the same rate for 12 seconds, from 25 m/s to a higher velocity. It travels 300 m during this time. Calculate its final velocity.

You may find the equation $v^2 - u^2 = 2 \times a \times x$ useful.

velocity = ... m/s **(3 marks)**

(c) The car now slows down to 5 m/s from the velocity calculated in (b) at a rate of –2 m/s^2. Calculate how far the car travels when decelerating to this new final velocity.

distance = ... m **(3 marks)**

Velocity/time graphs

1 A cyclist takes 5 seconds to reach maximum velocity of 4 m/s, from being stationary, moving in a straight line.

(a) Calculate the cyclist's acceleration.

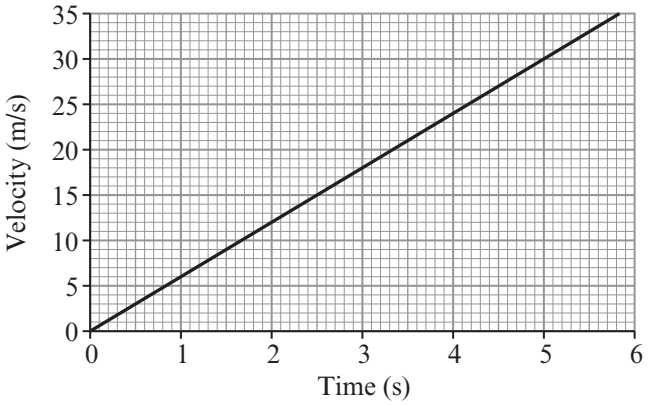
acceleration = ...unit ..... **(3 marks)**

(b) The cyclist travels at constant velocity for 15 seconds and then takes another 15 seconds to slow down to a stop. Explain how the total distance travelled could be calculated by drawing a graph of the ride.

.....

..... **(3 marks)**

2 The velocity/time graph shows how the velocity of a car changes with time.



(a) This graph can be used to analyse the car's journey. Choose **two** correct statements that describe the information the graph shows.

☐ **A** the distance the car travelled

☐ **B** how long the car was stopped

☐ **C** the acceleration of the car

☐ **D** the constant velocity of the car

(2 marks)

(b) Draw a triangle on the graph to show the acceleration and the time taken. **(1 mark)**

(c) Calculate the acceleration of the car.

Guided

change in velocity = ... m/s, time taken for the change = ... s

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} =$$

acceleration = ... m/s^2 **(2 marks)**

(d) Use the graph to calculate the distance travelled by the car in the first 5 s.

Work out the area under the graph.

distance = ...m **(2 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

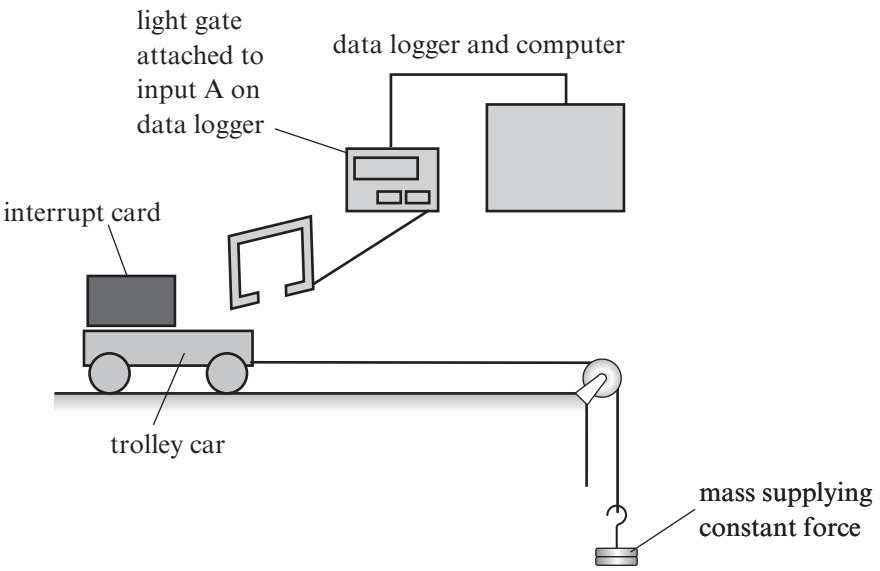
Determining speed

1 Draw a line from each activity to its correct speed. One has been done for you.

Activity	Speed
commuter train	330 m/s
running	1.5 m/s
speed of sound in air	3.0 m/s
walking	55 m/s

(1 mark)

2 The diagram shows a light gate being used to measure the speed of a model vehicle.



(a) Describe why a card is fixed to the vehicle in this experiment.

Guided

The light beam is .....
as it enters the light gate and this starts the timer. When the card has passed through, and .....
..... **(3 marks)**

(b) State how the speed is found using this method.

..... **(1 mark)**

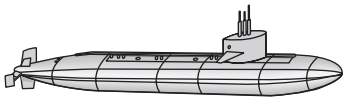
3 State two reasons why using light gates and a computer may be a more reliable method than using a person with a stop watch and a ruler to measure the speed of a toy car.

Light gates can measure instantly so computers can calculate speeds over very short distances. Consider this advantage over measurement by a person.

.....
.....
..... **(3 marks)**

Newton's first law

1 A submarine is travelling at a constant depth in the sea. It starts to move forwards. Draw a free-body force diagram for all the forces acting on the submarine. Label these forces. **(2 marks)**



The lengths of the arrows on a free-body force diagram should be proportional to the sizes of the forces.

2 A speed skater is standing on the ice waiting for the start of a race.

(a) Describe the action and reaction forces acting on the skater and her skates.

Guided

The action is the .....and the reaction is ..... **(2 marks)**

(b) The race begins and the skater pushes against the ice producing a forward thrust on the skates of 30 N. There is resistance from the air of 10 N and friction on the blades of 1 N. Calculate the resultant force.

Add up all the forces in a straight line. Give forces that act opposite to the thrust a minus sign.

force = ... N **(2 marks)**

(c) During the race the resistive forces become equal to the forward thrust. Explain what happens to the velocity of the skater.

.....

..... **(2 marks)**

(d) At the end of the race the skater stops skating. Explain what happens next before the skater comes to a halt.

.....

..... **(2 marks)**

3 A space probe falls towards the Moon. In the Moon's gravitational field the probe has a weight of 1700 N. The probe fires rockets giving an upward thrust of 1900 N.

(a) Calculate the resultant force on the space probe.

resultant force = ... N **(2 marks)**

(b) Explain the changes in the probe's velocity.

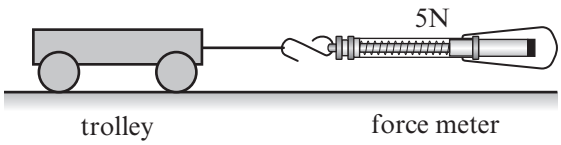
.....

..... **(2 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Newton's second law

1 In an experiment a student pulls a force meter attached to a trolley along a bench. The trolley has frictionless wheels. The force meter gives a reading of 5 N.



(a) Describe what happens to the trolley.

Guided

The trolley will .....

in the direction..... **(2 marks)**

(b) The student stacks some masses on the trolley and again pulls it with a force of 5 N. Explain why the trolley takes longer to travel the length of the bench.

The acceleration is .....because.....**(2 marks)**

2 When the Soyuz spacecraft returns to Earth from the International Space Station it is slowed by friction with the air. The spacecraft has a mass of 3000 kg and the craft slows with an average acceleration of −13 m/s^2.

(a) Calculate the average resultant force acting on the spacecraft. State the unit.

force = ... unit ..... **(3 marks)**

(b) State the direction in which the force acts.

..... **(1 mark)**

3 A Formula One racing car has a mass of 640 kg. A resultant force of 10 500 N acts on the car.

(a) Calculate the acceleration on the racing car. State the unit.

Newton's second law is $F = m \times a$ where F = (unbalanced) force, m = mass and a = acceleration

acceleration = ... unit ..... **(3 marks)**

(b) Explain what will happen to the acceleration of the car as its fuel tank empties, assuming the resultant force remains constant.

.....

..... **(2 marks)**

Weight and mass

1 The lunar roving vehicle (LRV), driven by astronauts on the Moon, has a mass of 210 kg on Earth. State the mass of the unchanged LRV on the Moon. Give a reason for your answer.

Guided

The mass of the LRV on the Moon is ..... kg

because .....

.....

..... **(2 marks)**

2 Which of the following is **not** a description of weight?

☐ **A** Weight is a type of force.

☐ **B** Weight is measured in kilograms (kg).

☐ **C** The weight of a mass changes according to gravitational field strength.

☐ **D** Weight is measured in newtons (N). **(1 mark)**

3 Calculate the total weight of a backpack of mass 1 kg, containing books with a mass of 2 kg and trainers with a mass of 1.5 kg. Take gravitational field strength (g) to be 10 N/kg.

Use the equation relating weight to mass and gravitational field strength.

weight = ... N **(3 marks)**

4 Kate is about to fly to Europe on holiday. The total baggage allowance is 20 kg. Kate only has scales that weigh in newtons. Determine the items that Kate can take on holiday, as well as her clothes, to get the mass as close as possible to the baggage allowance. Show your calculations. Take gravitational field strength (g) to be 10 N/kg.

laptop 45 N	camera bag 55 N	walking boots 25 N	jacket 35 N	clothes 105 N

total baggage = ... kg **(3 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Force and acceleration

A ramp, a trolley, masses and electronic light gates can be used to investigate the relationship between force, mass and acceleration.

1 State one advantage of using electronic measuring equipment to determine acceleration compared to using a ruler and stopwatch.

.....

.....

..... **(2 marks)**

2 Describe the relationship between acceleration and mass.

..... **(1 mark)**

3 Explain why it is necessary to use two light gates when measuring acceleration in this experiment.

Guided

Acceleration is calculated by the change in speed ÷ time taken, so.....

.....

..... **(2 marks)**

4 (a) Describe the conclusion that can be drawn from this experiment.

Guided

For a constant slope.....

.....

..... **(2 marks)**

(b) Identify which of Newton's laws can be referred to in verifying the results of this experiment.

The quantities of force, mass and acceleration are linked in this equation.

..... **(1 mark)**

5 Suggest one hazard associated with this experiment and two safety precautions that could be taken to minimise the risk of harm to the scientist.

Consider the potential dangers of using accelerated masses or electrical equipment.

.....

.....

.....

.....

.....

..... **(3 marks)**

Circular motion

Guided

1 (a) Explain why the velocity of a satellite is constantly changing even though its speed remains constant.

The velocity of an orbiting satellite changes because .....

even though .....

.....

..... **(2 marks)**

(b) Explain why the Moon can be described as accelerating in its orbit round the Earth.

Refer to forces in your answer.

.....

..... **(1 mark)**

2 What is the name of the force that is at 90° to the motion of a satellite?

☐ **A** acceleration

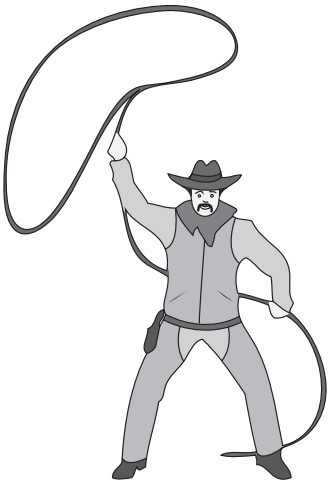
☐ **B** centripetal force

☐ **C** circular motion

☐ **D** orbiting force **(1 mark)**

3 Name the force that acts as the centripetal force in each example. Add another example of your own for each force.

Force	Example 1	Example 2
	a lasso used to catch cattle	
	Venus orbiting the Sun	
	a cyclist going around a velodrome track	



(6 marks)

4 A student presents his project on the moons of Jupiter and uses a ball tied to string to model their motion by rotating the ball around in a circle, holding on to the string.

Consider how the forces act together.

(a) State the force that the string is modelling.

..... **(1 mark)**

(b) Explain why the ball is accelerating.

..... **(1 mark)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Momentum and force

1 What is the momentum of a 10 000 kg lorry moving at 4 m/s?

☐ **A** 2500 kg m/s

☐ **B** 40 000 kg m/s

☐ **C** 14 000 kg m/s

☐ **D** 4×10^{-4} kg m/s **(1 mark)**

2 (a) Explain how force is related to momentum.

.....

..... **(2 marks)**

(b) A car with a mass of 1500 kg is travelling at 25 m/s along a motorway. It crashes into a central barrier and stops in 1.8 seconds resulting in a momentum of zero. Calculate the change in momentum of the car.

change in momentum = ... kg m/s **(3 marks)**

(c) Explain how a large force is exerted on a passenger in a vehicle in the event of a car crash and how this can be reduced.

Guided

The forces exerted on the passenger are large when .....

By fitting .....

So this will reduce the .....

.....

.....

..... **(4 marks)**

3 Calculate the force on a motorcycle of mass 500 kg as it speeds up from 10 m/s to 15 m/s in 20 s.

You may find this equation useful:
change in momentum = resultant force × time

force = ... N **(3 marks)**

4 Explain what a hockey player needs to consider when hitting the hockey ball with a hockey stick, to send the ball as far as possible down the pitch.

.....

.....

..... **(3 marks)**

Newton's third law

1 Select the statement that summarises Newton's third law.

☐ **A** For every action there is a constant reaction.

☐ **B** The action and reaction forces are different due to friction.

☐ **C** Reaction forces may be stationary or at constant speed.

☐ **D** For every action there is an equal and opposite reaction. **(1 mark)**

2 Calculate the momentum of a car with a mass of 1200 kg moving at 30 m/s from north to south.

> You may find this equation useful
> *momentum = mass × velocity*

Guided

momentum = ...

momentum = ... kg m/s in the ..... direction. **(3 marks)**

3 Dima and Sam are driving dodgem cars at a funfair. The total mass of Dima and his car is 900 kg. He is moving west at 1.5 m/s.

(a) Calculate the momentum of Dima and his car.

momentum = ... kg m/s **(1 mark)**

(b) Sam and his car also have a total mass of 900 kg but his car is travelling faster than Dima's car, at 3 m/s west. Sam's car collides with the back of Dima's car and both cars move forward together.

(i) Calculate the momentum of Sam and his car just before the collision.

momentum = ... kg m/s **(1 mark)**

(ii) Explain what happens to the sum of the momentum of both cars after the collision.

.....

..... **(2 marks)**

(iii) Calculate the velocity of both cars as they move off together after the collision.

velocity = ... m/s **(3 marks)**

4 A skater with a mass of 50 kg skates across the ice at 7.2 m/s in a straight line travelling north. She collides with her stationary partner who has a mass of 70 kg. They glide off together northwards. Calculate the velocity with which the pair glide across the ice.

velocity = ... m/s **(3 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Human reaction time

1 Reaction time is an important consideration in driving a vehicle safely. Which is the distance travelled due to the reaction time of a driver?

☐ **A** overall stopping distance

☐ **B** thinking distance

☐ **C** braking distance

☐ **D** reaction distance **(1 mark)**

2 Explain how human reaction time is related to the brain.

Guided

Human reaction time is the .....

.....

It is related to ..... **(2 marks)**

3 Explain how to measure human reaction times using a ruler.

.....

.....

.....

..... **(3 marks)**

4 (a) State the range of reaction times of an average person to an external stimulus.

..... **(1 mark)**

(b) Describe why people in certain professions train themselves to improve their reaction times. Give two examples and comment on why improved reaction times would be important in each case.

Examples of professions you could use are driving instructors and helicopter pilots.

.....

.....

.....

.....

..... **(4 marks)**

5 A rabbit runs across the road 50 metres in front of a car. Calculate the reaction time of a driver who covers a distance of 25 metres travelling at a speed of 20 m/s between seeing the rabbit and putting his foot on the brake.

You may find this equation useful *speed = distance ÷ time*

.....

.....

Reaction time ..... s **(2 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Stopping distance

1 (a) Write the word equation used to calculate overall stopping distance.

..... **(1 mark)**

(b) Calculate the overall stopping distance when a car increases its speed from 20 mph to 60 mph. Take thinking distance to be 6 m and braking distance to be 6 m when travelling at 20 mph.

(3 marks)

(c) Complete the table below to summarise the factors that affect overall stopping distance.

Separate the factors that may affect the reaction time of a driver from those that affect the vehicle.

Guided

Factors increasing overall stopping distance	
Thinking distance will increase if	**Braking distance will increase if**
	the car's speed increases
the driver is distracted	

(2 marks)

(d) Compare the overall stopping distances of a car with worn tyres and a car with new tyres.

.....

..... **(2 marks)**

2 Work is done on a moving car to bring it to rest. Calculate what force must be applied to the brakes of a car of mass 1500 kg travelling at 8 m/s for it to stop at the pedestrian crossing 75 m away.

force = ... N **(3 marks)**

3 Recent proposals have been made to increase the national speed limit in certain cases. Suggest how these proposals might increase the risk of damage to vehicles and their passengers.

Remember that kinetic energy is proportional to v^2.

.....

.....

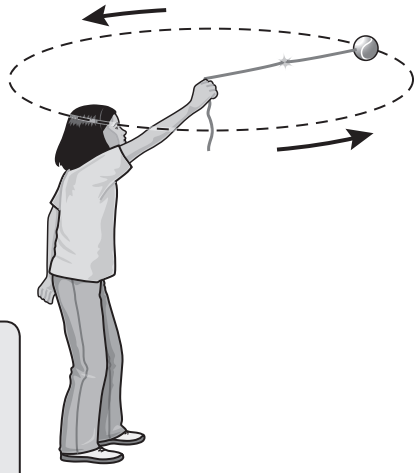
.....

..... **(3 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Extended response – Motion and forces

A student investigates circular motion by tying a 57 g tennis ball to a string which is then rotated in a horizontal plane at constant speed. The student counts the number of rotations.



Explain how acceleration and centripetal force are considered in this experiment.

Your answer should include an example of how the experiment may be extended to improve data collection.

You will be more successful in extended writing questions if you plan your answer before you start writing.

The question asks you to give a detailed explanation of acceleration and centripetal force. Think about:

- Why the tennis ball is described as accelerating.
- How centripetal force is described.
- How the student can improve his investigation by changing variables.
- How the student can improve data collection.
- Identify the importance of control variables.

You should try to use the information given in the question.

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(6 marks)

Energy stores and transfers

1 Which of the following is not an energy store?

- ☐ **A** chemical
- ☐ **B** light
- ☐ **C** thermal
- ☐ **D** kinetic

(1 mark)

Guided

2 Explain how an energy transfer diagram supports the law of conservation of energy.

The energy transfer diagram shows that .....

.....

.....

..... **(2 marks)**

3 A footballer has a breakfast of cereal and toast before setting off for a training session at the club. Complete the flow chart to show how energy is transferred to other stores.

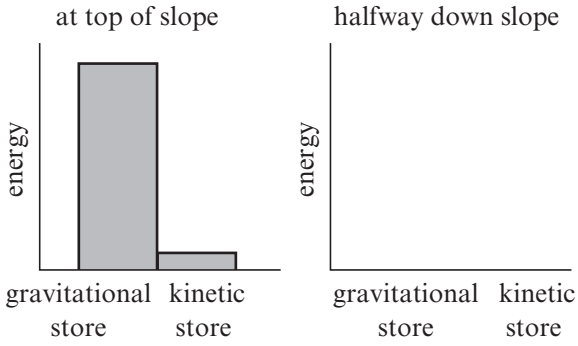
Write the correct store of energy in each space.

.....	→	→ .....
energy in the breakfast		energy of the footballer		energy dissipated to the surroundings

(3 marks)

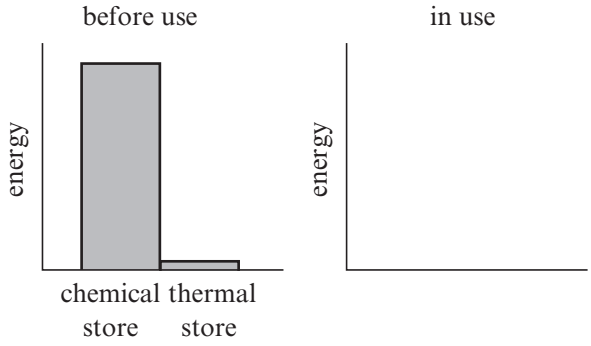
4 The bar graphs below illustrate energy stores before each energy transfer occurs. Add bars to the graphs to show energy stores for after each energy transfer has occurred.

(a) a bobsleigh at the top of a slope and halfway down the slope



(3 marks)

(b) a petrol lawnmower before use and in use



(4 marks)

Had a go ☐ Nearly there ☐ Nailed it! ☐

Efficient heat transfer

1 Identify the most suitable material, from the table below, for building an energy-efficient garage. Give a reason for your answer.

The larger the relative thermal conductivity, the more heat will be conducted through the material.

Material	Relative thermal conductivity
brick	1.06
concrete	1.00
sandstone	2.20
granite	2.75

.....

..... **(2 marks)**

2 (a) Some houses are built with very thick walls. Explain how these walls help to keep the houses warm in the winter in cold countries.

.....

.....

..... **(2 marks)**

(b) In hot countries, such as Greece, traditional houses have thick walls with small windows. Explain why these houses in a hot country also have thick walls.

.....

.....

..... **(2 marks)**

3 A crane lifts a box to the top of a building. 1 000 000 joules is transferred to the gravitational store when the box is moved from the bottom to the top of the building. The crane uses fuel with 4 000 000 joules in a chemical store. Calculate the efficiency of the crane.

Guided

useful energy transferred = energy transferred to the box = ...

total energy used by the crane = the energy stored in the fuel = ...

efficiency = ... **(2 marks)**

4 (a) The motor in a food blender has an efficiency of 20%. The motor transfers 40 joules per second into the kinetic store. Calculate the energy that is transferred to the motor each second.

energy transferred each second = ... J **(3 marks)**

(b) State the power of the motor. Give the unit.

power = ... unit ..... **(1 mark)**

Energy resources

1 Some of the sources of renewable energy listed below are only available at certain times, while other sources can be used at any time.

hydroelectric	tidal	solar	wind	geothermal

Guided

(a) Name the sources of renewable energy in the list that are always available.

Hydroelectric and ..... **(1 mark)**

(b) Explain why it is an advantage to have a source of energy available at any time.

Think about how the weather affects some renewable energy sources.

Demand is greatest .....

Demand may be high when ..... **(2 marks)**

2 A hydroelectric power station is used to produce electricity when demand is high.

(a) Explain why the hydroelectric power station is a reliable producer of electricity.

.....

..... **(2 marks)**

(b) Give one reason why we cannot use hydroelectric power stations in more places in the UK.

.....

..... **(1 mark)**

3 Comment on each statement referring to the use of fossil fuels with regard to environmental impact.

Think about the possible consequences of the statements describing the use of fossil fuels.

(a) Carbon dioxide is released as a result of burning fossil fuels.

.....

..... **(2 marks)**

(b) Burning fossil fuels produces sulfur dioxide and nitrogen oxides.

.....

..... **(2 marks)**

(c) Fossil fuel power stations can be built away from areas of natural beauty such as coasts, estuaries and mountains.

.....

..... **(2 marks)**

4 Some people say that we have passed the time of 'peak oil'. After this time, the amount of crude oil extracted will decrease and prices for fuel will rise rapidly. Other people say that we will not pass this peak until 2020. Suggest why there is uncertainty about peak oil.

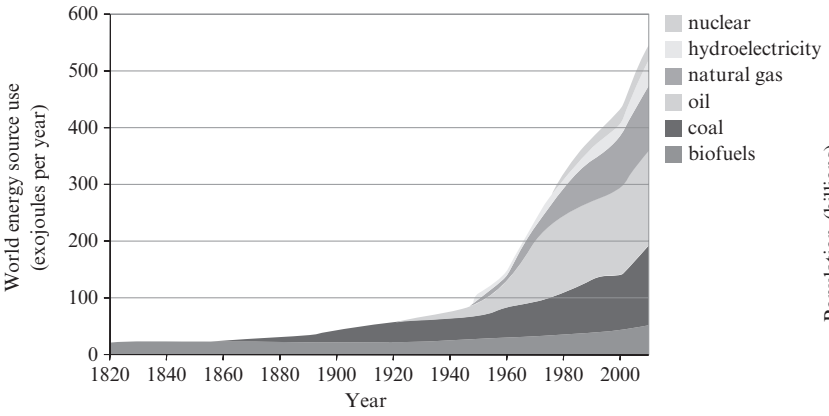
.....

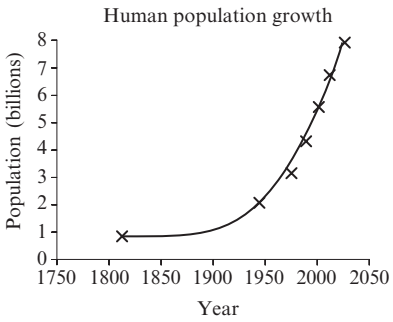
..... **(2 marks)**

Had a go ☐ Nearly there ☐ Nailed it! ☐

Patterns of energy use

1 The graphs show patterns of energy use and human population growth.





(a) Give three reasons why energy consumption rose significantly after the year 1900.

Guided

After 1900 the world's .....

There was development in .....

and ..... **(3 marks)**

(b) (i) Identify which category of energy resources has been the main contributor to world energy consumption since the year 1900.

..... **(1 mark)**

(ii) Suggest two reasons why the consumption of energy resources has increased in the developed world.

.....

..... **(2 marks)**

(iii) Suggest a reason why nuclear energy resources only appear after 1950.

..... **(1 mark)**

(iv) Identify a renewable resource from the graph that makes use of gravitational potential energy.

..... **(1 mark)**

2 If the patterns in energy consumption are similar to the patterns in the world's population growth, discuss the issues resulting from the continuing use of energy in the way shown in the graph in Q1.

Consider finite non-renewable resources and increasing demand due to population, transport and industrial growth.

.....

.....

.....

.....

..... **(6 marks)**