SAMPLE

PRACTICE MAKES PERMANENT

350+ questions

AQA GCSE Physics

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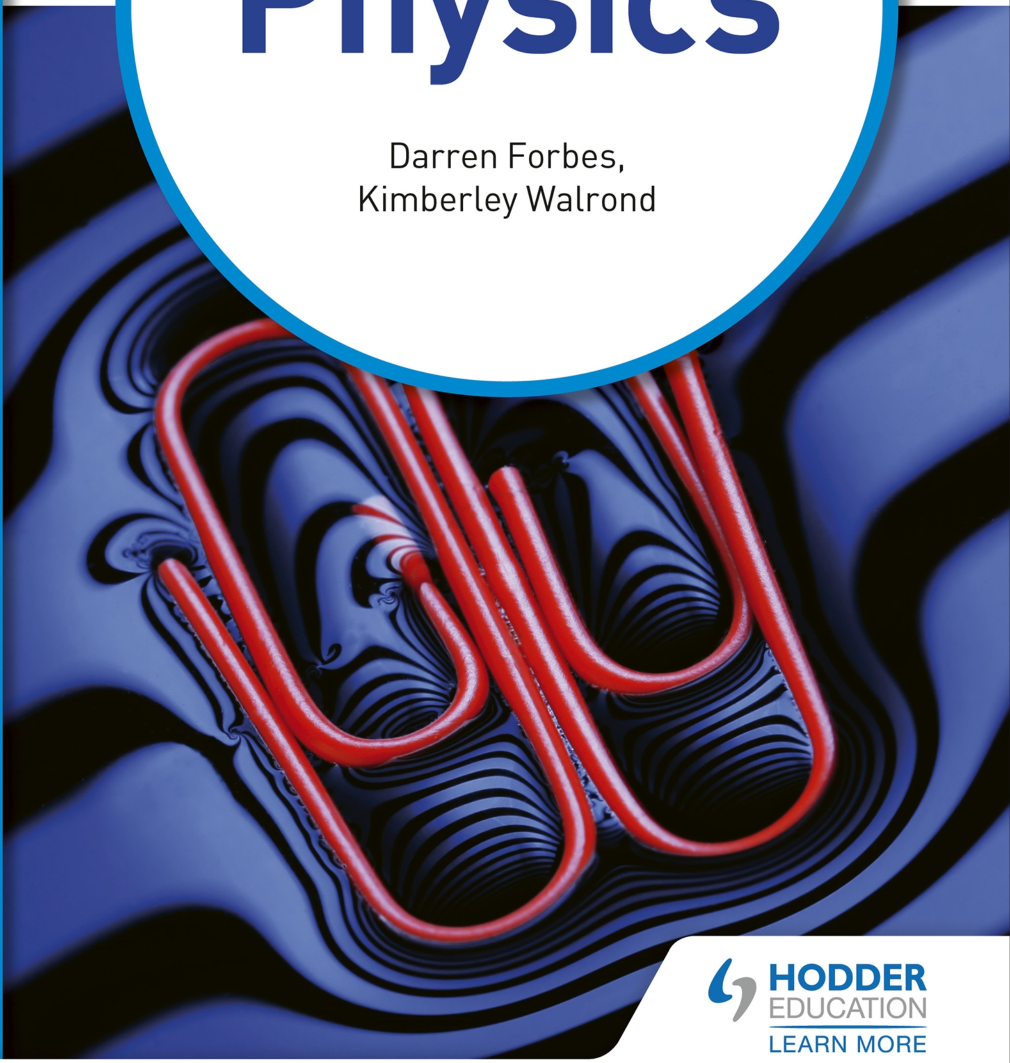

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Contents

Introduction

Practice Makes Permanent is a series that advocates the benefits of answering lots and lots of questions. The more you practise, the more likely you are to remember key concepts; practice does make permanent. The aim is to provide you with a strong base of knowledge that you can automatically recall and apply when approaching more difficult ideas and contexts.

This book is designed to be a versatile resource that can be used in class, as homework, or as a revision tool. The questions may be used in assessments, as extra practice, or as part of a SLOP (i.e. Shed Loads of Practice) teaching approach.

How to use this book

This book is suitable for the AQA GCSE Physics course, both at Higher and Foundation levels. It covers all the content that you will be expected to know for the final examination.

The content is arranged topic-by-topic in the order of the AQA specification, so areas can be practised as needed. Within each topic there are:

- **Quick questions** – short questions designed to introduce the topic.
- **Exam-style questions** – questions that replicate the types, wording and structure of real exam questions, but highly-targeted to each specification point.
- **Topic reviews** – sections of exam-style questions that test content from across the entirety of each topic more synoptically.

These topic questions are tagged with the following:

p64	page references for the accompanying Hodder Education Student Book: AQA GCSE 9–1 Physics, 9781471851377. This can be revisited before or after attempting the questions in a topic.
4.1.1.1	the AQA specification reference, which can be used if you want to practise specific areas.
H	indicates Higher-only content.
MS 3b	indicates where questions test Maths skills.
QWC	indicates where answers will also be marked on the quality of written communication.
WS 4.1	indicates where questions require you to work scientifically.
AT 1	indicates where questions ask you to use practical knowledge of apparatus and techniques.
RP 1	indicates where questions test understanding of required practicals.

At the end of the book there is a full set of **practice exam papers**. These have been carefully assembled to resemble typical AQA question papers in terms of coverage, marks and skills tested. We have also constructed each one to represent the typical range of demand in the GCSE Physics specification as closely as possible.

Full worked **answers** are included at the end of the book for quick reference, with awarded marks indicated where appropriate.

Equation sheet

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2as$
elastic potential energy = 0.5 × spring constant × (extension)^2	$E_e = \frac{1}{2} ke^2$
change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = mc\Delta\theta$
period = $\frac{1}{\text{frequency}}$	
magnification = $\frac{\text{image height}}{\text{object height}}$	
thermal energy for a change of state = mass × specific latent heat	$E = mL$
For gases: pressure × volume = constant	pV = constant

Higher-only equations

pressure due to a column of liquid = height of column × density of liquid × gravitational field strength (g)	$p = h\rho g$
force = $\frac{\text{change in momentum}}{\text{time taken}}$	$F = \frac{m\Delta v}{\Delta t}$
force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density × current × length	$F = BI\ell$
$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$	$\frac{V_p}{V_s} = \frac{n_p}{n_s}$
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$

1 Energy

Energy changes in a system

Quick questions

p2 4.1.1.1 WS4.1

1 What does the term ‘system’ mean in physics?

p3 4.1.1.1 WS4.1

2 Describe how to increase the energy in:

- the kinetic energy store of a car
- the thermal energy store of a potato.

p2 4.1.1.1

3 What are the energy changes in energy stores when a candle is used to heat a beaker of water?

p64 4.1.1.2 MS3b,3c WS4.1-4.3

4 Write down the correct SI unit for each of these quantities used in energy calculations.

mass	distance (or extension)	energy
speed (or velocity)	gravitational field strength	spring constant

p5 4.1.1.2 MS3b,3c

5 Write down the equation that can be used to find the amount of energy in a kinetic store.

p5 4.1.1.2 MS3b,3c

6 Calculate the kinetic energy for cars A and B shown in **Figure 1**.

Figure 1

p5 4.1.1.2 MS3b,3c

7 A large spring used in the suspension system of a lorry has a spring constant of 200 kN/m. Calculate the elastic potential energy stored in the spring when it is compressed by 4.0 cm.

p12 4.1.1.3 WS4.1

8 Some materials are more difficult to heat than others because they have higher specific heat capacities. Give the definition of specific heat capacity.

p12 4.1.1.3 MS3b,3c

9 A bottle of cold water is taken out of a refrigerator and is left in a warm room. The bottle contains 0.25 kg of water and warms from 5 °C to 20 °C. The specific heat capacity of water is 4200 J/kg °C.

Use the equation

change in thermal energy = mass × specific heat capacity × temperature change

to calculate the change in the thermal energy store of the bottle of water.

p10 | 4.1.1.4 | WS4.1
10 Define the term 'power' in terms of energy transferred.

p10 | 4.1.1.4 | MS3b,3c
11 The engine driving a fairground ride provides 42 kJ in one minute. What is the power rating of the engine?

p10 | 4.1.1.4 | MS3b,3c
12 A weightlifter can lift a weight of 1700 N to a height of 2.0 m by doing 3400 J of work in 2.2 s. Calculate the effective power of the weightlifter during the lift.

p10 | 4.1.1.4 | MS3b,3c
13 How much energy is transferred by an electric motor with a power rating of 250 W if it operates for one hour?

p10 | 4.1.1.4 | MS3b,3c
14 Calculate the time it will take for a heating element with a power rating of 75 W to transfer 3.6 kJ of energy.

Exam-style questions

15 A motorcycle and rider have a mass of 300 kg and are travelling at 4.0 m/s.

p5 | 4.1.1.2 | MS3b, 3c,3d
15–1 Calculate the kinetic energy stored by the motorcycle and rider. *[3]*

p5 | 4.1.1.2
15–2 What would happen to the amount of energy in the kinetic store if the speed of the motorcycle doubled? *[1]*

p2 | 4.1.1.1 | WS4.1
15–3 The motorcycle leaves a motorway and travels up a slope to a junction. The motorcycle slows down without braking.

Describe the energy changes that take place while the motorcycle is slowing down. *[2]*

Total: 6

16 The equation used to calculate the amount of energy stored in a stretched spring is:

elastic potential energy = 0.5 × spring constant × $(\text{extension})^2$

p5 | 4.1.1.2 | WS4.1
16–1 Define the 'extension of a spring'. *[1]*

p5 | 4.1.1.2
16–2 A spring with a high spring constant and a spring with a low spring constant are stretched by the same length.

Compare the amount of energy stored by the two springs. *[1]*

p5 | 4.1.1.2 | MS3a, 3c,3d
16–3 The spring used in a suspension system for a car has a spring constant of 5000 N/m and is compressed by 5.0 cm.

Calculate the energy stored in the spring. *[2]*

p2 | 4.1.1.1 | WS4.1
16–4 The spring is repeatedly compressed and stretched as the car travels.

Explain why the spring becomes hot. *[2]*

Total: 6

p6 | 4.1.1.2
17–1 Write the equation which can be used to calculate the amount of gravitational potential energy stored in a system. *[1]*

p6 | 4.1.1.2 | MS3a, 3c,3d
17–2 An astronaut in training climbs a ladder on a landing module while on Earth. The total mass of the astronaut and their suit is 120 kg. He climbs a vertical distance of 2.3 m.

The gravitational field strength near the Earth's surface is 9.8 N/kg.

Calculate the change in gravitational potential energy of the astronaut as he climbs the ladder. *[2]*

p6 | 4.1.1.2 | MS3a, 3c,3d

17–3 The gravitational field strength on the Moon is 1.6 N/kg. The astronaut again climbs the ladder to a vertical height of 2.3 m to get back into the landing module after exploring the Moon's surface.

Calculate the change in gravitational potential energy as the astronaut climbs the ladder. *[2]*

p7 | 4.1.1.2 | MS3b

17–4 The astronaut falls from the top of the ladder.

Compare the speed at which the astronaut will hit the ground on the Moon to the speed at which they would hit the ground on Earth. Show working to explain your answer. *[3]*

Total: 8

18 A toy rocket launcher uses a compressed spring to launch a small plastic rocket of mass 0.15 kg vertically.

The spring has a spring constant of 50 N/m and is compressed by 4.0 cm.

p2 | 4.1.1.1 | WS4.1

18–1 Describe the energy changes from when the rocket is launched until it reaches its maximum height. *[2]*

p6 | 4.1.1.2 | MS3a,3c

18–2 Calculate how much energy is stored elastically in the spring when it is fully compressed. *[2]*

p6 | 4.1.1.2

18–3 Write down the amount of energy stored kinetically by the rocket just after it has been launched. *[1]*

p6 | 4.1.1.2

18–4 Explain your answer to question 18–3. *[1]*

p6 | 4.1.1.2 | MS3a-d

18–5 Calculate the maximum speed at which the rocket will leave the launcher. *[4]*

p6 | 4.1.1.2 | MS3a-d

18–6 Calculate the maximum possible height the rocket can reach. *[3]*

Total: 13

19 A group of students tested the principle of conservation of energy by allowing toy cars to roll down a ramp, as shown in **Figure 2**. The mass of each car was 0.12 kg and the gravitational field strength was 9.8 N/kg.

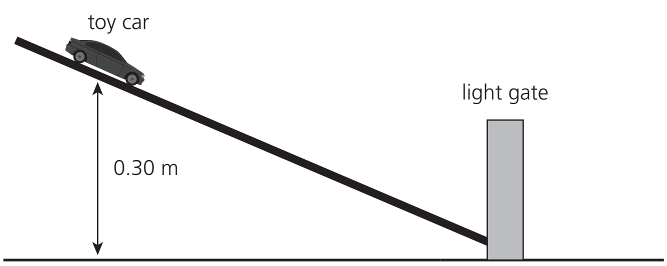

Figure 2

Each car was released from a vertical height of 0.30 m and rolled freely down the ramp until it passed through a light gate at the bottom of the ramp which measured its speed. The students repeated this several times and found that the average speed was 2.31 m/s.

p2 | 4.1.1.1

19–1 Describe the energy changes as the car travels down the ramp. *[2]*

p6 4.1.1.2 MS3a, 3b,3d **19–2** Calculate the gravitational potential energy of the car before it is released. *[2]*

p6 4.1.1.2 **19–3** State the maximum kinetic energy of the car as it passes through the light gate. *[1]*

p7 4.1.1.2 MS3a-d **19–4** Calculate the maximum speed at which the car can be travelling as it passes through the light gate. *[4]*

p7 4.1.1.2 MS3a-d **19–5** Suggest why the speed that the students measured was less than the speed you calculated in question 19–4. *[1]*

Total: 10

p12 4.1.1.3 **20** Some students are attempting to find the specific heat capacity of copper.

- The students warm a small copper block with a mass of 0.10 kg in a water bath until its temperature reaches 80 °C.
- They place the block into a well-insulated beaker containing 0.20 kg of water.
- The metal block cools down as it heats up the water.
- The students gently stir the water until the block and water reach the same temperature.
- The students measured the initial and final temperature of the water.

The initial temperature of the water was 25.0 °C.

The final temperature of water was 27.3 °C.

The specific heat capacity of water is 4200 J/kg °C.

change in thermal energy = mass × specific heat capacity × temperature change

MS3a, 3b,3d RP1 **20–1** Calculate the energy transferred to the water using the equation above. *[3]*

MS3a, 3c,3d **20–2** Calculate the decrease in temperature of the copper block. *[1]*

20–3 Write down the thermal energy change for the block of copper. *[1]*

MS3a-d **20–4** Calculate the specific heat capacity of copper. *[3]*

20–5 Explain why the beaker of water needed to be well insulated in the experiment. *[1]*

Total: 9

p10 4.1.1.4 **21** **Table 1** shows the results of an experiment to determine the power of some motors. The electric motors are used to lift different weights through different heights. The time taken to do this is recorded.

Motor	Weight lifted in N	Height lifted through in m	Time taken in s
A	45	3.0	21
B	35	2.7	14
C	104	1.4	32

Table 1

21–1 Identify which motor has done the most work during the experiment. *[1]*

21–2 Compare the power of each motor. State which was the most powerful motor. *[4]*

MS3a, 3c,3d **21–3** A fourth motor is tested. The motor has a power rating of 12 W.

Calculate the amount of work that this additional motor can do in 15 seconds. *[2]*

Total: 7

Conservation and dissipation of energy

Quick questions

p15 4.1.2.1 WS4.1 **1** What is the principle of conservation of energy?

p18 4.1.2.2 **2** Explain the difference between an efficient energy transfer and an inefficient energy transfer.

p19 4.1.2.2 **3** A microwave oven is used to heat a baked potato. The oven transfers 2.0 kJ of energy but the potato only gains 1.8 kJ.

How much energy is wasted? Explain where the wasted energy goes.

p18 4.1.2.2 **4** There are two equations which are used to calculate the efficiency of a system. The first is shown here. Write the other equation.

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$

p18 4.1.2.2 WS4.1 **5** Explain why it is not possible for the efficiency of a device to be greater than 1.

p19 4.1.2.2 MS3c,3d **6** Determine the efficiency of a lamp that has a power rating of 75 W but only produces 55 W of useful energy.

p20 4.1.2.1 WS1.4 **7** Describe how the efficiency of a mechanical motor can be improved.

p20 4.1.2.2 MS3b,3c **8** A bouncy ball of mass 54 g is dropped from a height of 1.00 m onto a hard surface. The ball bounces back up to a height of 0.93 m. Calculate the efficiency of the bounce.

p20 4.1.2.2 MS3b,3c **9** Use the efficiency relationships to complete **Table 2**.

Device	**Power input in W**	**Useful power output in W**	**Power wasted in W**	**Efficiency**
Loudspeaker	1.4	0.40		
LED light	4.0		1.0	
Fluorescent light	9.0		8.0	
Electric drill motor		1200		0.80

Table 2

Exam-style questions

10 The motor used in a lift is supplied with 25 kJ of energy. It does 22 kJ of useful work.

p19 4.1.2.2 MS3a, 3c,3d **10–1** Calculate the energy wasted by the motor. *[1]*

p19 4.1.2.2 MS3a, 3c,3d **10–2** Calculate the efficiency of the motor. *[2]*

p15 4.1.2.1 **10–3** Describe where the wasted energy goes. *[1]*

p15 4.1.2.1 **10–4** The two common ways of improving efficiency are lubrication and using thermal insulation. Suggest whether these methods would improve the efficiency of the lift motor. Explain your answer. *[4]*

Total: 7

11 A lamp is designed to produce infra-red radiation to heat a surface. The manufacturer states that the lamp has an efficiency of 0.94. It is provided with energy at a rate of 110 W.

p19 4.1.2.2 MS3a-d **11–1** Calculate the energy usefully transferred by the lamp per second. *[2]*

p15 4.1.2.1 **11–2** Suggest how energy might be wasted by this device. *[1]*

p18 4.1.2.2 MS4.1 **11–3** A student claims that the lamp might be considered to have an efficiency of 1.

Suggest why this claim might be considered to be true. *[2]*

p18 4.1.2.2 **11–4** Explain why the efficiency of the lamp cannot be greater than 1. *[1]*

Total: 6

p17 4.1.2.1 RP2 **12** A group of students conducted an experiment to test the effectiveness of a material as a thermal insulator. They investigated how effective different numbers of layers of expanded polystyrene sheets were at keeping water warm. The equipment they had available included a kettle, measuring cylinders, beakers, stopwatches, thermometers, elastic bands and thin sheets of expanded polystyrene.

AT1 QWC **12–1** Describe how the students could use this equipment to determine how the number of layers affects the effectiveness of the insulation provided. *[6]*

12–2 Name the independent variable in this experiment. *[1]*

12–3 Write down **two** other factors that the students should control to make this experiment a valid test. *[2]*

AT2 **12–4** Describe how the students could reduce energy losses due to evaporation in this experiment. *[1]*

12–5 **Table 3** shows the results of the students' experiment. Explain what the results show about the effectiveness of polystyrene layers. *[2]*

Time in s	No layers of polystyrene	One layer of polystyrene	Two layers of polystyrene	Three layers of polystyrene
	Temperature in °C			
0	90	90	90	90
60	83	84	86	86
120	77	79	81	82
180	72	74	76	77
240	68	71	73	74
300	65	70	72	73

Table 3

Total: 12

p17 | 4.1.2.1 | RP2

13 A group of students are testing which materials are the best insulators. They insulate a beaker containing 50 cm^3 of hot water using a single layer of a range of materials and measure the temperature change after 5 minutes. Each container has only one layer of insulating material.

The results are shown in **Table 4**.

	Temperature in °C			
	No insulation	**Cardboard**	**Polystyrene**	**Cotton wool**
Start	85	83	86	85
End	64	65	70	72

Table 4

MS3a, 3c,3d

13–1 Calculate the change in temperature for the four different containers. *[2]*

13–2 Name the material that was the best thermal insulator. *[1]*

13–3 Suggest **two** ways in which the students could improve the accuracy of the results. *[2]*

Total: 5

National and global energy reserves

Quick questions

p21 | 4.1.3 | WS4.1

1 Explain what is meant by a non-renewable energy resource. List as many examples of this type of resource as you can.

p22 | 4.1.3 | WS4.1

2 Explain what is meant by a renewable energy resource. List some examples.

p22 | 4.1.3

3 Is uranium a renewable or non-renewable resource?

p22 | 4.1.3

4 Explain why the waste produced in a nuclear power station is dangerous.

p24 | 4.1.3

5 Give **two** advantages and **two** disadvantages of using hydroelectric dams to generate electricity.

Exam-style questions

p21–2 | 4.1.3

6–1 Copy and complete **Table 5** to show some suggestions of how different non-renewable fuels are used as energy sources. *[3]*

Fuel	**Application**
	To power a motorcycle
	In a central heating system used to heat a house
Coal	

Table 5

WS4.1

Some energy resources are said to be reliable while others are unreliable.

6–2 Explain what 'reliable' means in this context. *[1]*

6–3 State an example of a reliable energy resource and explain why it is considered to be reliable. *[2]*

6–4 State an example of an unreliable energy resource and explain why it is considered to be unreliable. *[2]*

Total: 8

p22 4.1.3

7 The graph in **Figure 3** shows the energy demand in the UK over a period of one day. The lines show the typical demand for a day in winter and a day in summer.

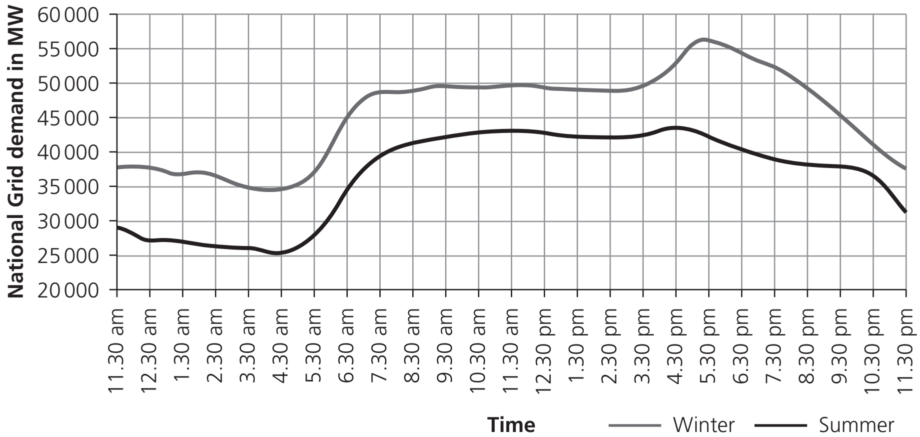

Figure 3

7–1 Explain why there is a difference between the demand during a day in summer and a day in winter. *[1]*

7–2 Suggest why the demand increases significantly between the hours of 5:30 am and 7:30 am. *[2]*

7–3 Suggest why there is a peak at around 5:30 pm. *[2]*

Total: 5

p21 4.1.3

8 Most cars use either petrol or diesel fuel which are extracted from crude oil. Some cars have been adapted to use biofuels which contain ethanol. This is produced by plant crops.

8–1 Explain why biofuels, such as ethanol, are sometimes described as 'carbon neutral'. *[2]*

8–2 Explain why the use of ethanol fuels has a smaller impact on climate change than using crude oil-based ones. *[2]*

WS1.4 **8–3** Some people are concerned that an increase in the use of ethanol-based fuels will have an impact on food security and may also increase deforestation.

Suggest how this could happen. *[3]*

Total: 7

p22 4.1.3

9 The use of electric cars to replace fuel-burning cars is expected to increase rapidly over the next decade.

WS4.1 **9–1** Describe how energy is stored in an electric car. *[1]*

9–2 Suggest how the use of electric cars may reduce pollution in cities. *[2]*

WS1.4 **9–3** Predict the effect that the increase in electric cars will have on the need for new power stations in the UK. Give a reason for your answer. *[2]*

Total: 5

4.1.3 p23 QWC **10** The government want to build a new nuclear power station on the coast of the UK. Explain why some local residents might object to the construction while others support it. In your explanation you should mention scientific, economic and social considerations. *[6]*

Total: 6

Energy topic review

p12&18 4.1.2 **1** A gas boiler is used to heat 50 kg of water from 25 °C to 34 °C. It transfers 2.5 MJ of energy when burning the gas. The specific heat capacity of water is 4200 J/kg °C.

MS3a, 3c,3d **1–1** Calculate the increase in the thermal energy store of the water. *[3]*

1–2 Calculate the efficiency of the gas boiler. *[2]*

1–3 Describe what happens to the energy that is not used to heat the water. *[1]*

Total: 6

p5&18 4.1.1.2 MS3a, 3c,3d **2** A model electric scooter of mass 42 kg accelerates from rest to a speed of 3.0 m/s in 4.5 s. The scooter is powered by a single electric motor with a power rating of 75 W.

2–1 Calculate the increase in the kinetic energy store of the scooter. *[3]*

2–2 Calculate the energy transferred by the motor during the 4.5 s. *[2]*

2–3 Calculate the efficiency of the electric motor. *[2]*

Total: 7

3 An experimental micro drone of mass 0.25 kg lifts off from the floor and reaches a height of 0.40 m. While doing this, the electric motor transfers 4.4 J of energy to the motor from the battery. Assume g = 9.8 m/s.

p6 4.1.1.2 MS3a, 3c,3d **3–1** Calculate the gain in gravitational potential energy of the micro drone. *[3]*

p18 4.1.2.2 MS3a, 3c,3d **3–2** Calculate the efficiency of the motor. *[2]*

p2 4.1.1.1 **3–3** The motor fails and the drone falls back to the ground. Describe the energy transfers which take place during the fall. *[2]*

p6 4.1.1.2 **3–4** Write down the change in kinetic energy as the drone falls. *[1]*

p7 4.1.1.2 MS3a-d **3–5** Calculate the speed at which the drone hits the floor. *[4]*

Total: 12

			4	The remote island of Caprona uses various sources of renewable energy to produce electricity. During periods of low electricity demand, an electric pump in a hydroelectric storage system lifts 1000 kg of water through a vertical height of 50 m each second. To do this, the pump operates with a power of 600 kW.	
p6	4.1.1.2	MS3a, 3c,3d	4–1	Calculate the gain in gravitational potential energy per second of the water. Assume g = 9.8 m/s.	*[2]*
p18	4.1.2.2	MS3a, 3c,3d	4–2	Calculate the efficiency of the energy transfer.	*[2]*
p15	4.1.2.2		4–3	Describe what has happened to the energy wasted by the motor.	*[2]*
p6	4.1.1.2	MS3a, 3c,3d	4–4	When there is a high demand for electricity the water is released and passed through a set of turbines. The water falls through a vertical height of 50 m and passes through the turbines at a rate of 5000 kg/s.	
				Calculate the maximum theoretical power output from the turbines.	*[2]*
p18	4.1.2.2	MS3a-d	4–5	The actual efficiency of the turbines and generators is 0.75.	
				Calculate the energy output per second from the system.	*[2]*
					Total: 10
			5	A spring in a pinball machine is used to launch a ball of mass 80 g. The spring has a spring constant of 100 N/m and is compressed by 8.0 cm before launching the ball.	
				Specific heat capacity of the ball = 460 J/kg °C.	
p5	4.1.1.2	MS3a, 3c,3d	5–1	Calculate the elastic potential energy stored in the spring.	*[2]*
p5	4.1.1.2		5–2	When the spring is released the ball is accelerated into the pinball machine.	
				State the maximum kinetic energy of the ball when it is launched.	*[1]*
p7	4.1.1.2	MS3a-d	5–3	Calculate the maximum speed of the ball as it is launched.	*[3]*
p12	4.1.1.3		5–4	During the game, the ball is hit by flippers and its temperature increases. The thermal energy stored by the ball increases by 94 J.	
				Explain why the temperature of the ball increases.	*[1]*
p12	4.1.1.3	MS3a-d	5–5	Calculate the increase in temperature of the ball.	*[3]*
					Total: 10
			6	The villagers of a remote Scottish island want to build wind turbines to generate their electricity. The economy of the island depends on tourism and its apple crop.	
p24	4.1.3	WS4.1 QWC	6–1	Discuss the advantages and disadvantages of using wind turbines in a remote location.	*[6]*
p18	4.1.2.2	MS3a, 3c,3d	6–2	A small scale model of a wind turbine is constructed to test its efficiency. The model produces an electricity output of 0.50 kW when the measured kinetic energy of the wind driving it is 6.00 kW.	
				Calculate the efficiency of the model wind turbine.	*[2]*
					Total: 8

Practice exam papers

Paper 1

1 **Figure 1** shows a crane powered by a petrol engine being used to lift a pallet of bricks to the top of a building.

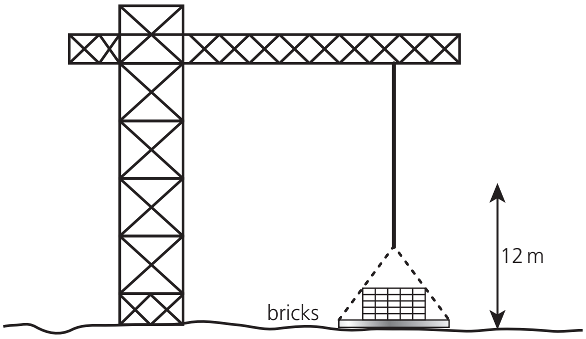

Figure 1

1–1 Copy and complete the sentence describing the energy changes which take place as the crane lifts the bricks. Choose your answers from the options below. *[3 marks]*

thermal	chemical	elastic potential	kinetic	gravitational potential

As the __________ energy stored in the petrol decreases and the __________ energy store of the bricks increases, the temperature of the engine increases and so its __________ energy store increases.

1–2 The mass of the bricks is 2500 kg and they are lifted through a height of 12 m.

Calculate the increase in gravitational potential energy (g.p.e.) for the bricks.

Include the correct unit for energy.

Gravitational field strength = 9.8 N/kg. *[2 marks]*

1–3 When the engine is operating, its temperature increases until it reaches a maximum, even though it is still burning petrol.

Explain why the temperature of the engine stops increasing. Answer in terms of energy transfer. *[2 marks]*

Total: 7

2 A variable resistor is used to control the current through a lamp in a simple electric circuit. The variable resistor is connected in series with the lamp, a 6.0 V battery and a switch as shown in **Figure 2**. The symbol for the variable resistor has been left off the diagram.

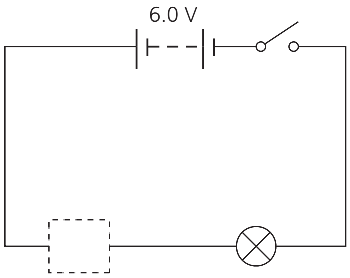

Figure 2

The resistance of the variable resistor is set to 4.5 Ω and a current of 0.5 A passes through it.

2–1 Draw the symbol for a variable resistor. *[1 mark]*

2–2 Give the size of the current through the lamp. *[1 mark]*

2–3 Calculate the total resistance of the circuit. *[2 marks]*

2–4 Calculate the resistance of the lamp. *[1 mark]*

2–5 Calculate the potential difference across the variable resistor. *[1 mark]*

2–6 The resistance of the variable resistor is gradually decreased.

What happens to the size of the current through the lamp? Choose your answer from the options below. Give a reason for your answer. *[3 marks]*

It increases	It decreases	It does not change

Total: 9