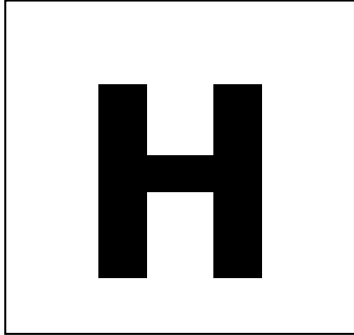




**ST MARY'S SCIENCE
DEPARTMENT:
PHYSICS**



**GCSE PHYSICS HOMEWORK BOOK
TOPIC 4: ATOMIC STRUCTURE
PART 1: ATOMIC RADIATION
STUDENT BOOK**

YOU MUST ANSWER ALL THREE SECTIONS IN EACH PART OF THE HOMEWORK TASKS

NAME	
CLASS	
TEACHER	
FORM	

TASK	MARK	GRADE
1		
2		
3		
4		
OVERALL		

**GCSE
PHYSICS
YEAR 10
TOPIC 2**



HOMEWORK SCHEDULE

Please use the following table to ensure each homework task is completed and submitted on time.

Carrying out these homework tasks can only increase your ability to gain a high grade in the GCSE examinations.

Failure to hand in work on time will lead to sanctions to complete this work.

Task	Submission Date	Completed?	On Time?
Task 1 Atomic Structure			
Task 2 Model of the Atom			
Task 3 Nuclear Decay			
Task 4 Nuclear Equations			



PHYSICS DEPARTMENT MARKING CODE

ID = Insufficient detail in answer

W = Wrong understanding of physics

IR = Irrelevant information given.

V = This is too vague to get a mark.

AQ = Answer the question asked

R = Read the question/information

M = Maths mistake

BOD = Benefit of the doubt given.

E = Explain the answer further please.

U = Wrong units used.

SF = Wrong significant figures used.

SP = Wrong spelling of a technical term

SR = Same reason given twice.

A circle means this lost you marks

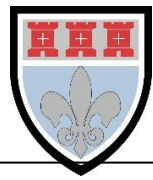
An underline means this gained you marks

IMPORTANT NOTE

All sections in each task must be **FULLY ATTEMPTED**.

If students fail to achieve an acceptable mark on each task, they will be made to carry out supervised intervention the following week.

Each week, intervention sessions will be provided to help assist with answering the questions in the homework booklet if students are struggling with the difficulty of the problems.



PLEASE READ

This homework booklet has made with custom selected examination questions and activities to assess your understanding in the concepts covered in class. This will increase your familiarity with the style of examination questions.

Carrying out these questions can only increase your ability to gain a high grade in the GCSE examination.

Thank you for your hard work in completing this book, and good luck.

Mr. Turnbull



TASK 1: ATOMIC STRUCTURE

SPEC CHECK

Content	Achieved?
Atoms are very small, having a radius of about 1×10^{-10} metres.	
The basic structure of an atom is a positively charged nucleus composed of both protons and neutrons surrounded by negatively charged electrons.	
The radius of a nucleus is less than 1/10 000 of the radius of an atom.	
Most of the mass of an atom is concentrated in the nucleus.	
The electrons are arranged at different distances from the nucleus (different energy levels). The electron arrangements may change with the absorption of electromagnetic radiation (move further from the nucleus; a higher energy level) or by the emission of electromagnetic radiation (move closer to the nucleus; a lower energy level).	
In an atom, the number of electrons is equal to the number of protons in the nucleus. Atoms have no overall electrical charge. All atoms of an element have the same number of protons.	
The number of protons in an atom of an element is called its atomic number. The total number of protons and neutrons in an atom is called its mass number.	
Atoms can be represented as shown in this example: (Mass number) 23 (Atomic number) 11 Na	
Atoms of the same element can have different numbers of neutrons; these atoms are called isotopes of that element. Students should be able to relate differences between isotopes to differences in conventional representations of their identities, charges and masses.	
Atoms turn into positive ions if they lose one or more outer electron(s).	



Target Setting

In this assessed piece of work, what target should I look to achieve in completing this task?
Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

What Topics Do I Know Well?

What Topics Do I Need to Revise?

**SECTION A****Electricity Revision**

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

Q1. Figure 8 shows an electric lawnmower.

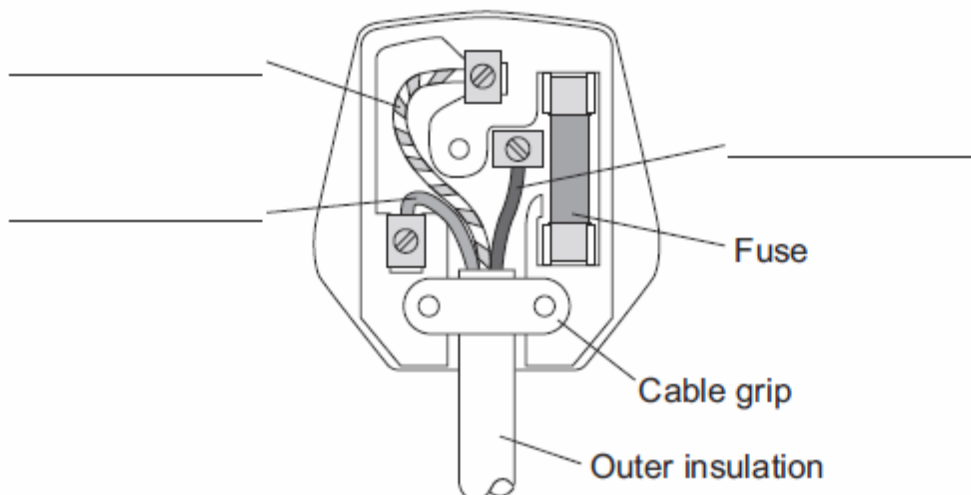
Figure 8



A three-pin plug connects the electric lawnmower to the mains.

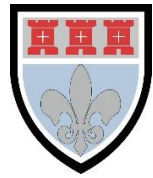
Figure 9 shows a three-pin plug.

Figure 9



Q1.1 Complete **Figure 9** by adding the names of the wires.

[2 marks]



Q1.2 The lawnmower must be earthed because it is not double insulated.

What does double insulated mean?

[1 mark]

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Q1.3 The fuse protects the wiring in the lawnmower circuit.

Describe how a fuse protects the wiring in a circuit.

[3 marks]

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Q1.4 The lawnmower is plugged into a mains circuit. The mains circuit contains a Residual Current Circuit Breaker (RCCB).

Give one reason why an RCCB gives better protection than a fuse.

[1 mark]

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Q1.5 A householder uses an electric lawnmower to cut the grass.

The lawnmower has a power of 1500 W.

It takes 20 minutes to cut the grass.

Calculate the energy transferred, in kWh, by the lawnmower.

[4 marks]

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Energy Transferred = _____ kWh

Q1.6 The householder buys a new lawnmower.

The new lawnmower transfers 0.25 kWh of energy each time the grass is cut.

The householder cuts the grass 40 times per year.

Calculate the cost of the electricity used to cut the grass in one year.

1 kilowatt-hour of electricity costs 12 p.

[3 marks]

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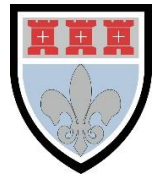
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Cost = _____ p



SECTION B

This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

Q1. Bananas contain a radioactive isotope of potassium (K).

Q1.1 There are different isotopes of the element potassium.

What is meant by isotopes of an element?

[2 marks]

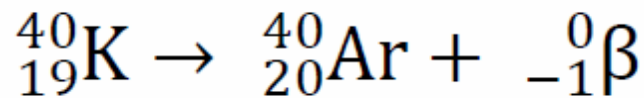
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Q1.2 An isotope of potassium decays into argon (Ar) by emitting a beta particle (β).



Compare the numbers of protons and neutrons in the argon nucleus to those in the potassium nucleus.

[2 marks]

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Q1.3 A student investigated the radiation emitted by a banana.

The student used the following method:

- Measure the count in one minute without the banana.
- Measure the count in one minute with the banana present.
- Repeat the measurements several times.

Table 2 shows the student's results.

Table 2

Count in one minute without the banana	Count in one minute with the banana
21	23
20	21
21	21
18	22
19	18
20	24

Evaluate whether it is safe to eat a banana.

Use information from **Table 2**. Include a calculation in your answer.

[3 marks]

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Q1.4 Explain **one** improvement to the student's method.

[4 marks]

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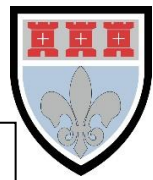
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SECTION C

This will contain questions on content found later in the course

This is a challenge question to extend your understanding.

You should aim to spend **10 minutes** answering this section.

Q1. Different radioactive isotopes have different values of half-life.

Q1.1 What is meant by the 'half-life' of a radioactive isotope?

[1 mark]

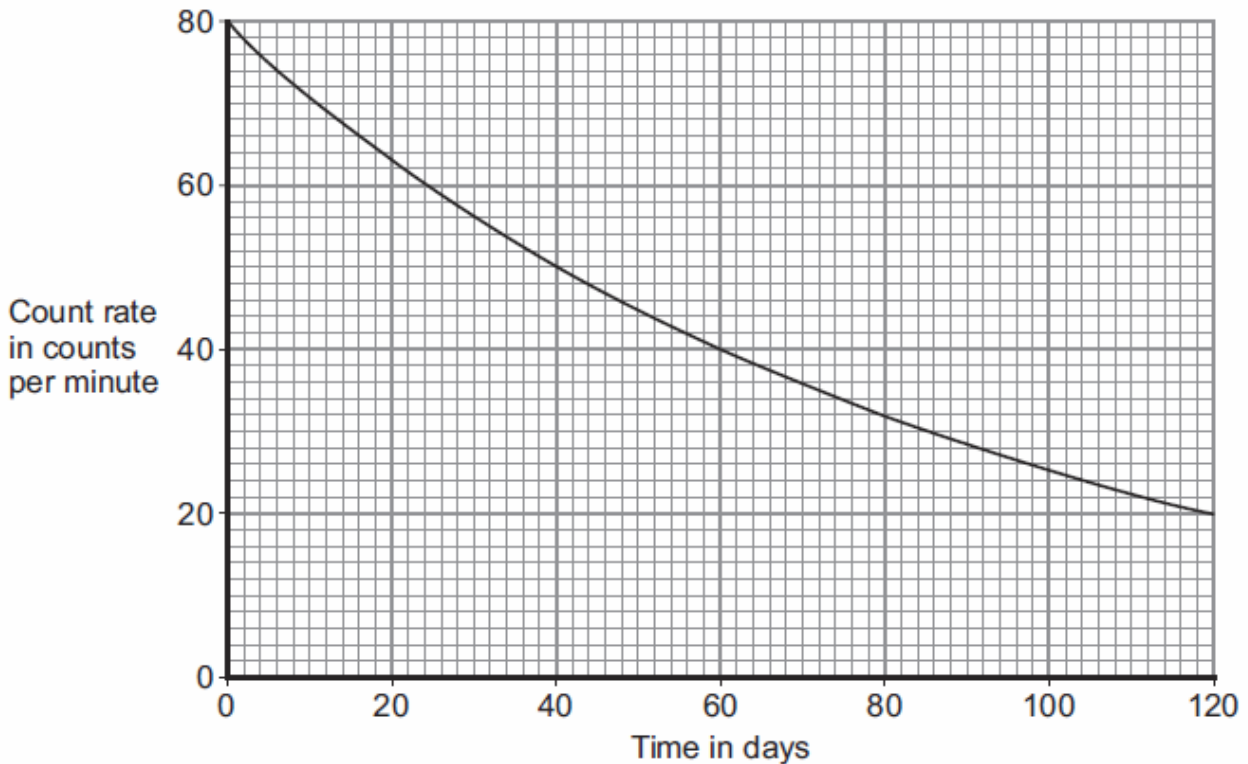
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Q1.2 **Figure 10** shows how the count rate from a sample of a radioactive isotope varies with time.

Figure 10



Use information from **Figure 10** to calculate the half-life of the radioactive isotope.

Show clearly on **Figure 10** how you obtain your answer.

[2 marks]

Half-life = Days

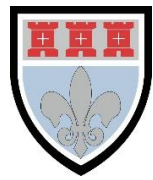


Table 3 shows data for some radioactive isotopes that are used in schools.

Table 3

Radioactive isotope	Type of radiation emitted	Half-life in years
Americium-241	Alpha and gamma	460
Cobalt-60	Gamma	5
Radium-226	Alpha, beta and gamma	1600
Strontium-90	Beta	28
Thorium-232	Alpha and beta	1.4×10^{10}

Q1.3 State which radioactive isotope in **Table 3** emits only radiation that is not deflected by a magnetic field.

Give a reason for your choice.

[2 marks]

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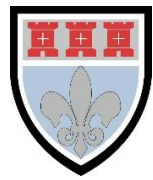
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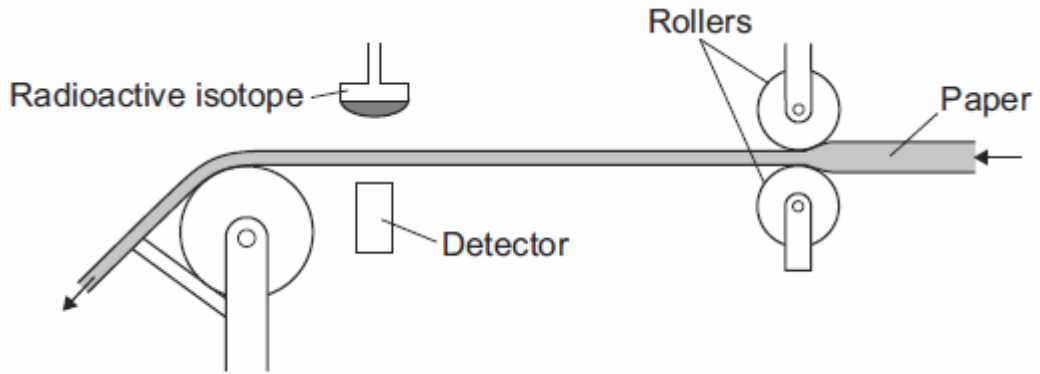
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Q1.4 Figure 11 shows a radioactive isotope being used to monitor the thickness of paper during production.

Figure 11



State which radioactive isotope in **Table 3** should be used to monitor the thickness of the paper.

Explain your choice.

[3 marks]

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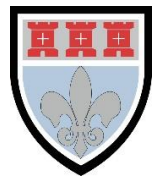
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Q1.5 All the radioactive isotopes in **Table 3** have practical uses.

State which source in **Table 3** would need replacing most often.

Explain your choice.

[3 marks]

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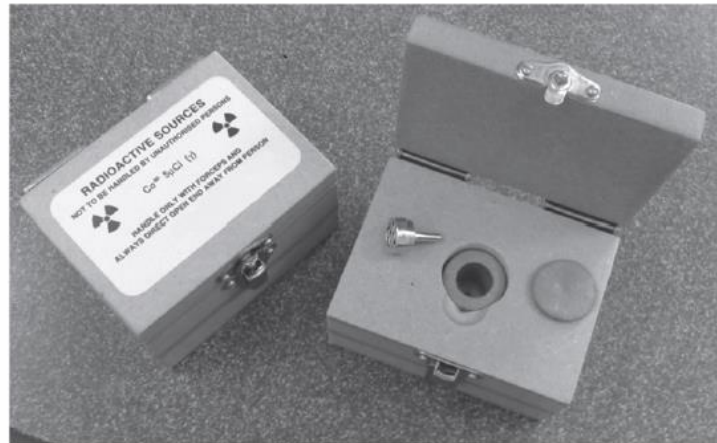
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Q1.6 When the radioactive isotopes are not in use, they are stored in lead-lined wooden boxes.

The boxes reduce the level of radiation that reaches the surroundings.

Figure 12 shows two of these boxes.

Figure 12



State one source from **Table 3** which emits radiation that could penetrate the box.

Explain your answer.

[3 marks]

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FEEDBACK SHEET

Overall Mark:	/39	GRADE ACHIEVED: 9 <input type="checkbox"/> 5 <input type="checkbox"/> 8 <input type="checkbox"/> 4 <input type="checkbox"/> 7 <input type="checkbox"/> 3 <input type="checkbox"/> 6 <input type="checkbox"/> U <input type="checkbox"/>
Section A:	/14	
Section B:	/11	
Section C:	/14	

Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding
Strengths:	<input type="checkbox"/> Basic Knowledge of Concepts <input type="checkbox"/> Quality of Written Communication <input type="checkbox"/> Working Scientifically <input type="checkbox"/> Answering Examination Questions <input type="checkbox"/> Analytical Skills Others (Topic Specific)		<input type="checkbox"/> Applications of Concepts <input type="checkbox"/> Mathematical Skills <input type="checkbox"/> Experimental Technique <input type="checkbox"/> Previous Topics <input type="checkbox"/> Problem Solving	
Areas to Improve:	<input type="checkbox"/> Basic Knowledge of Concepts <input type="checkbox"/> Quality of Written Communication <input type="checkbox"/> Working Scientifically <input type="checkbox"/> Answering Examination Questions <input type="checkbox"/> Analytical Skills Others (Topic Specific)		<input type="checkbox"/> Applications of Concepts <input type="checkbox"/> Mathematical Skills <input type="checkbox"/> Experimental Technique <input type="checkbox"/> Previous Topics <input type="checkbox"/> Problem Solving	
Progress:	Unsatisfactory	Satisfactory	Good	Outstanding
Working:	Below	In line with	Above	(your target)
Effort:	Poor	Inconsistent	Good	Excellent

To improve further you need to:

<ul style="list-style-type: none"> <input type="checkbox"/> Carry out independent revision. <input type="checkbox"/> Complete outstanding work. <input type="checkbox"/> Make corrections as indicated by the teacher. <input type="checkbox"/> Attend intervention for this topic <input type="checkbox"/> Include more information in responses. <input type="checkbox"/> Include more key words in responses. <input type="checkbox"/> Attend departmental revision sessions. <input type="checkbox"/> Read the questions carefully. <input type="checkbox"/> Explain your answers in more detail. <input type="checkbox"/> Carry out revision on Seneca Learning. 	<ul style="list-style-type: none"> <input type="checkbox"/> Revise the equations. <input type="checkbox"/> Check the units on answers. <input type="checkbox"/> Check the correct amount of sig figs on answers. <input type="checkbox"/> Check to convert values correctly. <input type="checkbox"/> Show your full working out. <input type="checkbox"/> Check your calculations. <input type="checkbox"/> Revise the science investigative skills. <input type="checkbox"/> Revise the key concepts of the topics. <input type="checkbox"/> Thoroughly check your work for mistakes. <p>Other:</p>
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TASK 2: MODELS OF THE ATOM

SPEC CHECK

Content	Achieved?
New experimental evidence may lead to a scientific model being changed or replaced.	
Before the discovery of the electron, atoms were thought to be tiny spheres that could not be divided.	
The discovery of the electron led to the plum pudding model of the atom. The plum pudding model suggested that the atom is a ball of positive charge with negative electrons embedded in it.	
The results from the alpha particle scattering experiment led to the conclusion that the mass of an atom was concentrated at the centre (nucleus) and that the nucleus was charged. This nuclear model replaced the plum pudding model.	
Niels Bohr adapted the nuclear model by suggesting that electrons orbit the nucleus at specific distances. The theoretical calculations of Bohr agreed with experimental observations.	
Later experiments led to the idea that the positive charge of any nucleus could be subdivided into a whole number of smaller particles, each particle having the same amount of positive charge. The name proton was given to these particles.	
The experimental work of James Chadwick provided the evidence to show the existence of neutrons within the nucleus. This was about 20 years after the nucleus became an accepted scientific idea.	

**SECTION A****Electricity Revision**

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

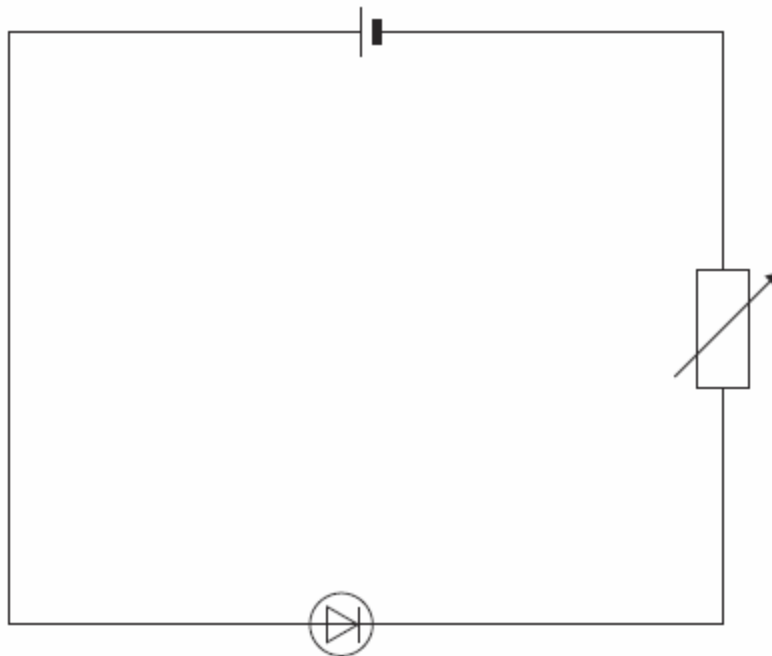
Q1. Diodes and thermistors are electrical components.

A student investigated how the current in a diode varies with the potential difference across it.

Q1.1 Figure 10 shows part of the circuit the student used.

The diagram is not complete.

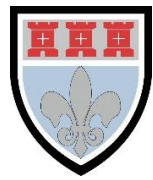
Figure 10



Add an ammeter and a voltmeter to the student's circuit in **Figure 10**.

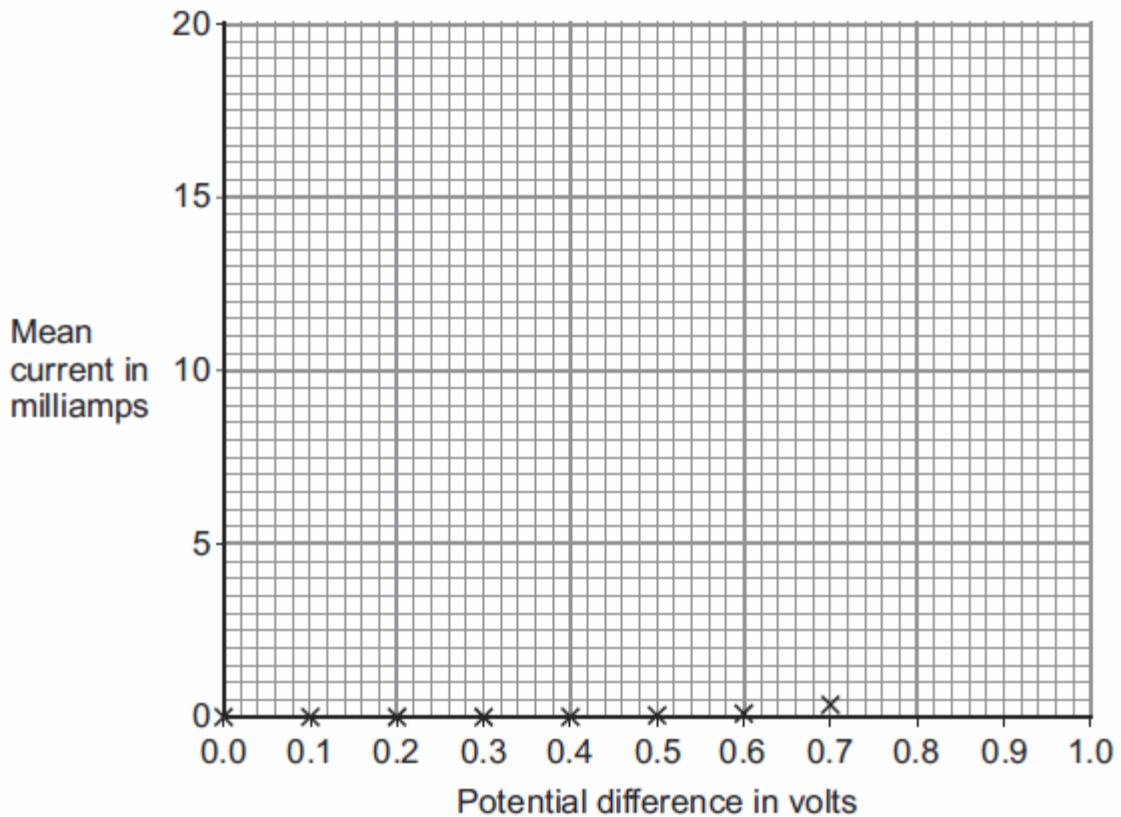
Use the correct circuit symbols.

[2 marks]



Q1.2 The student plotted his results on **Figure 11**.

Figure 11



The student did not plot all of his results.

The rest of his results are given in **Table 3**.

Table 3

Potential difference in volts	Mean current in milliamps
0.80	2.1
0.90	6.7
1.00	20.0

Use the data in **Table 3** to complete the graph.

Draw a line of best fit.

[3 marks]



A light-emitting diode (LED) produces visible light when there is a current through it.

Q1.3 What is the advantage of using LED lights compared with other forms of lighting?

Tick **one** box.

[1 mark]

	Tick (✓)
LED lights have a much lower efficiency.	
LED lights use a much lower current.	
LED lights will only allow current in one direction.	

Q1.4 The 'threshold potential difference' of an LED is the lowest potential difference at which it starts to emit light.

Table 4 shows data for different LEDs.

Table 4

Colour of light emitted by LED	Wavelength of light emitted in nanometres	Threshold potential difference in volts
Red	655	1.58
Orange	615	1.68
Yellow	560	1.82
Green	505	2.07
Blue	430	2.45



It is suggested that the wavelength of light emitted is inversely proportional to the threshold potential difference.

Is this suggestion correct? Use data from **Table 4** to support your answer.

To get full marks you must include calculations in your answer.

[3 marks]

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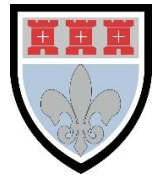
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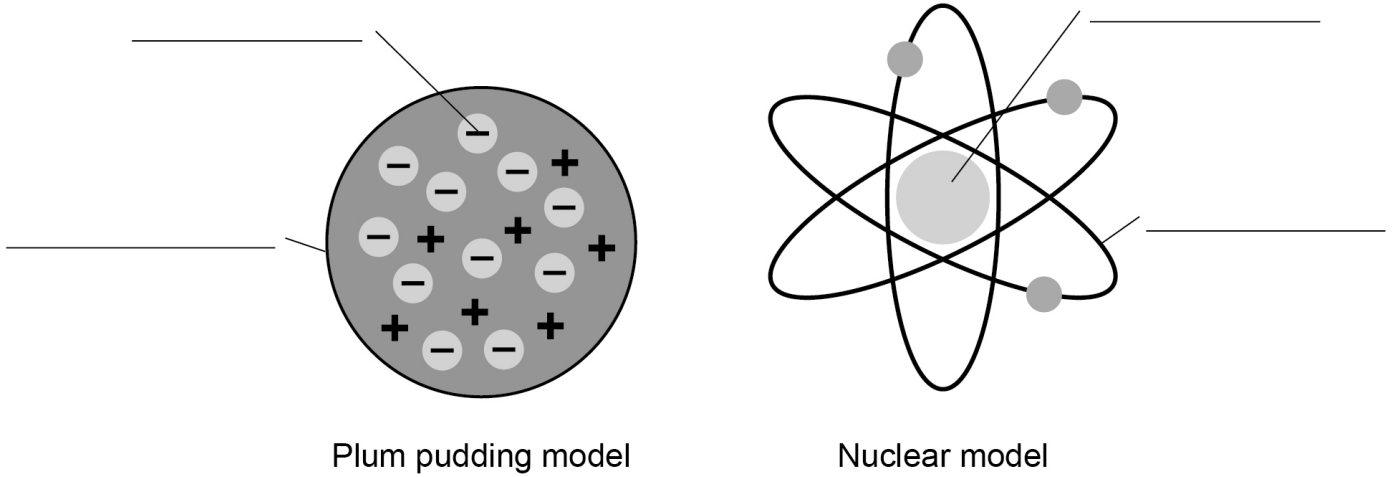
SECTION B

This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

Q1. Figure 1 shows two models of the atom.

Figure 1



Q1.1 Write the labels on **Figure 1**

Choose the answers from the box.

[4 marks]

atom	electron	nucleus
neutron	orbit	proton

Q1.2 Explain why the total positive charge in every atom of an element is always the same.

[2 marks]

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Q1.3 The results from the alpha particle scattering experiment led to the nuclear model.

Alpha particles were fired at a thin film of gold at a speed of 7% of the speed of light.

Determine the speed of the alpha particles.

Speed of light = 300 000 000 m/s

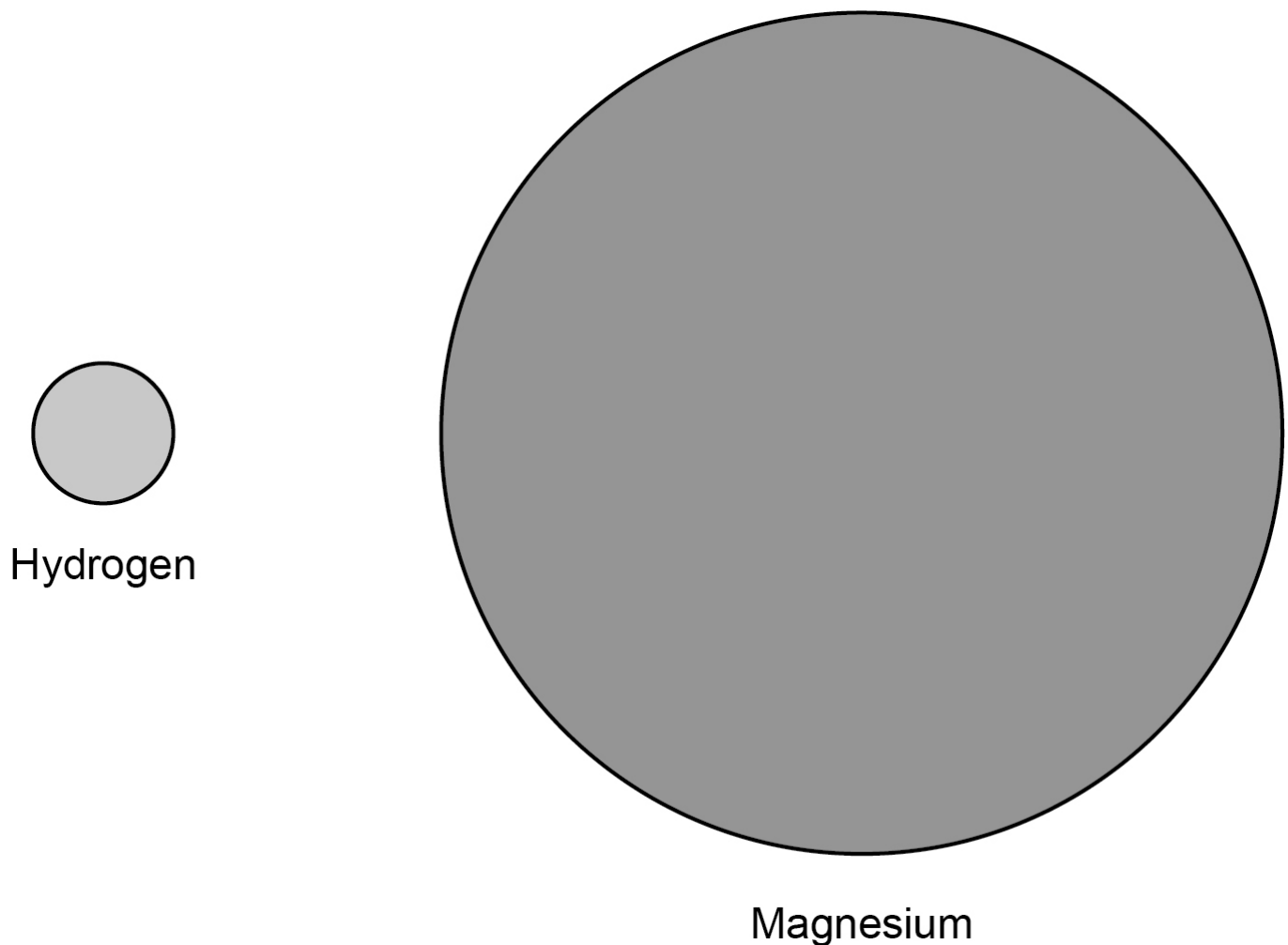
[2 marks]

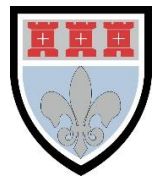
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Speed = m/s

Q1.4 **Figure 2** shows two atoms represented as solid spheres.

Figure 2





A hydrogen atom has a radius of 2.5×10^{-11} m

Determine the radius of a magnesium atom.

Use measurements from **Figure 2**

[2 marks]

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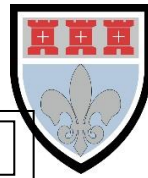
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Radius = m



SECTION C

This will contain questions on content found later in the course

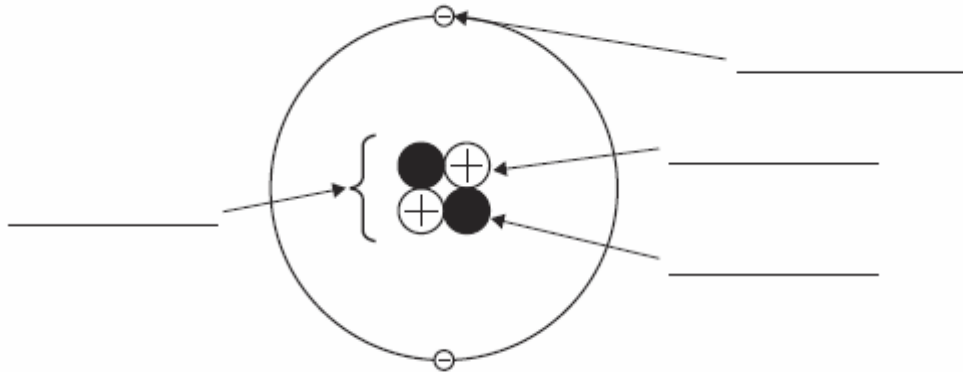
This is a challenge question to extend your understanding.

You should aim to spend **10 minutes** answering this section.

Q1. Atoms contain three types of particle.

Figure 8 shows the structure of an atom.

Figure 8



Q1.1 Use the correct words from the box to complete the labelling on **Figure 8**.

[4 marks]

electron	ion	isotope	neutron	nucleus	proton
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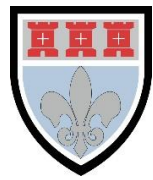
The process of nuclear fission is used in a nuclear reactor.

Q1.2 What happens in the process of nuclear fission?

[1 mark]

Tick one box.

	Tick (✓)
Two nuclei join together.	
A nucleus splits to form two smaller ones.	
Protons are emitted from the nucleus.	
A high-speed electron is emitted.	



Q1.3 Give the name of an isotope commonly used in nuclear fission reactors.

[1 mark]

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Radioactive isotopes have many uses.

Table 2 gives information about four radioactive isotopes.

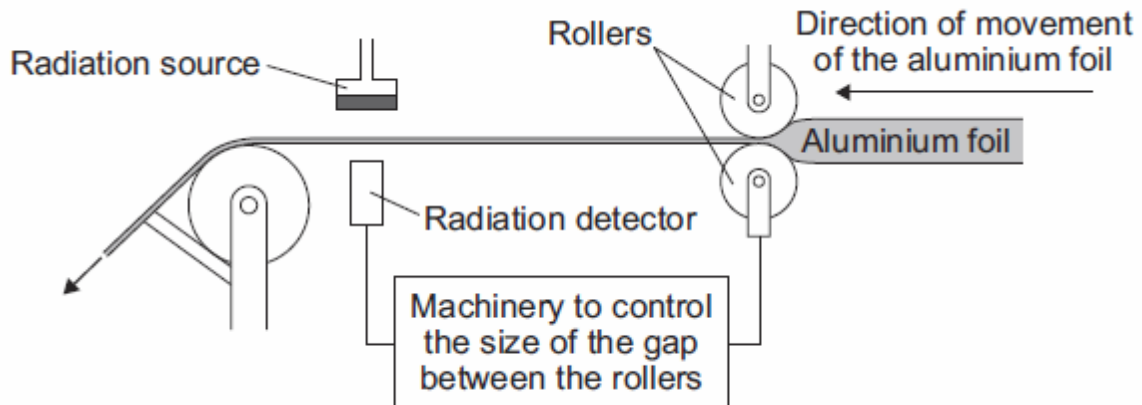
Table 2

Isotope	Type of radiation emitted	Half-life
Cobalt-60	gamma	5 years
Strontium-90	beta	29 years
Technetium-99	gamma	6 hours
Copper-66	beta	5 minutes

Some isotopes are used in industry.

Figure 9 shows how aluminium foil is made.

Figure 9



Machinery adjusts the spacing of the rollers depending on the amount of radiation detected.

Q1.4 State which isotope listed in **Table 2** would be the best to use for monitoring the thickness of the aluminium foil.

Give reasons for your answer.

[3 marks]

Isotope _____

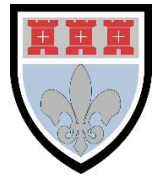
Reasons

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Q1.5 Some isotopes are used for medical imaging.

The radioactive isotope is injected into the patient and then the radiation emitted by the isotope is detected.

Suggest which isotope from **Table 2** would be the best to use for this purpose.

Give reasons for your answer.

[3 marks]

Isotope _____

Reasons

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Q1.6 The use of radioactive isotopes for medical imaging involves a risk to the patient.

State the main risk associated with the use of radioactive isotopes.

Suggest why radioactive isotopes are used for medical imaging despite this risk.

[2 marks]

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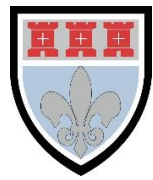
FEEDBACK SHEET

Overall Mark:	/39	GRADE ACHIEVED: 9 <input type="checkbox"/> 5 <input type="checkbox"/> 8 <input type="checkbox"/> 4 <input type="checkbox"/> 7 <input type="checkbox"/> 3 <input type="checkbox"/> 6 <input type="checkbox"/> U <input type="checkbox"/>
Section A:	/15	
Section B:	/10	
Section C:	/14	

Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding
Strengths: <input type="checkbox"/> Basic Knowledge of Concepts <input type="checkbox"/> Quality of Written Communication <input type="checkbox"/> Working Scientifically <input type="checkbox"/> Answering Examination Questions <input type="checkbox"/> Analytical Skills Others (Topic Specific)	<input type="checkbox"/> Applications of Concepts <input type="checkbox"/> Mathematical Skills <input type="checkbox"/> Experimental Technique <input type="checkbox"/> Previous Topics <input type="checkbox"/> Problem Solving			
Weaknesses: <input type="checkbox"/> Basic Knowledge of Concepts <input type="checkbox"/> Quality of Written Communication <input type="checkbox"/> Working Scientifically <input type="checkbox"/> Answering Examination Questions <input type="checkbox"/> Analytical Skills Others (Topic Specific)	<input type="checkbox"/> Applications of Concepts <input type="checkbox"/> Mathematical Skills <input type="checkbox"/> Experimental Technique <input type="checkbox"/> Previous Topics <input type="checkbox"/> Problem Solving			
Progress:	Unsatisfactory	Satisfactory	Good	Outstanding
Working:	Below	In line with	Above	(your target)
Effort:	Poor	Inconsistent	Good	Excellent

To improve further you need to:

<input type="checkbox"/> Carry out independent revision. <input type="checkbox"/> Complete outstanding work. <input type="checkbox"/> Make corrections as indicated by the teacher. <input type="checkbox"/> Attend intervention for this topic <input type="checkbox"/> Include more information in responses. <input type="checkbox"/> Include more key words in responses. <input type="checkbox"/> Attend departmental revision sessions. <input type="checkbox"/> Read the questions carefully. <input type="checkbox"/> Explain your answers in more detail. <input type="checkbox"/> Carry out revision on Seneca Learning.	<input type="checkbox"/> Revise the equations. <input type="checkbox"/> Check the units on answers. <input type="checkbox"/> Check the correct amount of sig figs on answers. <input type="checkbox"/> Check to convert values correctly. <input type="checkbox"/> Show your full working out. <input type="checkbox"/> Check your calculations. <input type="checkbox"/> Revise the science investigative skills. <input type="checkbox"/> Revise the key concepts of the topics. <input type="checkbox"/> Thoroughly check your work for mistakes. Other:
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**SECTION A****Particle Model of Matter Revision**

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

Q1. A teacher carried out an experiment to determine the specific latent heat of vaporisation of water.

Q1.1 State what is meant by 'specific latent heat of vaporisation of water'.

[2 marks]

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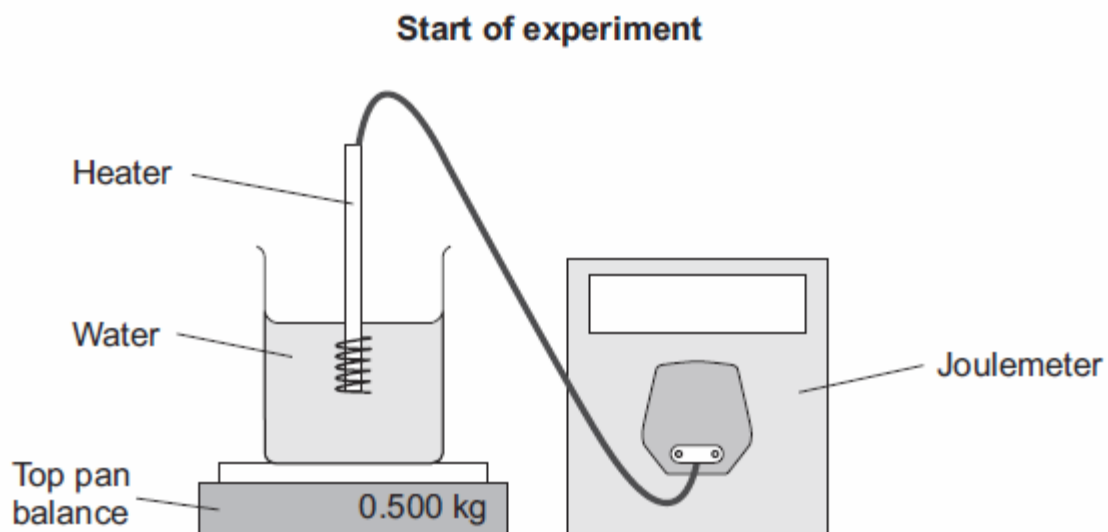
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Figure 7 shows the apparatus the teacher used.

Figure 7



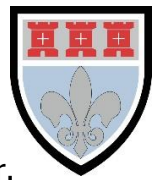
The teacher heated the water until it reached boiling point.

When the water began to boil, the teacher started a stopwatch and switched on the joulemeter.

After 2 minutes:

The reading on the joulemeter was 240 000 J

The reading on the top pan balance was 0.425 kg.



Q1.2 Use these readings to calculate the specific latent heat of vaporisation of water.

Tick **one** box to show the correct unit.

[4 marks]

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Specific Latent Heat of Vaporisation = _____

Unit	Tick (✓)
kJ	
J/(kg °C)	
J/kg	

Q1.3 Not all of the energy supplied to the heater changed the state of the water.

Suggest what happened to the rest of the energy.

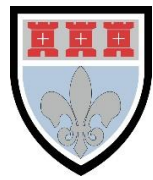
[2 marks]

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Q1.4 After the heater was switched off, the water started to cool.

Describe the processes by which the water cooled.

[4 marks]

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SECTION B

This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

Q1. Atoms are very small and most of their mass is concentrated in the nucleus.

Electrons orbit at different distances from the nucleus.

Q1.1 A nucleus is much smaller than an atom.

Approximately, how many times smaller is a nucleus than an atom?

[1 mark]

Tick **one** box.

- 100
- 1000
- 10 000
- 100 000

The electrons in an atom can only orbit at specific distances from the nucleus.

Q1.2 State what causes an electron's distance from the nucleus to increase or decrease.

[2 marks]

Increase

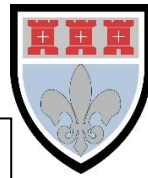
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Decrease

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SECTION C

This will contain questions on content found later in the course

This is a challenge question to extend your understanding.

You should aim to spend **10 minutes** answering this section.

Q1. The arrangement of electrons in atoms can change.

Q1.1 Describe what might happen to make an electron move from a lower energy level to a higher energy level in a neon atom.

[1 mark]

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Q1.2 Describe what happens when an electron moves from a higher to a lower energy level in a neon atom.

[2 marks]

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Table 1 shows information about radiation doses.

Table 1

	Radiation dose in millisieverts
Mean annual dose from natural sources	2.7
Mean dose from one aircraft flight	3.0×10^{-2}

The mean annual dose a person receives from natural sources is greater than the mean dose from one aircraft flight.

Q1.3 Calculate how many times greater.

[2 marks]

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Number of Times Greater = _____



FEEDBACK SHEET

Overall Mark:	<input type="text" value="/33"/>	GRADE ACHIEVED:		
Section A:	<input type="text" value="/12"/>	9 <input type="checkbox"/>	5 <input type="checkbox"/>	
Section B:	<input type="text" value="/9"/>	8 <input type="checkbox"/>	4 <input type="checkbox"/>	
Section C:	<input type="text" value="/12"/>	7 <input type="checkbox"/>	3 <input type="checkbox"/>	
		6 <input type="checkbox"/>	U <input type="checkbox"/>	
Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding
Strengths:	<input type="checkbox"/> Basic Knowledge of Concepts <input type="checkbox"/> Quality of Written Communication <input type="checkbox"/> Working Scientifically <input type="checkbox"/> Answering Examination Questions <input type="checkbox"/> Analytical Skills Others (Topic Specific) <input type="checkbox"/> Applications of Concepts <input type="checkbox"/> Mathematical Skills <input type="checkbox"/> Experimental Technique <input type="checkbox"/> Previous Topics <input type="checkbox"/> Problem Solving			
Areas to Improve:	<input type="checkbox"/> Basic Knowledge of Concepts <input type="checkbox"/> Quality of Written Communication <input type="checkbox"/> Working Scientifically <input type="checkbox"/> Answering Examination Questions <input type="checkbox"/> Analytical Skills Others (Topic Specific) <input type="checkbox"/> Applications of Concepts <input type="checkbox"/> Mathematical Skills <input type="checkbox"/> Experimental Technique <input type="checkbox"/> Previous Topics <input type="checkbox"/> Problem Solving			
Progress:	Unsatisfactory	Satisfactory	Good	Outstanding
Working:	Below	In line with	Above	(your target)
Effort:	Poor	Inconsistent	Good	Excellent

To improve further you need to:

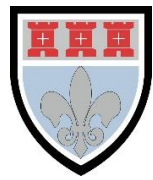
<input type="checkbox"/> Carry out independent revision. <input type="checkbox"/> Complete outstanding work. <input type="checkbox"/> Make corrections as indicated by the teacher. <input type="checkbox"/> Attend intervention for this topic <input type="checkbox"/> Include more information in responses. <input type="checkbox"/> Include more key words in responses. <input type="checkbox"/> Attend departmental revision sessions. <input type="checkbox"/> Read the questions carefully. <input type="checkbox"/> Explain your answers in more detail. <input type="checkbox"/> Carry out revision on Seneca Learning.	<input type="checkbox"/> Revise the equations. <input type="checkbox"/> Check the units on answers. <input type="checkbox"/> Check the correct amount of sig figs on answers. <input type="checkbox"/> Check to convert values correctly. <input type="checkbox"/> Show your full working out. <input type="checkbox"/> Check your calculations. <input type="checkbox"/> Revise the science investigative skills. <input type="checkbox"/> Revise the key concepts of the topics. <input type="checkbox"/> Thoroughly check your work for mistakes. Other:
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TASK 4: NUCLEAR EQUATIONS

SPEC CHECK

Content	Achieved?
<p>Nuclear equations are used to represent radioactive decay. In a nuclear equation, an alpha particle may be represented by the symbol:</p> ${}^4_2\text{He}$ <p>and a beta particle by the symbol:</p> ${}^0_{-1}\text{e}$	
<p>The emission of the different types of nuclear radiation may cause a change in the mass and /or the charge of the nucleus. For example:</p> ${}^{219}_{86}\text{radon} \longrightarrow {}^{215}_{84}\text{polonium} + {}^4_2\text{He}$	
<p>So alpha decay causes both the mass and charge of the nucleus to decrease.</p> ${}^{14}_6\text{carbon} \longrightarrow {}^{14}_7\text{nitrogen} + {}^0_{-1}\text{e}$	
<p>So beta decay does not cause the mass of the nucleus to change but does cause the charge of the nucleus to increase.</p>	
<p>Students should be able to use the names and symbols of common nuclei and particles to write balanced equations that show single alpha (α) and beta (β) decay. This is limited to balancing the atomic numbers and mass numbers. The identification of daughter elements from such decays is not required.</p>	
<p>The emission of a gamma ray does not cause the mass or the charge of the nucleus to change.</p>	



Target Setting

In this assessed piece of work, what target should I look to achieve in completing this task?
Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

What Topics Do I Know Well?

What Topics Do I Need to Revise?

**SECTION A****Electricity Revision**

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

Q1. Some electrical appliances use electricity from the mains supply and some use electricity from a battery.

Q1.1 Explain the differences between the current supplied by the mains supply and the current supplied by a battery.

[2 marks]

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Q1.2 Which set of units correctly links current, potential difference and power?

[1 mark]

one watt = one volt \times one amp

one watt = $\frac{\text{one amp}}{\text{one volt}}$

one watt = $\frac{\text{one volt}}{\text{one amp}}$



Electrical appliances can be connected to the mains supply using three-core cables.

The cables contain the mains wires.

1.3 What are the colours of the insulation around the wires?

[1 mark]

Tick **one** box.

Earth	Live	Neutral	Tick one box
Blue	Brown	Green and yellow	
Blue	Green and yellow	Brown	
Brown	Blue	Green and yellow	
Brown	Green and yellow	Blue	
Green and yellow	Blue	Brown	
Green and yellow	Brown	Blue	

1.4 Touching the live wire of an appliance is dangerous when the appliance is connected to the mains electricity supply.

Explain why.

[4 marks]

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SECTION B

This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

Q1. A student models the random nature of radioactive decay using 100 dice. He rolls the dice and removes any that land with the number 6 facing upwards. He rolls the remaining dice again. The student repeats this process a number of times. The table below shows his results.

Roll number	Number of dice remaining
0	100
1	84
2	70
3	59
4	46
5	40
6	32
7	27
8	23

Q1.1 Give **two** reasons why this is a good model for the random nature of radioactive decay.

[2 marks]

Reason 1

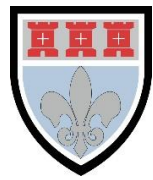
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Reason 2

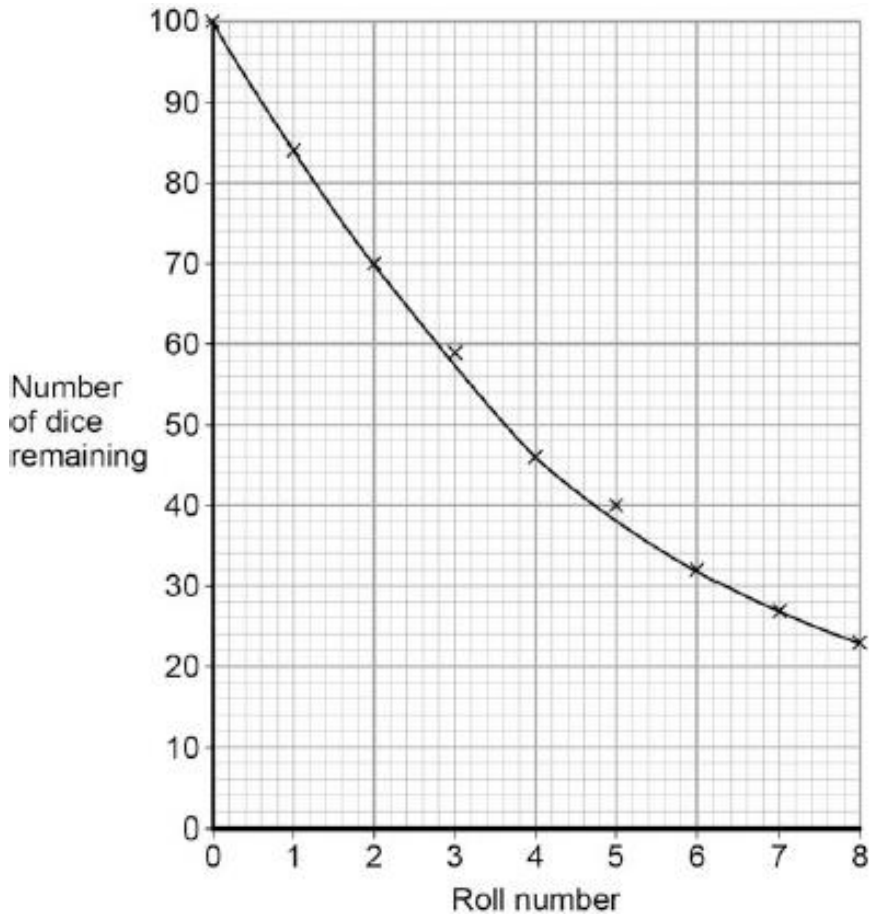
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The student's results are shown in **Figure 1**.

Figure 1



Use **Figure 1** to determine the half-life for these dice using this model.

Q1.2 Show on **Figure 1** how you work out your answer.

[2 marks]

Half-Life = rolls

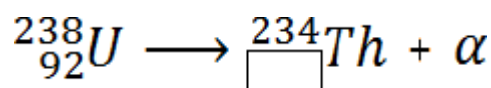
Q1.3 A teacher uses a protactinium (Pa) generator to produce a sample of radioactive material that has a half-life of 70 seconds.

In the first stage in the protactinium generator, uranium (U) decays into thorium (Th) and alpha (α) radiation is emitted.

The decay can be represented by the equation shown in **Figure 2**.

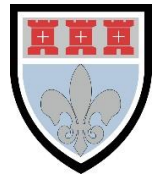
[1 mark]

Figure 2



Determine the atomic number of thorium (Th) 234.

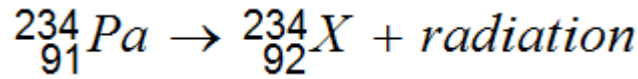
Atomic Number =



Q1.4 When protactinium decays, a new element is formed, and radiation is emitted.

The decay can be represented by the equation shown in **Figure 3**.

Figure 3



When protactinium decays, a new element, **X**, is formed.

Use information from **Figure 2** and **Figure 3** to determine the name of element **X**.

[1 mark]

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Q1.5 Determine the type of radiation emitted as protactinium decays into a new element.

Give a reason for your answer.

[2 marks]

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Q1.6 The teacher wears polythene gloves as a safety precaution when handling radioactive materials.

The polythene gloves do **not** stop the teacher's hands from being irradiated.

Explain why the teacher wears polythene gloves.

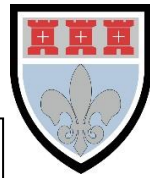
[2 marks]

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**SECTION C**

This will contain questions on content found later in the course

This is a challenge question to extend your understanding.You should aim to spend **10 minutes** answering this section.**Q1.** The Chernobyl disaster was a nuclear accident that happened in 1986

Radioactive isotopes were released into the environment.

The radioactive isotopes emitted alpha, beta and gamma radiation.

Q1.1 What is an alpha particle?**[1 mark]**Tick **one** box.

2 charged particles and 2 neutral particles.

2 charged particles and 4 neutral particles.

4 charged particles and 2 neutral particles.

4 charged particles and 4 neutral particles.

Q1.2 Which statement about beta radiation is true?**[1 mark]**Tick **one** box.

It is the fastest moving type of radiation.

It is the type of radiation with a negative charge.

It is the type of radiation with the greatest mass.

It is the type of radiation with the greatest range in air.



Q1.3 Which statement about gamma radiation is true?

[1 mark]

Tick **one** box.

It is a low frequency electromagnetic wave.

It causes the charge of the nucleus to change.

It causes the mass of the nucleus to change.

It has a very long range in air.

Table 3 shows the half-lives of two of the radioactive isotopes that contaminated the environment.

Table 3

Isotope	Half-life
Caesium-137	30 years
Iodine-131	8 days

Q1.4 A soil sample was taken from the area around Chernobyl in 1986

The soil sample was contaminated with equal amounts of caesium-137 and iodine-131

Explain how the risk linked to each isotope has changed between 1986 and 2018

Both isotopes emit the same type of radiation.

[4 marks]

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Q1.5 Determine the year when the activity of the caesium-137 in the soil sample will be $1/32$ of its original value.

[3 marks]

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Year =



FEEDBACK SHEET

Overall Mark:	/28	GRADE ACHIEVED: 9 <input type="checkbox"/> 5 <input type="checkbox"/> 8 <input type="checkbox"/> 4 <input type="checkbox"/> 7 <input type="checkbox"/> 3 <input type="checkbox"/> 6 <input type="checkbox"/> U <input type="checkbox"/>
Section A:	/8	
Section B:	/10	
Section C:	/10	

Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding
Strengths: <input type="checkbox"/> Basic Knowledge of Concepts <input type="checkbox"/> Quality of Written Communication <input type="checkbox"/> Working Scientifically <input type="checkbox"/> Answering Examination Questions <input type="checkbox"/> Analytical Skills Others (Topic Specific)			<input type="checkbox"/> Applications of Concepts <input type="checkbox"/> Mathematical Skills <input type="checkbox"/> Experimental Technique <input type="checkbox"/> Previous Topics <input type="checkbox"/> Problem Solving	
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Working:	Below	In line with	Above	(your target)
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EQUATIONS SHEET



GCSE Physics Equation Sheet

1	pressure due to a column of liquid = height of column \times density of liquid \times gravitational field strength (g)	$p = h \rho g$
2	(final velocity) ² - (initial velocity) ² = 2 \times acceleration \times distance	$v^2 - u^2 = 2 a s$
3	force = $\frac{\text{change in momentum}}{\text{time taken}}$	$F = \frac{m \Delta v}{\Delta t}$
4	elastic potential energy = 0.5 \times spring constant \times (extension) ²	$E_e = \frac{1}{2} k e^2$
5	change in thermal energy = mass \times specific heat capacity \times temperature change	$\Delta E = m c \Delta \theta$
6	period = $\frac{1}{\text{frequency}}$	
7	magnification = $\frac{\text{image height}}{\text{object height}}$	
8	force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density \times current \times length	$F = B I l$
9	thermal energy for a change of state = mass \times specific latent heat	$E = m L$
10	$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$	$\frac{V_p}{V_s} = \frac{n_p}{n_s}$
11	potential difference across primary coil \times current in primary coil = potential difference across secondary coil \times current in secondary coil	$V_s I_s = V_p I_p$
12	For gases: pressure \times volume = constant	$p V = \text{constant}$



Acknowledgements

This document has been produced by Mr J Turnbull.

All relevant information has been credited in the document.

This document has been produced for educational purposes only.

This document has been produced for the AQA GCSE Physics Specification.

