GCSE
COMBINED SCIENCE: SYNERGY
8465/3F

Foundation Tier Paper 3 Physical Sciences

Mark scheme

June 2025

Version:1.0 Final

256G8465/3F/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the examiner make their judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Alternative words in the mark scheme are shown by a solidus eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name **two** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks should be awarded for a correct numerical answer, without any working shown.
Full marks are **not** awarded for a correct final answer from incorrect working.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level.

The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

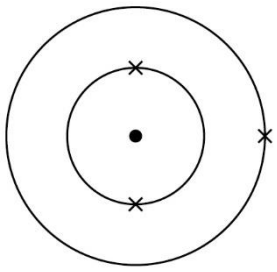
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	Ca		1	AO1 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	Cl		1	AO1 4.5.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	C		1	AO1 4.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	He		1	AO2 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	C / carbon **and** Si / silicon		1	AO2 4.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6		allow ●, O, $e^{(-)}$ for electrons	1	AO2 4.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	rubidium / Rb		1	AO2 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	any **two** from: • bubbles • sodium floats • sodium moves (on the surface of the water) • sodium melts • sodium gets smaller	 allow sodium forms a ball allow sodium disappears	2	AO1 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	sodium hydroxide solution		1	AO2 4.5.1.4 4.7.3.2

Total Question 1	**10**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	between 4 seconds and 5 seconds the gradient is constant **or** the line is straight	 MP2 dependent on scoring MP1	1 1	AO2 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	the driving force was the same size as air resistance the resultant force was zero	 allow the forces were balanced MP2 dependent on scoring MP1	1 1	AO1 4.7.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	increases		1	AO1 4.7.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	increases		1	AO1 4.7.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	decrease		1	AO1 4.7.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	the driver may lose control of the car		1	AO1 4.7.1.10

Total Question 2	**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	4 cells		1	AO2 4.7.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	current = $\frac{3.0}{2000}$ current = 0.0015 (A)		1 1	AO2 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the potential difference across the battery is the same		1	AO1 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	6.0 V − 3.0 V		1	AO2 4.7.2.3

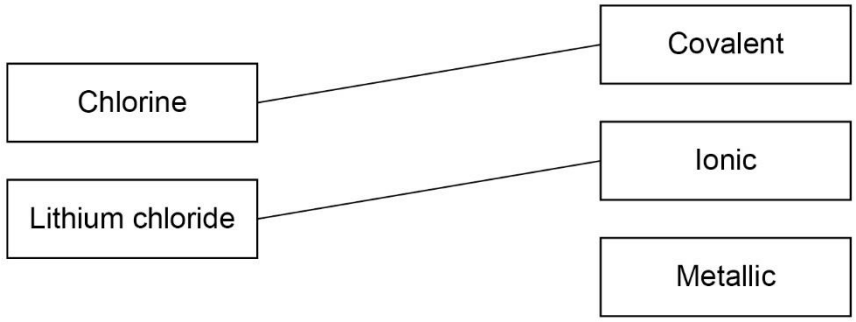
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	1500 (ohms)		1	AO2 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	resistance and light intensity have a non-linear relationship resistance decreases as light intensity increases		1 1	AO3 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	a circuit to switch lights on at night		1	AO2 4.7.2.2

Total Question 3	**9**

Question 4

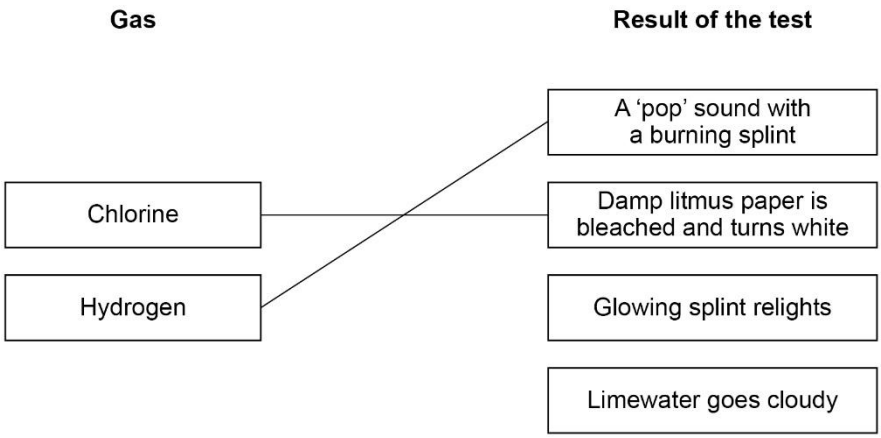
Question	Answers	Mark	AO / Spec. Ref.
04.1	**Substance** **Type of bonding**  do **not** accept more than one line from a box on the left	1 1	AO1 AO2 4.6.2.1 4.6.2.2 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	hydrochloric acid		1	AO2 4.7.3.1 4.7.3.2

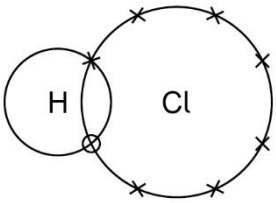
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	salt		1	AO2 4.7.3.1 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	chloride ions are negative(ly charged) (so chloride ions) are attracted to the positive electrode	 allow (and) opposite charges attract	1 1	AO1 4.7.5.2 RPA21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	electrons ions	must be in this order	1 1	AO1 4.6.2.3 4.6.2.7 4.7.5.3 RPA21

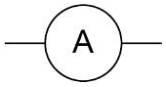
Question	Answers	Mark	AO / Spec. Ref.
04.6	 do **not** accept more than one line from a box on the left	1 1	AO1 4.7.3.1 4.7.5.4 RPA21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	hydrogen is less reactive than lithium		1	AO2 4.7.5.3 RPA21

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8		allow any combination of ●, O, X, $e^{(-)}$ for electrons		
	pair of electrons in the overlap		1	AO1 4.6.2.1 4.6.2.4
	six non-bonding electrons on the chlorine atom	do **not** accept non-bonding electrons on the hydrogen atom an answer of  scores **2** marks	1	

Total Question 4	**13**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1			1	AO1 4.7.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	5 correctly plotted points	allow 1 mark for 3 or 4 plotted points allow a tolerance of ± half a small square	2	AO2 4.6.3.4
	curved line of best fit		1	

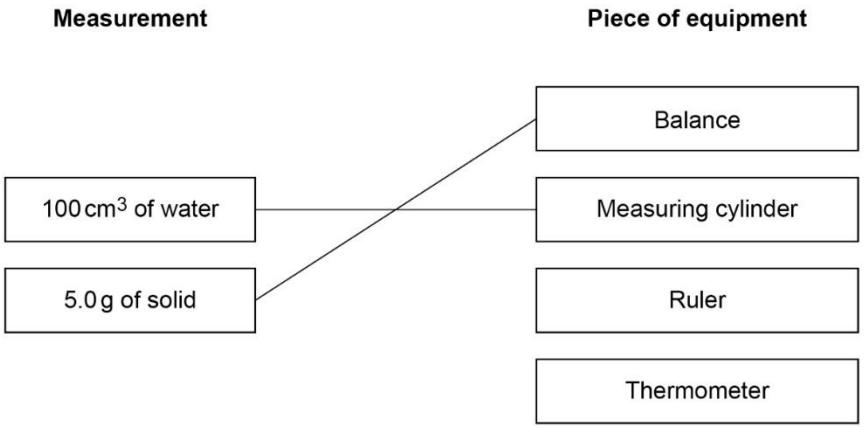
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	fewer paperclips will be picked up		1	AO1 4.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	cobalt		1	AO1 4.6.3.2
	nickel		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	an electromagnet can be switched off (and on)	allow the strength of an electromagnet can be varied allow an electromagnet is stronger	1	AO1 4.6.3.4

Total Question 5	**8**

Question 6

Question	Answers	Mark	AO / Spec. Ref.
06.1	 do **not** accept more than one line from a box on the left	1 1	AO1 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(scale 0) 5, 10, 15, 20 (25)	ignore intermediate values	1	AO2 4.7.3.3
	bar correctly plotted for lithium chloride	allow a tolerance of ± ½ a small square ignore width of bar	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	the temperature increases		1	AO3 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(**X** =) $\frac{5.8 + 6.3 + 5.9 + 6.4}{4}$	allow (**X** =) $\frac{24.4}{4}$	1	AO2 4.7.3.3
	= 6.1 (°C)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	**D**		1	AO1 4.7.4.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	**B**		1	AO1 4.7.4.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	**C**		1	AO1 4.7.4.4

Total Question 6	**10**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	displacement		1	AO2 4.7.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	the solution becomes blue silver / solid forms (on the copper)	allow the solution changes colour	1 1	AO3 4.7.5.1

Question	Answers		Extra information	Mark	AO / Spec. Ref.
07.3	(most reactive) (least reactive)	nickel copper silver		1	AO3 4.7.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	wear eye protection		1	AO1 4.7.3.2 RPA17

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	the rate of reaction was increased	allow the reaction was faster	1	AO3 4.7.3.2 4.7.4.3 RPA17

Question	Answers	Mark	AO / Spec. Ref.
07.6	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO1 4.7.3.2 RPA17
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • filter (the reaction mixture) ○ using filter paper and a filter funnel ○ to remove excess copper oxide • heat the solution ○ using Bunsen burner and a water bath **or** using an electric heater ○ to crystallisation point • leave solution to crystallise ○ pat crystals dry with filter paper		

Total Question 7	**10**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	$s = v \times t$		1	AO1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	$44 = v \times 5.0$ $v = \frac{44}{5.0}$ $v = 8.8$ (m/s)		1 1 1	AO2 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$a = \frac{\Delta v}{t}$		1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	$t = 0.400$ (s) $a = \frac{(0.0\ -)\ 6.0}{0.400}$ $a = (-)\ 15$ (m/s^2)	all subsequent marks may be awarded if t is incorrectly / not converted allow $a = \frac{6.0\ -\ 0.0}{0.400}$	1 1 1	AO2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	$F = m \times a$		1	AO1 4.7.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	*m* = 3.5 kg	all subsequent marks may be awarded if *m* is incorrectly / not converted	1	AO2 4.7.1.6
	F = 3.5 × 540		1	
	F = 1890 (N)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	player can be treated for head injuries sooner **or** player can be taken off the field if there is a possibility of head injury **or** the doctor can get to the player sooner	ignore (data about) forces are transmitted	1	AO3 4.7.1.6

Total Question 8	**13**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(gold is) unreactive		1	AO1 4.8.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	(substance oxidised) carbon	allow C	1	AO2 4.8.2.1
	(reason) oxygen is gained (by carbon)	MP2 is dependent upon MP1 being awarded	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3		allow converse statements for reactivity		
	aluminium is more reactive than carbon	allow aluminium is above carbon in the reactivity series	1	AO2 4.8.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	to melt the mixture (of aluminium oxide and cryolite)	allow to melt the aluminium oxide allow to melt the compound(s)	1	AO1 4.8.2.2
	to produce the (electrical) current	allow process uses electricity	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	(energy decrease = 162 − 11 =) 151 (MJ)		1	AO2 4.8.2.9
	(percentage energy decrease =) $\frac{151}{162}$ × 100	allow correct use of an incorrectly determined value for energy decrease	1	
	= 93.2 (%)	allow 93.2098765…. (%)	1	
	= 93 (%)	allow an answer correctly rounded to 2 significant figures from an incorrect calculation which uses all the data in the table	1	
	alternative approach			
	(percentage energy for recycled aluminium =) $\frac{11}{162}$ × 100 (1)			
	= 6.79 (%) (1)	allow 6.790123…. (%)		
	(percentage energy decrease = 100 − 6.79 =) 93.2 (%) (1)	allow correct use of an incorrectly determined percentage for recycled aluminium allow 93.2098765…. (%)		
	= 93 (%) (1)	allow an answer correctly rounded to 2 significant figures from an incorrect calculation which uses all the data in the table		

Total Question 9	**10**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(conversion 2 mm =) 2 000 000 nm		1	AO2 4.8.1.1
	(length : diameter =) 2 000 000 : 0.8	allow incorrect / no conversion of length allow (length : diameter =) $\frac{2\ 000\ 000}{0.8}$ (: 1)	1	
	= 2 500 000 : 1		1	
	alternative approach: (conversion 0.8 nm =) 0.000 000 8 mm (1)			
	(length : diameter =) 2 : 0.000 000 8 (1)	allow incorrect / no conversion of diameter allow (length : diameter =) $\frac{2}{0.000\ 000\ 8}$ (: 1)		
	= 2 500 000 : 1 (1)			

Question	Answers	Mark	AO / Spec. Ref.
10.2	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	4–6	AO1 4.6.2.1 4.6.2.4 4.6.2.5 4.8.1.1
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content	0	

	Indicative content
	
	• both are made up of carbon atoms
	• both are giant structures
	• graphite has layers
	  ○ of hexagonal rings
	
	• in diamond each carbon / atom forms 4 bonds
	• in graphite each carbon / atom forms 3 bonds
	• graphite has delocalised electrons
	  ○ one delocalised electron per carbon atom
	• graphite has no bonds between the layers
	• graphite has weak forces between the layers
	
	• both have covalent bonds
	• both have bonds formed by sharing pairs of electrons
	• both have strong bonds		

Total Question 10	**9**