GCSE
COMBINED SCIENCE: SYNERGY
8465/2F

Foundation Tier Paper 2 Life and Environmental Sciences

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

226G8465/2F/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.

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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 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	endocrine system		1	AO1 4.2.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	through the bloodstream		1	AO1 4.2.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	A		1	AO1 4.2.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	D		1	AO1 4.3.1.6 4.2.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	body temperature		1	AO1 4.3.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	P		1	AO2 4.3.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	pancreas		1	AO1 4.3.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	Q		1	AO2 4.3.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	the person may have exercised	allow they have not eaten (recently) ignore sleep / digestion / temperature ignore diabetes unqualified	1	AO3 4.3.1.5

Total Question 1		**9**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	solid		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	1000 (°C)		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(15 g) 103 (°C)	allow a value in the range 102.8 to 103.2 (°C)	1	AO2 4.1.1.1
	(30 g) 106 (°C)	allow a value in the range 105.8 to 106.2 (°C)	1	
	(106 – 103 =) 3 (°C)	allow correct use of incorrectly determined boiling point(s) from Figure 4 ignore minus sign	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(as the mass of sodium chloride added increases) the boiling point increases	allow the boiling point is proportional to the mass of sodium chloride added ignore directly proportional	1	AO3 4.1.1.1
	until 108 ºC	allow until 40 g (of sodium chloride added)	1	
	(after 108 ºC) the boiling point remains constant	allow (after 40 g of sodium chloride added) the boiling point remains constant	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	E = 0.20 × 2 260 000		1	AO2
	E = 452 000	allow 4.52×10^5	1	AO2
	J		1	AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	the particles will move faster		1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	(boiling point) increases		1	AO3 4.1.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	food cooks quicker		1	AO3 4.1.1.3
	(because) boiling point of water is higher	allow cooks food at a higher temperature allow maximum temperature of water is higher ignore it gets hotter ignore the temperature of the water is higher	1	

Total Question 2		**15**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	osmosis		1	AO1 4.1.3.3 4.2.2.2 4.2.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	increases the surface (area)	allow has a large surface (area) allow able to grow in between soil particles	1	AO1 4.2.2.2 4.2.2.3
	(so) can absorb more water / minerals	allow (so) can absorb water / minerals faster	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(root hair cells) do not receive light	allow (root hair cells) are underground allow (root hair cells) are in the dark	1	AO3
	(so root hair cells) do not photosynthesise		1	AO2 4.2.2.2 4.1.3.2 4.2.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	water		1	AO1 4.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	chlorophyll		1	AO1 4.2.2.2

Question	Answers	Mark	AO / Spec. Ref.
03.6	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3−4	AO3 4.2.2.2
	Level 1: Relevant points are made. They are not logically linked.	1−2	
	No relevant content	0	
	Indicative content allow converse reasons for disadvantages of fertiliser **A** and **B** (advantages) fertiliser **A** (powder) • is cheaper (per gram) • 1 p per gram for fertiliser **A** vs 1.4 p per gram for fertiliser B • does not have to be applied as often • will last longer (because not used as often) (advantages) fertiliser **B** (liquid) • is easier / quicker (to use) • liquid soaks into the soil (faster) • can use the bottle cap • easier to measure out • easy to judge if evenly spread out on soil • can just water plants as usual • can treat a larger area		

Total Question 3		**11**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	a transverse wave		1	AO1 4.1.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the bar moves up and down	allow the bar vibrates	1	AO1 4.1.4.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(the) time (taken)		1	AO1 4.1.4.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	B there are more waves (in a given time)	no marks if B not selected allow the waves are closer together allow the wave has the shortest wavelength	1 1	AO3 4.1.4.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	any **one** from: • height the tray was lifted • length / size of the tray • temperature of the water	do **not** accept depth of water ignore used the same tray	1	AO3 4.1.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6 mark with 04.7	straight line through / touching all points	do **not** accept if line goes to 0,0	1	AO2 4.1.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7 mark with 04.6	0.4 (metres per second)	allow correct reading from their line ± ½ a small square	1	AO3 4.1.4.2

Total Question 4		**8**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	a square frame		1	AO1 4.4.2.4 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	$\frac{30}{6}$ **or** $\frac{4 + 6 + 3 + 8 + 7 + 2}{6}$ 5		1 1	AO2 4.4.2.4 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$100 \times 90 = 9000\ (m^2)$ $(1 \times)\ 2 \times 9000 = 18\ 000$	allow correct use of an incorrectly calculated field area using values of 100m and 90m	1 1	AO2 4.4.2.4 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	any **one** from: (there were more plants in field **A** because) • it is more sheltered (from wind) • it was not walked / played / run on (as much) • it has more fertile soil • it has a water source	allow not used / trampled (as much) allow not mowed (as often)	1	AO3 4.4.2.4 4.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	any **three** from: • more plants when no hedge (**Q**) • greater number of species of plants next to the hedge (**P**) • greater number of species of insects next to the hedge (**P**) • greater biodiversity next to the hedge (**P**) • the more species of plants there are the more species of insects	allow converse statements allow more plants in area Q (than P) allow greater variety of plants in area P (than Q) allow greater variety of insects in area P (than Q) ignore number of insects allow greater biodiversity in area P (than Q) allow where there is a greater number of plants there are fewer species of plants allow where there is a greater number of plants there are fewer species of insects	3	AO3 4.4.2.4 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any **one** from: • plant hedges / flowers / trees • add a pond • add a log pile or compost heap or beehive or bird box • avoid walking on it • avoid using pesticides / herbicides / insecticides • avoid using heavy machinery • avoid mowing (grass) • remove grazing animals • do not plant crops		1	AO2 4.4.2.5 4.4.2.7

Total Question 5		**10**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	plants		1	AO1 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	fertilisation mitosis differentiation	in this order only	1 1 1	AO1 4.1.3.4 4.1.3.5 4.1.3.6 4.3.3.9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	potential life is killed / destroyed	allow the embryo will die allow the embryo will be destroyed allow embryo could be damaged allow embryo cannot give consent allow it goes against some religious beliefs ignore it goes against God / religion unqualified	1	AO3 4.3.3.9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	to grow	allow replace dead / damaged cells	1	AO1 4.1.3.4

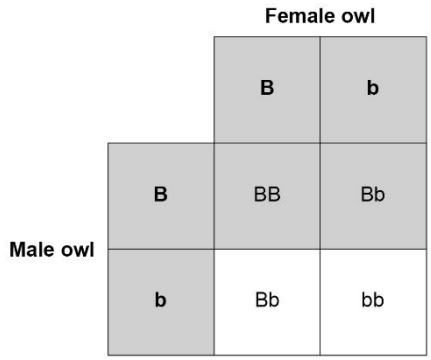
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	as a control		1	AO3 4.3.3.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	any **three** from: *drug injected once a day* • tumour (volume) increased (from 200 mm^3 to 620 mm^3) • slowed the rate of growth of the tumour after 12 days *drug injected twice a day* • tumour reduced in volume (from 200 mm^3 to 100 mm^3) • slowed the rate of growth over the first few (8) days (compared to once a day) • tumour increased in volume (by 40 mm^3) between 0 and 4 days	data must be used at least once for maximum marks for max **3** marks there must be a reference to once a day **and** to twice a day allow tumour (volume) increased (by 420 mm^3) allow tumour volume reduced (by 100 mm^3) allow had an increased volume between 0 and 12 / 13 / 14 days	3	AO3 4.3.2.7 4.3.3.7

Total Question 6		10

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	bb		1	AO2 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2 Mark with 07.3			1	AO2 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3 Mark with 07.2	75%	percentage must match answer given to question **07.2** if no answer in question **07.2** allow 75%	1	AO3 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	any **two** from: • the number of owls with grey feathers increased • there are less owls with brown feathers than owls with grey feathers in 1980 • there are less owls with brown feathers than owls with grey feathers in 2020 • the increase in owls with brown feathers is greater than the increase in owls with grey feathers • the total number of owls increased	allow for **2** marks there are always more owls with grey feathers if neither mark awarded allow **1** mark only for there are more owls with grey feathers allow (by 2020) the numbers of owls with grey feathers and owls with brown feathers are more similar	2	AO3 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5		ignore references to grey owls ignore they are camouflaged		AO2 4.4.4.2
	will be able to catch more prey / food	allow do not get eaten	1	4.4.2.2
	(so) will survive		1	
	(and so) be able to reproduce	allow have offspring	1	
	(and) pass on genes / DNA / chromosomes for brown feathers to offspring		1	

Total Question 7		9

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	heart muscle (cell) nucleus	in this order only	1	AO1 4.2.1.3 4.2.1.2 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	vena cava → right atrium → right ventricle → pulmonary artery		1	AO2 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	(the left ventricle) pumps blood a greater distance	allow pumps blood (all) around the body	1	AO2 4.2.1.3
	(so) needs to produce a greater force / pressure (of contraction)		1	
	or			
	(wall of the left ventricle) has more muscle (1)	ignore thicker unqualified		
	(because) pumps blood a greater distance (1)	allow (because) pumps blood all around the body (1) ignore pumps blood to the body		
		allow (because) pumps blood at a higher pressure (1)		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	to prevent blood flowing backwards	allow to keep blood flowing in one direction allow prevent blood flow from ventricle to atrium	1	AO1 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	right atrium		1	AO1 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	controls the (resting) heart rate		1	AO1 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7		ignore heart rate decreases		
	cardiac output is similar	allow (only) increased by 2 (cm^3) allow increased slightly	1	AO3
	(because heart rate decreased and) the stroke volume has increased	allow (because heart rate has decreased and) the volume of blood pumped out of the heart each beat has increased	1	AO2 4.2.1.3

Question	Answers	Mark	AO / Spec. Ref.
08.8	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	

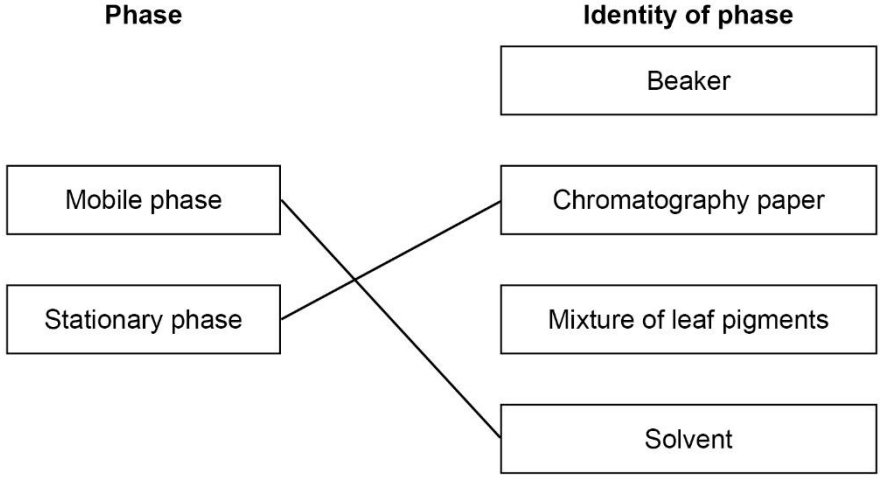
	Indicative content
	
	Diet risk factors and links:
	• high fat / energy diet
	  • overweight / obese
	  • coronary heart disease / attack
	
	• high (blood) cholesterol
	  • build-up of fatty material in (coronary) arteries
	  • coronary heart disease / attack
	
	• high sugar
	  • overweight / obese
	  • (type 2) diabetes
	
	• high salt
	  • high blood pressure
	
	• lack of vitamins / minerals / fibre
	  • deficiency diseases or named diseases
	
	Lifestyle risk factors and links:
	• lack of exercise / activity **or** sedentary **or** stressful lifestyle
	  • overweight / obese
	  • cardiovascular disease / CHD
	  • leads to poor mental health
	
	• smoking
	  • cancer
	  • lung disease eg emphysema / bronchitis / asthma
	  • cardiovascular disease / CHD
	
	• alcohol or (recreational) drugs
	  • damage to named organs eg liver / brain
	  • high blood pressure
	
	• exposure to UV light / ionising radiation
	  • skin cancer
	
	The main discriminator is the quality of linking.
	
	Both diet **and** lifestyle factors, with links, are needed for Level 3.
			4.3.1.1
			4.3.1.2
			4.3.1.3
			4.3.1.5
			4.2.1.3
			4.3.2.6

Total Question 8		**15**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	so the colour change (of the iodine) can be seen		1	AO3 4.2.1.5 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	the white area went brown	allow the white area did not turn black	1	AO3
	(which means) there was no starch in the white area	allow turning black indicates starch formed	1	AO3
	(because it does not contain chlorophyll so) cannot photosynthesise	allow (because) cannot produce glucose / sugar allow starch is made during photosynthesis	1	AO2 4.2.2.5 4.2.1.5 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	 do **not** accept more than one line from a box on the left		1 1	AO1 4.2.2.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	the ink will separate	allow the ink will run / smudge	1	AO1 4.2.2.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	$0.24 = \frac{\mathbf{X}}{121}$ (**X** =) 0.24 × 121 = 29.04 = 29 (mm)	 allow a correctly calculated answer to 2 significant figures from an incorrect calculation which uses the values in the question	1 1 1 1	AO2 4.2.2.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	brown		1	AO3 4.2.2.4 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	a different solvent was used		1	AO3 4.2.2.4 RPA9

Total Question 9		**13**