GCSE
COMBINED SCIENCE: TRILOGY
8464/B/2F

Biology Paper 2F

Mark scheme

June 2024

Version: 1.0 Final

2 4 6 G 8 4 6 4 / B / 2 F / M S

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

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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.

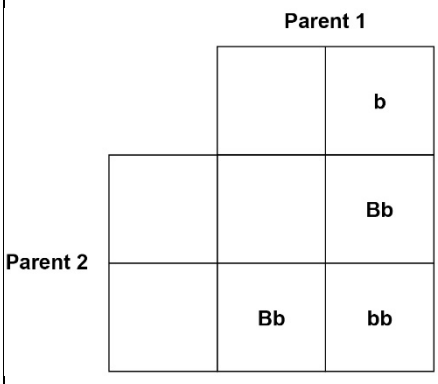
An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	cell membrane		1	AO1 4.1.1.2 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	dominant		1	AO2 4.6.1.4 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	heterozygous		1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4		allow **1** mark for **b** correct allow **2** marks for all 3 offspring genotypes correctly derived from gametes shown / given allow **1** mark for 1 or 2 offspring genotypes correctly derived from gametes shown / given derived genotypes must match parental gamete if given	1 2	AO2 4.6.1.4 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	25%	response must match question **01.4** if no answer in question **01.4** allow 25%	1	AO3 4.6.1.4 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	screening		1	AO1 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	mutation		1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	any **one** from: • diet • behaviour • infection • named environmental cause of variation such as sunlight	allow descriptions allow examples such as physical damage, scars, tattoos, (body) piercings, smoking, use of hair / nail colourings / dye allow air pollution ignore climate unqualified	1	AO2 4.6.2.1

Total Question 1	**10**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	pituitary (gland) adrenal (gland) ovary	must be in this order	1 1 1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	receptor cells		1	AO2 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(in / through / via) blood(stream)	allow (in / through / via) plasma allow (in / through / via) blood vessels **or** named blood vessel do **not** accept (in / through / via) red / white blood cells	1	AO2 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	liver		1	AO1 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	glycogen		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(11 – 5 =) 6 (arbitrary units)	allow answer on **Figure 3** if not on answer line	1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	increases		1	AO2 4.5.3.2
	then decreases	allow decreases at the end allow then returns to normal ignore reference(s) to rate of increase or decrease ignore reference to remaining constant between increase and decrease ignore values of time / concentration	1	

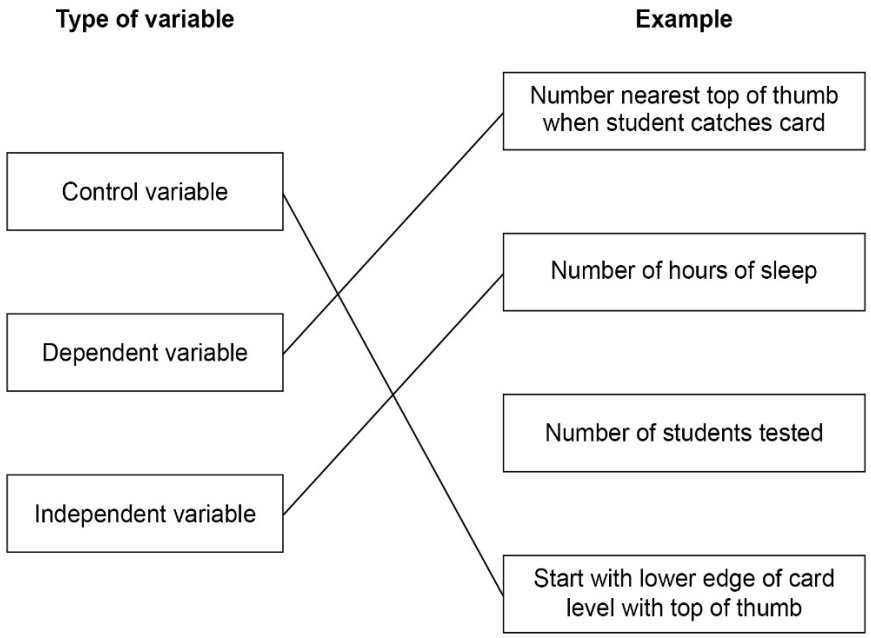
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	high / higher / highest (blood) glucose / sugar (concentration) **or** fast / faster / fastest (blood) glucose / sugar (concentration) rise / increase **or** slow / slower / slowest (blood) glucose / sugar (concentration) decrease **or** (blood) glucose / sugar (concentration) has not decreased (much)	allow (blood) glucose / sugar (concentration) goes up to 11 allow (blood) glucose / sugar (concentration) took longer to decrease	1	AO3
	(because) there is no / less insulin (produced by the body / pancreas) **or** (because cells of body / liver) not responding to insulin		1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	any **two** from: • eat less carbohydrate / sugar **or** a low / controlled carbohydrate diet • eat less fat • lose (body) mass / weight • (more) exercise	if neither of these awarded allow **1** mark for a calorie-controlled diet **or** reduced calorie diet ignore go on a diet unqualified allow examples of (increased) exercise allow stop smoking ignore take medicine / insulin ignore named medicine ignore pancreas transplant	2	AO1 4.5.3.2

Total Question 2	**14**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **one** from: • (react in order) to brake / steer • avoid accidents / collision / people / cars / objects	allow for safety	1	AO2 4.5.2

Question	Answers	Mark	AO / Spec. Ref.
03.2	 do **not** accept more than one line from a box on the left	1 1 1	AO1 4.5.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	students may catch the card between scores		1	AO3 4.5.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	plot at 8.5 hours and reaction score 3	allow a tolerance of ±½ small square	1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	7.5 (hours)	allow 7 ½ (hours) allow 7 hours and 30 minutes allow 7:30 allow answer on **Figure 6** if no answer on line do **not** accept 7.3	1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	reaction time stayed the same		1	AO3 4.5.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **two** from: • repeat (card drop) for each student • repeat on different days • repeat on larger number of students • repeat with wider range of sleep times • control / same age • control / same sex • control / same food / drink / caffeine / drugs (before test) • control distance between thumb and forefinger • control / same practice • remove distractions • use computer / phone reaction timer • have more divisions on the card • record sleep time in smaller intervals	if none of these awarded allow **1** mark for repeat unqualified allow control / same gender allow remove gaps between (reaction) scores for **2** marks allow repeat for each student and calculate a mean for **2** marks allow repeat on different days and calculate a mean	2	AO3 4.5.2 RPA6

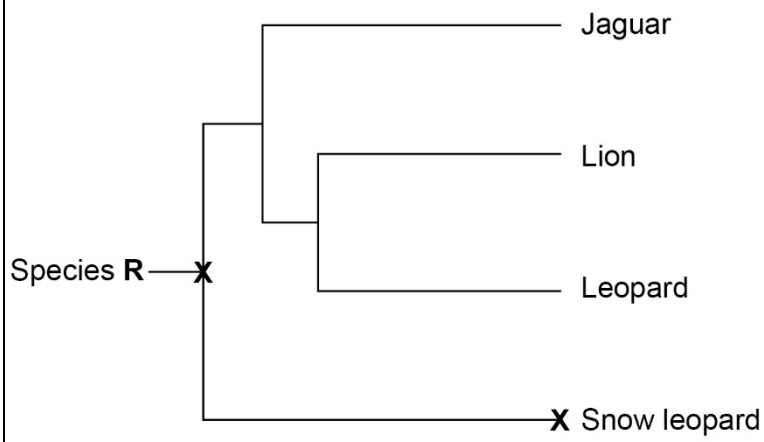
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	long (cell)		1	AO1 4.5.2
	to transport / carry the information / impulse(s) / signal	allow to transport / carry electrical messages ignore to carry messages unqualified	1	
	from CNS / coordinator / spinal cord / brain to muscle(s) / effector		1	
	alternative approach 1: (many) branches (1)	allow (many) dendrites		
	to transport / carry the information / impulse(s) / signal (1)	allow to transport / carry electrical messages ignore to carry messages unqualified		
	to many / several muscle cells (1)			
	alternative approach 2: attach to muscle cells (1)			
	to transport / carry the information / impulse(s) / signal (to muscle) (1)			
	for muscle contraction (1)			
	alternative approach 3: many mitochondria (1)			
	to respire (1)	allow to release energy do **not** accept energy produced / made / created		
	to assist / allow the information / impulse / signal to travel (1)	allow to assist / allow the transport / carriage of electrical messages		

	alternative approach 4: insulation **or** fatty sheath (1) to transport / carry the information / impulse(s) / signal (1) (along the neurone) faster (1)	 allow to transport / carry electrical messages ignore to carry messages unqualified **alternative approach 5:** allow narrow (1) so many (neurones) can fit in a small space (1)		

Total Question 3	**13**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	leopard		1	AO2 4.6.4

Question	Answers	Mark	AO / Spec. Ref.
04.2	a branch / line drawn at any point between 'X' marks, labelled 'tiger(s)'  	1	AO3 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	a species that the other species evolved from		1	AO3 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	natural selection		1	AO1 4.6.2.2 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	any **two** from: • drought • ice age • global warming	if none of these awarded allow **1** mark for climate change ignore weather	2	AO1 4.6.3.3
	• volcanic activity • asteroid collision	if neither of these awarded allow **1** mark for catastrophic event **or** natural disaster		
	• (new) predators	allow named example allow hunters		
	• (new) disease / pathogen	allow named example		
	• competition for food	allow lack of food		
	• competition for mates	allow lack of mates ignore competition unqualified		
	• lack of habitat **or** habitat change	ignore environment change ignore isolation ignore pollution		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	any **one** from: • if species is extinct • if (fossil) species is unknown • evolution is (usually) slow • (fossils) show (evolutionary) change	ignore fossils are (usually) very old	1	AO1 4.6.4 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	**(D) → B → A → E → C**	allow **1** mark for link **B → A** allow **1** mark for link **A → E** allow **1** mark for link **E → C**	3	AO2 4.6.3.1 4.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	antibiotic resistant bacteria will continue to evolve bacteria reproduce very rapidly		1 1	AO3 4.6.3.1 4.6.3.4

Total Question 4	12

Question 5

Question	Answers	Mark	AO / Spec. Ref.
05.1	alga(e) → limpet(s) → crab(s) direction of arrows must be correct	1	AO2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(50 (cm) × 50 (cm) =) 2500 (cm^2)	allow conversion cm to m (50 ÷ 100 =) 0.5 (m)	1	AO2 4.7.2.1 RPA7
	$(\frac{2500}{100 \times 100}$ =) 0.25 (m^2)	allow ¼ (m^2) allow (0.5 × 0.5 =) 0.25 (m^2) for **2** marks allow (½ × ½ =) ¼ (m^2) for **2** marks	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(1800 × $\frac{2}{100}$ =) 36 (m^2)	allow (1800 × 0.02 =) 36 (m^2)	1	AO2 4.7.2.1 RPA7
	($\frac{36}{0.25}$ =) 144 (quadrats)	allow (36 × 4 =) 144 (quadrats) allow a correct calculation of number of quadrats with an incorrect calculation of 2% of 1800 allow ecf from question **05.2**	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(location of sample will be) biased / chosen **or** (location of sample will be) limited by how far students can throw	allow students may aim for limpets allow students may aim to avoid limpets allow students may stand / start near groups of limpets	1	AO1 4.7.2.1 RPA7
	(therefore) results will not be representative (of (actual) abundance)	allow population size will be too high / low	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	tape measure along two (perpendicular) sides (of sea shore) **or** allocate co-ordinates (to sea shore) **or** divide area into a grid		1	AO1 4.7.2.1 RPA7
	use random number generator	allow description of generating random number(s) for example pulling numbers from container do **not** accept throwing quadrats	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any **one** from: • water • tide • rocks • quicksand • named hazardous material on the sea shore eg needles, glass • sewage • animals	allow named example of a hazard allow sea allow waves allow slippery / uneven surfaces allow appropriate named animal for example crab / jellyfish	1	AO3 4.7.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	any **one** from: • fertiliser • sewage • toxic chemicals	allow named toxic chemical eg herbicide / pesticide / insecticide / DDT / (crude) oil allow (micro)plastics allow (dissolved) carbon dioxide allow heavy metals allow thermal pollution	1	AO2 4.7.3.2

Total Question 5	**11**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	domain		1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	offspring are genetically identical		1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	a gamete contains half of the number of chromosomes		1	AO1 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any **one** from: • similar / same structure / characteristics / phenotype (as potatoes)	allow named similar structure / characteristics such as same shape / leaves / flowers / taste allow studied with microscopes ignore 'look the same / similar' unqualified	1	AO1 4.6.4
	• similar DNA / genes	allow DNA analysis allow analysis of genetic material allow similar genetic material ignore genetic information do **not** accept same DNA / genes		
	• similar / same biochemistry			
	• same first part of binomial (name)	allow same first part of Latin / scientific name		

Question	Answers	Mark	AO / Spec. Ref.
06.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2
	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 allow reference to named crop throughout **effects of climate change** • climate change will change weather patterns / trends • climate change causes flooding **or** drought **or** temperature change • farming land decreased by sea level rise / flooding / desertification • current crops cannot grow / survive (in changing conditions) **benefits of GM** ○ GM may allow crops to grow in wider range of conditions ○ GM may allow crops to be resistant to wider range of pests / diseases ○ GM may allow crops to be stored for longer ○ GM may increase crop yield **or** increase growth rate ○ to feed the increasing human population ○ useful if less area available for farming ○ larger human population needs more land for housing **other relevant content** ▪ variation amongst current crops reduced by asexual reproduction **or** selective breeding ▪ rate of evolution (by natural selection) may be slower than rate of climate change For **Level 3**, answers must explain effect(s) of climate change **and** benefit(s) of GM with logical link.		4.6.2.4 4.7.3.2 4.7.3.5 4.7.3.6

Total Question 6	**10**