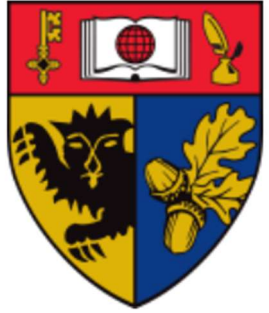


Name _____



Combined Science

Foundation

Biology: Paper 2

Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier
Biology Paper 2F

Friday 7 June 2019

Afternoon

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

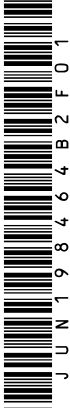
- a ruler
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.



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IB/M/Jun19/E10

8464/B/2F

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Conditions inside the human body are controlled.

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What is the control of conditions inside the body called?

Tick (✓) **one** box.

Excretion

Fertilisation

Homeostasis

Osmosis

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2

What are the **two** ways information is sent to control body conditions?

Tick (✓) **two** boxes.

By antigens

By hormones

By muscles

By nerve impulses

By red blood cells

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3

One condition in the body that needs to be controlled is the level of water.

Give **one** other condition in the human body that needs to be controlled.

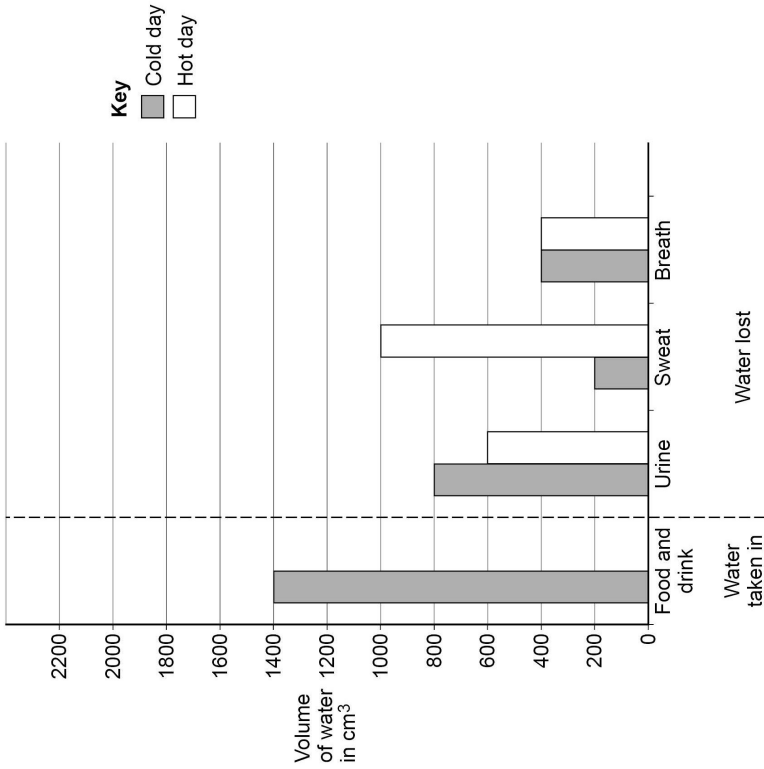


0 2

Figure 1 shows the volumes of water taken in and lost by one person.

The volume for water taken in on a hot day has **not** been plotted on the bar graph.

Figure 1



The person lost 1400 cm³ of water on the cold day.

How much extra water did they lose on the hot day?

[2 marks]

Extra volume of water lost = _____ cm³

Turn over ►



Explain why the volume of water lost on a hot day is higher than on a cold day.

[2 marks]

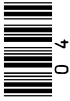
A boy drank 750 cm³ of water.

His total intake of water for that day was 3000 cm³

Calculate the percentage of the boy's total intake that the 750 cm³ represents.

[2 marks]

Percentage = _____ %



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Turn over ►



Some students estimated the population of daisy plants in a field.

This is the method used.

- 1. Place a quadrat randomly on the field.
- 2. Count and record the number of daisy plants in the quadrat.
- 3. Repeat steps 1 and 2 another four times.

How could the students have made sure the quadrats were placed randomly? [1 mark]

Describe the piece of equipment called a quadrat. [1 mark]

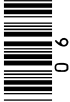
Table 1 shows the results.

Table 1

Quadrat number	Number of daisy plants
1	8
2	11
3	4
4	6
5	16
Mean	X

Calculate mean value X. [1 mark]

X = _____ daisy plants



02.4

The field is a rectangle 100 m wide and 150 m long.
Calculate the area of the field.

[1 mark]

Area = _____ m²

02.5

The quadrat used by the students had an area of 1.0 m²
Estimate the population of daisy plants in the field.
Use your answers to Question 02.3 and Question 02.4

[2 marks]

Estimated population = _____ daisy plants

02.6

More daisy plants grew in some parts of the field compared to other areas of the field.
Give **two** biotic factors that may affect where daisy plants grow in the field.

[2 marks]

1 _____

2 _____

02.7

The students noticed that the daisy plants growing near a building were smaller.
Explain why smaller daisy plants grew near the building.

[2 marks]



03

Animals have adaptations to survive in their environment.
These adaptations may be structural, behavioural or functional.
Draw **one** line from each animal adaptation to the type of adaptation it is.

[2 marks]

Type of adaptation

Animal adaptation



Male palm cockatoos use sticks to beat on hollow branches to attract females.

Structural



The harmless hornet moth has black and yellow stripes to look like a bee or wasp.

Behavioural



Sea spiders have automatic muscle contractions that move oxygen around their bodies.

Functional



Plants also have adaptations.
Orchid plants have adaptations which make them one of the most successful plant groups.
Orchids rely on insects for pollination.

Figure 2 shows an orchid.

Figure 2



Which **two** features help orchids survive?

Tick (✓) **two** boxes.

- Brightly coloured flowers
- Large quantities of pollen
- No scent
- Oval shaped leaves
- Small leaves

[2 marks]

Turn over ►



Many orchid species grow in tropical rainforest ecosystems.
What name describes the variety of all the different species found in an ecosystem?

Tick (✓) **one** box.

- Biodiversity
- Evolution
- Feeding relationship
- Habitat

Some species of orchid may become extinct because of deforestation.
Give **one** reason why tropical rainforests are being cut down.

Give **one** factor that might cause a species of orchid to become extinct.
Do **not** refer to deforestation in your answer.

Scientists have analysed the entire genetic material of one species of orchid.
What chemical is the genetic material made from?

What is the name for the entire genetic material of an organism?



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 A cat breeder noticed that four kittens from one Siamese cat mother had a new blue colour at the tip of their tails.

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 What has caused the new colour to appear? [1 mark]

Tick (✓) **one** box.

Fertilisation

☐

Mitosis

☐

Mutation

☐

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2

 The cat breeder wants to use selective breeding so that all new kittens have blue tail tips.

Describe the process of selective breeding the cat breeder could use.

[3 marks]

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 Suggest **one** reason why the cat breeder wants to have all new kittens with the blue tail tips.

[1 mark]

Turn over ▶



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4

 Siamese cats can suffer from heart defects.

Why might there be more Siamese cats with heart defects amongst the kittens with blue tail tips?

[1 mark]

Tick (✓) **one** box.

They are clones

☐

They are formed by mitosis

☐

They are formed by sexual reproduction

☐

They are produced by inbreeding

☐

With each pregnancy, the cat breeder expected that:

- 50% of the kittens would be male
- 50% of the kittens would be female.

The sex chromosomes in cats are inherited in the same way as in humans.

The sex chromosomes are X and Y.

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5

 Give the combination of sex chromosomes present in a male cat and in a female cat. [1 mark]

Male cat

Female cat



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 The cat breeder expected 50% male kittens and 50% female kittens.
Complete the Punnett square in **Figure 3** to show why.

[2 marks]

Figure 3

Female cat		
Male cat		

0

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7

 In the first pregnancy there was one male kitten and three female kittens.
Give the reason why there were **not** two kittens of each sex.

[1 mark]

10

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Turn over ►

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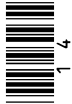
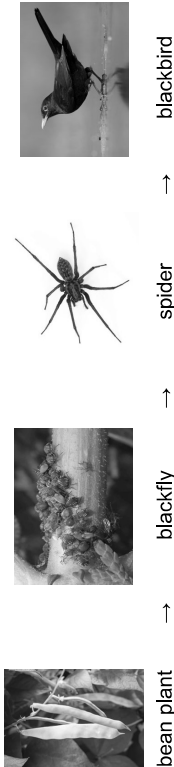


Figure 4 shows a food chain in a garden.

Figure 4



Which term describes the spider in this food chain?

[1 mark]

Tick (✓) **one** box.

- Primary consumer ☐
- Producer ☐
- Secondary consumer ☐
- Tertiary consumer ☐

Many of the spiders in the garden died.

What is likely to happen to the number of blackflies in the garden?

[1 mark]

Tick (✓) **one** box.

- Decrease ☐
- Increase ☐
- Stay the same ☐

Give a reason for your answer to Question 05.2

[1 mark]

Turn over ►

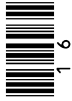
Table 2 shows the estimated biomass of organisms in the garden.

Table 2

Organism	Biomass in g
Bean plants	225
Blackflies	115
Spiders	65
Blackbirds	10

What conclusion can be made about biomass in food chains?

[1 mark]



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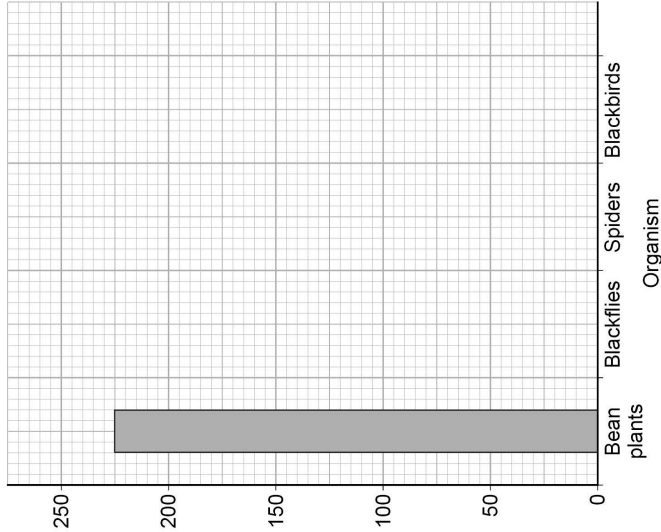
0 5 . 5 Complete Figure 5.

You should:

- label the y-axis
- plot the data from Table 2.

[3 marks]

Figure 5



0 5 . 6 Explain why a garden is **not** a stable community.

[2 marks]

9

Turn over ▶



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ANSWER IN THE SPACES PROVIDED



Some students investigated the effect of drinking caffeine on reaction time.

They used a drink containing 32.25 mg of caffeine per 100 cm³

This is the method used.

1. Divide the students into four groups, **A**, **B**, **C** and **D**.
2. Measure and record the reaction time of each student using the ruler-drop test.
3. Students in:
 - group **A** drink 200 cm³ of water
 - group **B** drink 200 cm³ of the caffeine drink
 - group **C** drink 400 cm³ of the caffeine drink
 - group **D** drink 600 cm³ of the caffeine drink.
4. Repeat step 2 after 15 minutes.

06.1

Describe how to do the ruler-drop test.

[3 marks]

06.1

Table 3 shows the mass of caffeine taken in by each student.

Table 3

Group	Mass of caffeine in mg
A	0
B	64.5
C	129.0
D	X

Calculate value **X**.

[1 mark]

X = _____ mg

Why did group **A** drink water instead of the caffeine drink?

[1 mark]

Question 6 continues on the next page

Turn over ►



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6

 For three students the decrease in reaction time was negative.

Give the reason why the value was negative.

[1 mark]

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7

 What is the range of results for group C?

[1 mark]

0

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8

 Suggest **two** variables that should have been controlled in this investigation.

[2 marks]

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9

 Explain why the ruler-drop test does **not** involve a reflex action.

[2 marks]

Turn over for the next question

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 There has been a rapid increase in the percentage of carbon dioxide in the atmosphere since 1960.

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 Carbon dioxide is a greenhouse gas that contributes to global warming.

Name **one** other greenhouse gas.

[1 mark]

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2

 Global warming causes climate change.

Give **two** effects of climate change.

[2 marks]

1

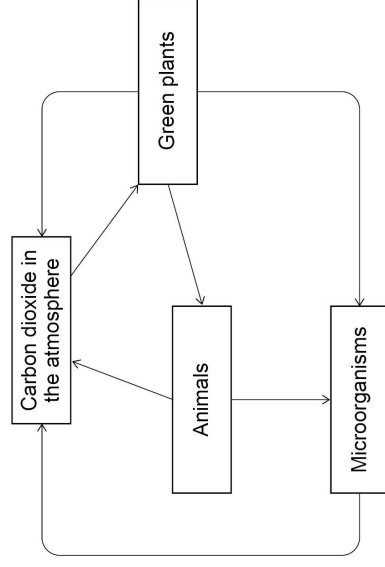
2



Plants take in carbon dioxide from the atmosphere.

Figure 7 shows part of the carbon cycle.

Figure 7



Describe how carbon from the atmosphere is cycled through living organisms.

[illegible]

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END OF QUESTIONS

9

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2 7

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2 8

IB/M/Jun19/8464/B/2F



1 9 6 G 8 4 6 4 / B / 2 F

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	homeostasis		1	AO1 4.5.1
01.2	by hormones by nerve impulses		1 1	AO1 4.5.1 4.5.3.1
01.3	any one from: • temperature • (blood) glucose / sugar (concentration)	ignore water allow pH / ions / salts allow oxygen or carbon dioxide	1	AO1 4.5.1
01.4	2000 – 1400 600 (cm ³)	an answer of 600 (cm ³) scores 2 marks allow 800 – 200 if no mark awarded allow (600 + 1000 + 400 =) 2000 for 1 mark	1 1	AO2 4.5.1
01.5	more sweat (on hot day) cools the body		1 1	AO3 AO2 4.5.1
01.6	$\frac{750}{3000} \times 100$ 25 (%)	an answer of 25 (%) scores 2 marks	1 1	AO2 4.5.1
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	description of any correct method to achieve randomness e.g. random number generator	ignore throwing quadrat / frame	1	AO3 4.7.2.1 10.2.7
02.2	frame / square	allow rectangle ignore internal squares / grid	1	AO1 4.7.2.1 10.2.7
02.3 mark with 2.4 and 2.5	9(,0)		1	AO2 4.7.2.1 10.2.7
02.4 mark with 2.3 and 2.5	15 000 (m ²)		1	AO2 4.7.2.1 10.2.7
02.5 mark with 2.3 and 2.4	9.0 × 15 000 135 000	answer must be consistent with answers in questions 02.3 and 02.4	1 1	AO2 4.7.2.1 10.2.7
02.6	any two from: • herbivores / animals • competing (with other plants) • (human) trampling / playing • (plant) disease / pathogen • mowing	allow being eaten	2	AO1 4.7.1.2 4.7.1.3
02.7	less light / water for photosynthesis or fewer ions / nitrates / minerals (1) so fewer proteins (1)	ignore Sun allow fewer magnesium (ions) allow less nutrients idea of fewer only needed once to gain both marks allow fewer ions / nitrates / minerals / nutrients so less growth for 2 marks	1 1	AO3 AO2 4.7.1.3 4.7.1.2
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	Male palm cockatoos Hornet moth Sea spiders Structural Behavioural Functional additional lines from a box on the left negates the mark for that box 3 lines correct for 2 marks 1 or 2 lines correct for 1 mark		2	AO2 4.7.1.4
03.2	brightly coloured flowers large quantities of pollen		1 1	AO2 4.6.2.2 4.7.1.1 4.7.1.4
03.3	biodiversity		1	AO1 4.7.3.1
03.4	any one from: - to grow crops - to raise cows - to build	allow farming / biofuels or named crop allow houses or building materials allow mining allow paper / fuel	1	AO1 4.7.3.4
03.5	any one from: (new) disease (new) herbivore - climate change or global warming or ice age - volcano / earthquake / tsunami / meteor - lack of pollinators (new) competitor	ignore (new) predator allow drought / flooding allow plant collectors	1	AO1 4.6.3.3
03.6	DNA	allow deoxyribonucleic acid	1	AO1 4.6.1.3
03.7	genome		1	AO1 4.6.1.3
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.						
04.1	mutation		1	AO1 4.6.2.1						
04.2	any three from: - choose the cats with the blue tail - breed these cats together - choose offspring with blue tails and breed these together - repeat until all cats have blue tails	allow choose the cats with the desired characteristic allow breed for several generations	3	AO1 AO2 4.6.2.3						
04.3	they are rare / beautiful / expensive	allow description e.g. the breeder will make (more) profit	1	AO3 4.6.2.3						
04.4	they are produced by inbreeding		1	AO2 4.6.2.3						
04.5	(male cat) XY or YX (female cat) XX	both required for the mark allow lower case letters	1	AO1 4.6.1.6						
04.6	<table><tr><td>(X)</td><td>(X)</td></tr><tr><td>XX</td><td>XX</td></tr><tr><td>XY</td><td>XY</td></tr></table>	(X)	(X)	XX	XX	XY	XY	allow 2 or 3 derivation squares correct for 1 mark	2	AO2 4.6.1.6
(X)	(X)									
XX	XX									
XY	XY									
04.7	random (if X or Y goes into each sperm)	allow it is a chance event allow it is only a probability	1	AO3 4.6.1.6						
Total			10							

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	secondary consumer		1	AO2 4.7.2.1
05.2	increase		1	AO3 4.7.1.1
05.3 view with 05.2	(because) the blackflies are not being eaten	allow idea of other predators (of blackflies) if 'stay the same' selected in question 5.2	1	AO3 4.7.1.1
05.4	biomass decreases as you go up / along the food chain	allow converse	1	AO3 4.7.2.1
05.5	label biomass in g(rams) three bars plotted correctly	allow $\pm$ half small square allow 1 mark for 2 bars correct ignore width and spacing of bars	1 2	AO2 4.7.2.1
05.6	organisms / species are always being added / removed so population sizes not (fairly) constant	allow example of an environmental change e.g. gardener did not water for a month	1 1	AO2 4.7.1.1
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	hold a ruler (just) above the (open) hand of the other student drop the ruler and other student catches it record where the ruler is caught	ignore near the hand do not accept give verbal signal ignore timing	1 1 1	AO1 4.5.2
06.2	193.5		1	AO2 4.5.2
06.3	to compare the effect of no caffeine	allow as a control (group) allow to show the effect of caffeine do not accept control variable	1	AO3 4.5.2
06.4	0.217 (s)	allow any value in the range 0.2150 to 0.2180	1	AO2 4.5.2
06.5	as mass of caffeine increases the decrease / change in reaction time increases	allow converse ignore caffeine decreases reaction time do not accept the greater the increase in reaction time the greater the mass of caffeine	1	AO3 4.5.2
06.6	their reaction time was greater (after the drink)	allow converse allow slower / longer for greater do not accept anomalous result	1	AO3 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	0.01(0) to 0.18(0) or 0.18(0) to 0.01(0) or 0.17(0)	allow values in range 0.008 to 0.012 and 0.178 to 0.182 allow correct calculation from values in range if no values are given, allow answers in the range 0.166 to 0.174 allow $0.01 \leq C \leq 0.18$ ignore units	1	AO2 4.5.2
06.8	any two from: (same range of) age (same) sex / gender (same) height / weight / BMI - all had no caffeine / medication / drugs earlier that day - equally tired or (same) amount of sleep - practice of the ruler drop test - starting point of ruler / hand - same point to take measurement above / below the thumb / finger - using the same hand (same) number of students in each group	allow height ruler dropped from do not accept volume / concentration of caffeine	2	AO3 4.5.2
06.9	not automatic (because) it involves the (conscious part of the) brain	allow it is a voluntary action allow because it involves thinking / decision or conscious action	1 1	AO2 4.5.2
Total			13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	methane	allow CH ₄ or water (vapour) or H ₂ O allow correct example such as CFCs, nitrous oxide, ozone	1	AO1 4.7.3.5
07.2	any two from: - ice caps melting - rise in sea levels - desertification - extreme weather - change in species distribution - change in migration patterns - loss of biodiversity - coral bleaching - crop failure or food insecurity - loss of habitat qualified	ignore references to increased temperature and greenhouse gas / effect allow storms or droughts or flooding allow some species become extinct / endangered allow correct examples such as polar bears losing ice ignore forest fires	2	AO1 4.7.3.5

Question	Answers	Mark	AO/ Spec. Ref
07.3	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO1 4.7.2.2 4.4.1.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1-3	4.4.1.3 4.4.2.1
	No relevant content	0	
	Indicative content Photosynthesis • (carbon dioxide is) taken in through stomata / leaves • (carbon dioxide is) used in photosynthesis • to make glucose / carbohydrate • (glucose used) to make other carbon compounds or named example such as proteins, lipids • (glucose) stored as starch Feeding • plants are eaten / consumed by animals • which use the carbon compounds to make other carbon compounds Decay • when plants / animals die they are decomposed / decayed • by microorganisms • which use the carbon compounds to make other carbon compounds Respiration • plants / animals / microorganisms respire • (respiration) releases carbon dioxide back into the atmosphere Level 2 answers must consider photosynthesis and at least one other process in the carbon cycle. Level 2 answers must include some accurate detail.		
Total		9	



Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Biology Paper 2F

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

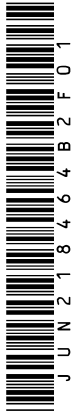
- a ruler
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.



IB/M/Jun21/E7

8464/B/2F

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 A human body cell contains 46 chromosomes.

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1

 How many chromosomes does a human sperm cell contain?

Tick (✓) **one** box.

22		23		46	
----	--	----	--	----	--

[1 mark]

0

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.

2

 Draw **one** line from each word to the meaning of that word.

[3 marks]

Word	Meaning
------	---------

A small ring of DNA in the cytoplasm

Gene

All the genetic material of an organism

Genome

A small section of DNA which codes for a protein

Nucleus

A structure which contains chromosomes

Turn over ►



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Some plants contain a harmful chemical called PTC.

Some people can taste PTC.

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3

 Suggest **one** advantage of being able to taste PTC.

[1 mark]

Only people with a dominant allele **T** can taste PTC.

People with **only** the allele **t** cannot taste PTC.

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4

 A person has the genotype **Tt**.

What word describes the person's genotype?

Tick (✓) **one** box.

Heterozygous

Phenotype

Recessive

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5

 Give the genotype of a person who **cannot** taste PTC.

[1 mark]



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6

 A woman and a man plan to have a child.
The woman and the man both have the genotype Tt.

Complete **Figure 1** to show the possible genotypes of the child.

[2 marks]

Figure 1

		Woman	
Man	T	T	t
	t	T T	

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7

 What is the chance of the child being able to taste PTC?

Use **Figure 1**.

[1 mark]

Tick (✓) **one** box.

☐	☐	☐	☐
25%	50%	75%	100%

10

Turn over for the next question

Turn over ►



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1

 Caffeine is a drug that affects reaction time.
Coffee is a drink that contains caffeine.

Five students investigated the effect of drinking coffee on their reaction time.
Each student sat in front of a computer screen showing a reaction timer.

This is the method used.

1. Press any key on the keyboard when the colour of the screen changes to green.
2. Record the reaction time shown on the computer screen.
3. Drink coffee containing caffeine.
4. Wait 15 minutes then repeat steps 1 and 2.

0

2

.

1

 What is the dependent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

The coffee containing caffeine	☐
The number of students	☐
The reaction time	☐

0

2

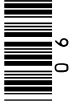
.

2

 Give **two** control variables the students should have used.

[2 marks]

1	
2	



Why did the students wait 15 minutes after drinking the coffee before repeating the test?

[1 mark]

Responding to the colour change of the screen involves a receptor in the student.

Where is the receptor in the student?

[1 mark]

Tick (✓) **one** box.

Ear ☐

Eye ☐

Skin ☐

Responding to the colour change of the screen involves an effector in the student.

What is the effector in the student?

[1 mark]

Tick (✓) **one** box.

Brain ☐

Gland ☐

Muscle ☐

Spinal cord ☐

Turn over ►

Table 1 shows the results.

Table 1

Student	Reaction time in milliseconds	
	Before drinking coffee	After drinking coffee
1	385	255
2	420	291
3	285	265
4	871	259
5	463	247

What is the effect of drinking coffee on reaction time?

Use Table 1.

[1 mark]



0

2

.

7

 Which student had the smallest change in reaction time after drinking coffee? **[1 mark]**

Tick (✓) **one** box.

Student 1	☐
Student 2	☐
Student 3	☐
Student 4	☐
Student 5	☐

0

2

.

8

 The students decided that one of the results was anomalous.
What should the students do with the anomalous result when calculating the mean change in reaction time? **[1 mark]**

9

Turn over for the next question

Turn over ►



0

3

.

1

Figure 2 shows one species of bird on a bird feeder.

Figure 2



The birds use their beaks to reach nuts inside the bird feeder.
Cats sometimes eat the birds.

0

3

.

1

 Give the food chain for the birds, cats and nuts. **[2 marks]**

0

3

.

2

 Which organism in the food chain you gave in Question **03.1** is the primary consumer? **[1 mark]**



0

3

.

3

 Cats are one biotic factor that affects the size of the bird population.

Which **two** of the following are **biotic** factors?

Tick (✓) **two** boxes.

- Food
- Pathogens
- Sunlight
- Temperature
- Water

[2 marks]

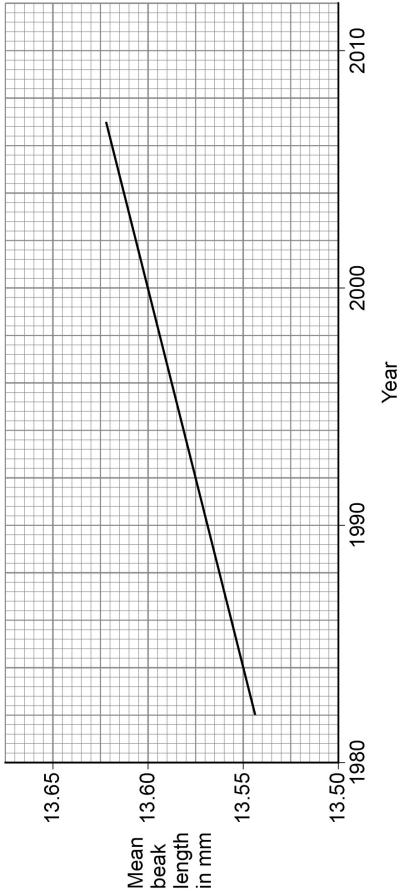
Question 3 continues on the next page

Turn over ▶



Figure 3 shows the mean beak length of this species of bird from 1982 to 2007.

Figure 3



0

3

.

4

What was the mean beak length in 2000?

[1 mark]

Mean beak length = _____ mm

0

3

.

5

What type of adaptation is beak length?

[1 mark]

Tick (✓) **one** box.

- Behavioural
- Chemical
- Structural



Figure 3 shows evidence of evolution in this species of bird.

03.6

Scientists have concluded that beak length in this species of bird is increasing.

Complete the sentences about the evolution of this species of bird.

Choose answers from the box.

[4 marks]

excretion	generation	mutation
reproduction	respiration	variation

The difference in beak length in the bird population is called _____.

A change in a gene affects the beak length.

Change in a gene is called _____.

The birds with the longest beaks get more food.

Getting more food improves a bird's chances of survival and _____.

This process of evolution takes place over more than one _____.

Question 3 continues on the next page

Turn over ▶



Birds of this species:

03.7

- live for about 3 years
- produce up to 24 eggs every year.

Why is evolution easier to study in birds than in humans?

Tick (✓) **one** box.

[1 mark]

Birds breed less frequently than humans.

☐

Birds have a shorter life cycle than humans.

☐

Birds have fewer offspring than humans.

☐

03.8

Bacteria also provide evidence for evolution.

Which statement describes evidence for evolution?

Tick (✓) **one** box.

[1 mark]

Bacteria can become resistant to antibiotics.

☐

Decomposition can be caused by bacteria.

☐

Some bacteria are pathogens.

☐

Do not write
outside the
box

04.1

A fossil was found in rocks. The rocks were formed from mud.

The fossil is of the fungus *Ourasphaira giraldae*.

04.1

What is the genus of the fungus?

Tick (✓) **one** box.

Giraldae

☐

Ourasphaira

☐

Ourasphaira giraldae

☐

[1 mark]

04.2

The mud around the fungus did **not** contain oxygen.

Which process did the mud around the fungus prevent?

Tick (✓) **one** box.

Decay

☐

Geological activity

☐

Photosynthesis

☐

[1 mark]

Question 4 continues on the next page

Turn over ►



Do not write
outside the
box

04.3

The fossilised fungus is estimated to be 890 000 000 years old.

What is 890 000 000 in standard form?

Tick (✓) **one** box.

8.9×10^6

☐

8.9×10^7

☐

8.9×10^8

☐

8.9×10^9

☐

[1 mark]

04.4

Traditional classification divided organisms into kingdoms.

Who developed the traditional system of classification?

Tick (✓) **one** box.

Carl Linnaeus

☐

Carl Woese

☐

Charles Darwin

☐

[1 mark]



Do not write
outside the
box

04.5

More recent classification methods use a three-domain system.

What is the name of the domain the fungus *Ourasphaira giraldae* is classified in?

[1 mark]

Tick (✓) **one** box.

Bacteria ☐

Eukaryota ☐

Plants ☐

04.6

Why has classification changed over time?

[1 mark]

Tick (✓) **one** box.

Electron microscopes allow more detail to be seen inside cells. ☐

Many more types of organisms have become extinct. ☐

Some fossils are buried so deep that they may never be discovered. ☐

04.7

The fungus *Ourasphaira giraldae* is now extinct.

Give **two** possible causes of extinction.

[2 marks]

1

2

8

Turn over ▶

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outside the
box

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ANSWER IN THE SPACES PROVIDED



Increased carbon dioxide levels in the atmosphere contribute to climate change.

0 5 . 1

Give **one** way deforestation can increase carbon dioxide levels in the atmosphere. [1 mark]

Name **one** other gas that contributes to climate change.

0 5 . 2

Do **not** refer to carbon dioxide in your answer.

[1 mark]

Meat is produced for humans to eat.

0 5 . 3

Give **two** ways the production of meat releases carbon dioxide.

[2 marks]

1

2

Question 5 continues on the next page

Turn over ►

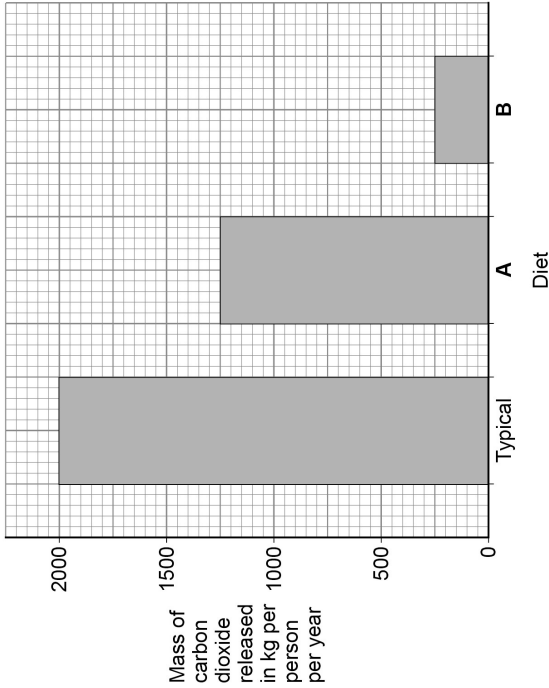


The mass of carbon dioxide released during the production of food varies depending on the type of food.

0 5 . 4

Figure 4 shows the mass of carbon dioxide released as a result of three different diets.

Figure 4



Compare the mass of carbon dioxide released as a result of the three diets shown in **Figure 4**.

Use data from **Figure 4** in your answer.

[4 marks]

8

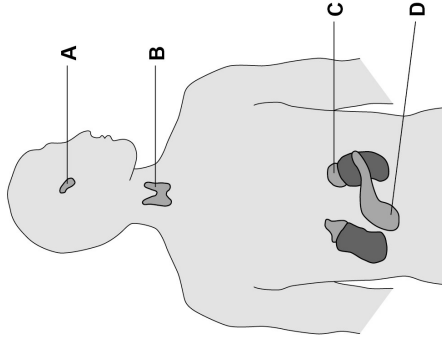
Turn over for the next question

Turn over ►



Figure 5 shows glands in the human body.

Figure 5



Which organ system includes the glands shown in **Figure 5**?

[1 mark]

06.1

Which gland produces insulin?

[1 mark]

Tick (✓) **one** box.

A

B

C

D

Which gland produces hormones that stimulate the other glands to produce hormones?

[1 mark]

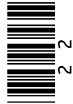
Tick (✓) **one** box.

A

B

C

D



0	6	4
---	---	---

How do hormones travel from one gland to another gland?

[1 mark]

5	.	6	0
---	---	---	---

Name **two** glands involved in human reproduction.

Do not refer to glands shown on **Figure 5** in your answer.

[2 marks]

6	6	.	0
---	---	---	---

Ovulation test kits can help women know when they are most fertile.

Ovulation test kits detect the increase in the hormone that stimulates ovulation.

Which hormone is detected by ovulation test kits?

[1 mark]

Tick (✓) **one** box.

10

Follicle stimulating hormone (FSH)

1

Luteinising hormone (LH)

Oestrogen

Progesterone

Turn over ►



0	6	7
---	---	---

A new contraceptive drug for men is being tested.

The drug:

- is given in one injection
- stops sperm being able to fertilise eggs
- is effective for up to 13 years.

Evaluate the use of the new drug compared with existing contraceptive methods.

[6 marks]

[illegible]

Turn over for the next question

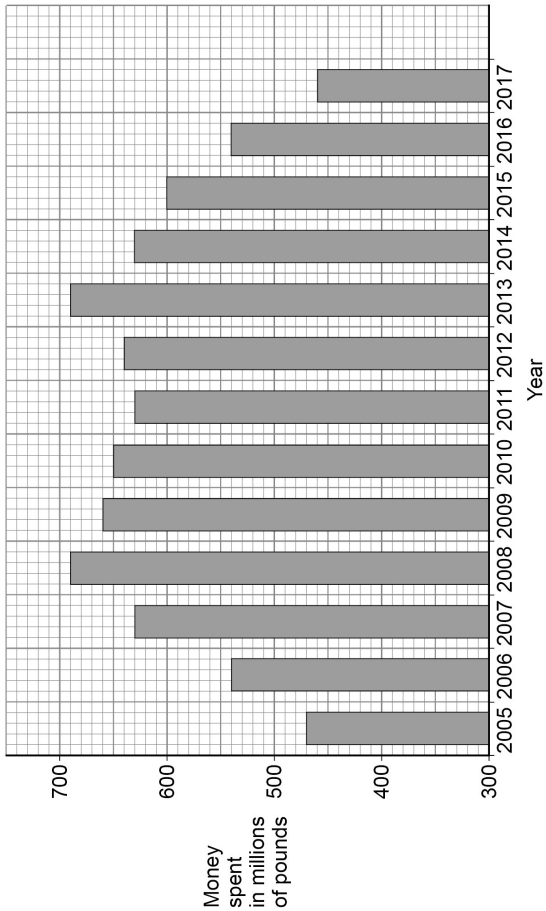
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ANSWER IN THE SPACES PROVIDED

Turn over ►



Figure 6 shows the money spent on conserving biodiversity in the UK by the government.

Figure 6



0 7 1

Describe the trends in the money spent on conserving biodiversity from 2005 to 2011.

Use data from **Figure 6** in your answer.

[2 marks]



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outside the
box

07.2

Calculate the percentage decrease in the money spent on conserving biodiversity from 2013 to 2017.

Use the equation:

percentage decrease = $\frac{\text{change in money spent from 2013 to 2017}}{\text{money spent in 2013}} \times 100$

Give your answer to 2 significant figures.

[3 marks]

Percentage decrease (2 significant figures) = _____ %

07.3

Conservation of peat bogs can help maintain biodiversity.

Give **two** uses of peat taken from peat bogs.

[2 marks]

1

2

Question 7 continues on the next page

Turn over ►



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box

07.4

Describe **two** ways to **increase** biodiversity in the UK.

Do **not** refer to money spent or to peat in your answer.

[2 marks]

1

2

END OF QUESTIONS



There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

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outside the
box*

Additional page, if required.
Write the question numbers in the left-hand margin.

Question
number

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outside the
box*



[illegible][illegible]

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	23		1	AO1 4.6.1.2
01.2	Word Gene Genome Nucleus Meaning A small ring of DNA in the cytoplasm All the genetic material of an organism A small section of DNA which codes for a protein A structure which contains chromosomes additional line from a box on the left negates the mark for that box	1 1 1	AO1 4.6.1.4 4.6.1.3	
01.3	any one from: - to survive - so you do not eat the plants - to stop you being harmed / poisoned	allow to protect them allow stop you getting ill / dying	1	AO2 4.7.1.4
01.4	heterozygous		1	AO2 4.6.1.4
01.5	tt	allow homozygous recessive	1	AO2 4.6.1.4

01.6	allow 1 or 2 genotypes correct for 1 mark <table><tr><td></td><td colspan="2">Woman</td><td></td></tr><tr><td></td><td>T</td><td>t</td><td></td></tr><tr><td></td><td>T T</td><td>Tt</td><td></td></tr><tr><td></td><td>Tt</td><td>tt</td><td></td></tr><tr><td>Man</td><td>T</td><td>t</td><td></td></tr></table>			Woman				T	t			T T	Tt			Tt	tt		Man	T	t		2	AO2 4.6.1.4
	Woman																							
	T	t																						
	T T	Tt																						
	Tt	tt																						
Man	T	t																						
01.7	75%	allow only a probability consistent with student's derivation if no answer to question 01.6 allow 75%	1	AO3 4.6.1.4																				
Total			10																					

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the reaction time		1	AO1 4.5.2 RPA6
02.2	any two from: • age • sex • previous intake of caffeine / coffee that day • usual intake of caffeine / coffee (on previous days) • concentration of caffeine / coffee • volume of caffeine / coffee • time of day • amount / length of sleep • health • body mass • same / type of reaction time program / software • same keyboard • prior experience with the reaction timer	allow gender] if neither given allow amount / mass of caffeine / drink or type / brand of coffee for 1 mark allow fatigue allow other drugs taken allow (body) weight	2	AO1 4.5.2 RPA6
02.3	any one from: • (time) for the coffee / caffeine to work • (time) for coffee / caffeine to be absorbed • (time) for caffeine to reach the brain • (time) for coffee / caffeine to get round the body	allow (time) for the coffee / caffeine to be digested allow (time) for coffee to reach the brain	1	AO3 4.5.2 RPA6

02.4	eye		1	AO2 4.5.2 RPA6
02.5	muscle		1	AO2 4.5.2 RPA6
02.6	(reaction time is) decreased	allow reaction time is shorter allow reactions are faster allow (reaction) time is quicker	1	AO2 4.5.2 RPA6
02.7	student 3		1	AO3 4.5.2 RPA6
02.8	leave it out (and divide sum of the others by 4) or divide the sum of the others by 4	ignore repeat the test	1	AO3 4.5.2 RPA6
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	nut(s) → bird(s) → cat(s)	allow 1 mark for organisms in correct order (left to right) but arrows incorrect or missing allow 2 marks for cat(s) ← bird(s) ← nut(s) do not accept cat(s)bird(s) nut(s) do not accept cat(s) → bird(s) → nut(s)	2	AO2 4.7.2.1
03.2	answer must be consistent with food chain given in question 03.1	if no answer to question 03.1 allow bird(s)	1	AO2 4.7.2.1
03.3	food pathogens		1 1	AO1 4.7.1.3
03.4	13.60 (mm)	allow 13.6 (mm)	1	AO2 4.6.2.2
03.5	structural		1	AO2 4.7.1.4
03.6	variation mutation reproduction generation	must be in this order	1 1 1 1	AO2 4.6.2.2

03.7	birds have a shorter life cycle than humans	1	AO3 4.6.3.1 4.6.3.4
03.8	bacteria can become resistant to antibiotics	1	AO1 4.6.3.1 4.6.3.4
Total		13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Oursaphaira		1	AO2 4.6.4
04.2	decay		1	AO2 4.6.3.2
04.3	8.9×10^8 years old		1	AO2 4.6.3.2
04.4	Carl Linnaeus		1	AO1 4.6.4
04.5	eukaryota		1	AO1 4.6.4
04.6	electron microscopes allow more detail to be seen inside cells		1	AO1 4.6.4

04.7	any two from: - drought - ice age - global warming - volcanic activity - asteroid collision (new) predators (new) disease / pathogen - competition for food - competition for mates - lack of habitat or habitat change	if none of these, allow climate change for 1 mark ignore weather if neither of these, allow catastrophic event or natural disaster for 1 mark allow named example allow hunters allow named example allow lack of food allow lack of mates ignore competition unqualified ignore environment change ignore isolation ignore pollution	2	AO1 4.6.3.3
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any one from: - less / decreased / reduced photosynthesis (more) burning / combustion (of wood) - decomposition / decay (of wood)	allow burning / combustion (of fossil fuel in machinery)	1	AO1 4.7.3.4
05.2	methane	allow water (vapour) allow other correct greenhouse gases eg nitrous oxide(s), nitrogen oxide, ozone, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride	1	AO1 4.7.3.5
05.3	any two from: - respiration (by animals) - fuel burnt / used for transport - fuel burnt / used to heat / light buildings (in intensive farming) - fuel burnt / used to process / cook (meat)	ignore burning / combustion unqualified	2	AO2 4.7.3.5 4.7.3.4 4.7.2.2

Question	Answers	Mark	AO / Spec. Ref.
05.4	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.	3–4	AO3 4.7.3.5
	Level 1: Relevant features are identified and differences noted.	1–2	
	No relevant content	0	
	Indicative content General - all diets cause carbon dioxide to be released Typical diet - releases more carbon dioxide than diet A and B - releases 750 (kg per person per year) more carbon dioxide than diet A - releases 1750 (kg per person per year) more carbon dioxide than diet B Diet A - releases less carbon dioxide than typical diet - releases more carbon dioxide than diet B - releases 1000 (kg per person per year) more carbon dioxide than diet B comparisons can be given in terms of correct data or calculations or proportions for example, typical diet releases 8 times more carbon dioxide than diet B For Level 2 both comparison of all three diets and quoting data or calculation are required.		
Total		8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	endocrine (system)	ignore hormonal (system)	1	AO1 4.5.3.1
06.2	D		1	AO1 4.5.3.1 4.5.3.2
06.3	A		1	AO1 4.5.3.1
06.4	(in / through / via) blood	allow (in / through / via) bloodstream allow (in / through / via) plasma allow (in / through / via) blood vessels or named blood vessel	1	AO1 4.5.3.1
06.5	ovary / ovaries testis / testes	in either order allow testicle(s) allow placenta if no other mark awarded allow gonad(s) for 1 mark	1 1	AO1 4.5.3.1 4.5.3.3
06.6	lutinising hormone (LH)		1	AO2 4.5.3.3

Question	Answers	Mark	AO / Spec. Ref.
06.7	Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.5.3.4 4.3.1.9
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content Advantages - non-permanent like condom / diaphragm / IUDs / spermicides / abstinence or unlike surgical sterilisation - longer lasting than condom / diaphragm / IUDs / spermicides - no need to remember unlike oral contraceptive - one injection rather than surgery for sterilisation - surgery (for sterilisation) has risks, for example, infection - no other method of long-lasting contraception (rather than sterilisation) relies on men Disadvantages - no protection from sexually transmitted diseases unlike barrier methods or named barrier method - not as long lasting as (surgical) sterilisation - at clinical / drug trial stage, so unknown side effects - at clinical / drug trial stage, so unknown efficacy - do not know how long it will last (as info only states 'up to 13 years') - can stop taking a pill or using a condom if you change your mind / want to get pregnant, whereas have to wait 13 years with the injection (minor) risk of infection posed with an injection compared to no risk with the oral contraceptive For Level 3 references to advantages and disadvantages of the new drug compared to named existing methods are required.		
Total		13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	increases (from 2005) to 690 million or increases to 2008 decreases (from 2008) to 630 million	allow peak in 2008 allow peak at 690 million if no other mark awarded, allow overall increase from 470 million or overall increase to 630 million or (overall) increase of 160 million or increases to 690 and decreases to 630 (without units) for 1 mark	1 1	AO2 4.7.3.1 4.7.3.6
07.2	$\frac{690(\text{million}) - 460(\text{million})}{690(\text{million})} \times 100$ 33.3 (%) 33 (%)	allow $\frac{230(\text{million})}{690(\text{million})} \times 100$ ignore number of decimal places allow calculated value from incorrect graph readings allow calculated answer correctly given to 2 significant figures	1 1 1	AO2 4.7.3.1 4.7.3.6
07.3	compost burning or as a fuel	allow improving soil (texture / drainage / quality) ignore farming unqualified ignore as fertiliser	1 1	AO1 4.7.3.3

07.4	any two from: • reduce pollution • plant trees • breeding programmes (for endangered species) • rewilding / regeneration of habitats / hedgerows / meadows • (reintroducing) wider field margins • plant a variety of crops • reduce use of pesticide / herbicide / insecticide	ignore references to carbon dioxide, greenhouse gases or global warming allow reduce named example of pollution, eg smoke or acidic gases or sewage or fertiliser allow reduce toxic waste dumping allow afforestation allow reforestation ignore reduce / stop deforestation allow planting wild flower seeds allow reduce monoculture ignore recycling ignore protect / conserve habitat(s) / areas	2	AO1 4.7.3.1 4.7.3.2 4.7.3.4 4.7.3.6
Total			9	

Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier
Biology Paper 2F

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

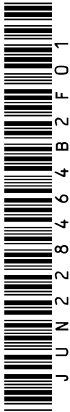
- a ruler
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.



0

1

This question is about genetics.

0

1

.

1

Crop plants are genetically modified (GM) for useful characteristics.

Which useful characteristic are crops genetically modified for?

Tick (✓) **one** box.

Fewer roots

Larger yields

Smaller fruits

[1 mark]

0

1

.

2

What is **one** concern about GM crops?

Tick (✓) **one** box.

GM crops will add to global warming.

GM crops will cause air pollution.

GM crops will harm wildlife.

GM crops will produce too much food.

[1 mark]

0

1

.

3

Some inherited disorders are caused by a faulty piece of DNA.

What is the name of a piece of DNA that codes for a characteristic?

[1 mark]



Do not write
outside the
box

0

1

.

4

 DNA contains a code for making substances in the cell.
What type of substance is made using the DNA code?

[1 mark]

Tick (✓) **one** box.

- Fat
- Protein
- Starch
- Sugar

Cystic fibrosis (CF) is an inherited disorder.
The allele for having CF is recessive (**h**).
The allele for **not** having CF is dominant (**H**).

0

1

.

5

 What is a recessive allele?

[1 mark]

Tick (✓) **one** box.

- An allele that is always expressed.
- An allele that is expressed if only one copy is present.
- An allele that is only expressed if two copies are present.

Question 1 continues on the next page

Turn over ►



Do not write
outside the
box

A man and a woman do **not** have CF. The man has the alleles **Hh**.

0

1

.

6

 What word describes the alleles of the man?

[1 mark]

Tick (✓) **one** box.

- Heterozygous
- Homozygous
- Phenotype

0

1

.

7

 The man and the woman want to have a child.

[3 marks]

Complete **Figure 1** to show the possible genotypes of the child.
Draw a ring around the genotype of a child who will have CF.

Figure 1

Woman			
	H	h	Man
H			
h		hh	



0	1	8
---	---	---

What is the chance that a child of the man and the woman will have CF?

[1 mark]

Tick (✓) one box.

25%

10

50%

75%

1

100%

1

0	1	9
---	---	---

The woman is pregnant.

The woman can have embryo screening to find out if the child will have CF.

Suggest **one** reason why the woman might **not** want to have embryo screening.

[1 mark]

11

Turn over for the next question

Turn over ►



0	2
---	---

On a school field:

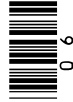
Students investigated the effect of water in the soil on the number of buttercup plants growing in each area.

On the field the students marked out:

0	2	.	1
---	---	---	---

Describe how a quadrat can be used to measure the size of the buttercup population on the wet soil area.

[4 marks]



What type of factor is water in the soil?

0

2

.

2

[1 mark]

Tick (✓) **one** box.

- A biotic factor

☐
- A control factor

☐
- An abiotic factor

☐

Give **two** factors which might affect the number of buttercups growing on the school field.

0

2

.

3

[2 marks]

Do **not** refer to water in your answer.

- 1
- 2

Complete the sentence.

0

2

.

4

Choose the answer from the box.

[1 mark]

a control

the dependent

the independent

In this investigation the number of buttercups in each quadrat was _____ variable.

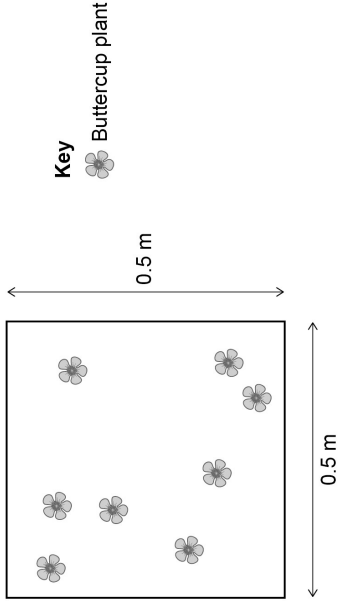
Question 2 continues on the next page

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Figure 2 shows a quadrat on an area of the school field.

Figure 2



Calculate the area of the quadrat.

0

2

.

5

[1 mark]

Area of the quadrat = _____ m²

The mean number of buttercups in one quadrat was 8

0

2

.

6

Calculate the number of buttercups per m²

Use your answer from Question 02.5

[2 marks]

Number of buttercups = _____ per m²



Question 2 continues on the next page

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In a laboratory another group of students investigated the effect of soil acidity on the growth of beans.

This is the method used.

1. Put soil with a neutral pH in two large boxes.
2. Add acid to the soil in one box.
3. Plant some bean seeds in each box.
4. Water the seeds over 3 weeks.
5. After 3 weeks, measure the height of the bean plants in each box.
6. Calculate the mean height of bean plants in each box.

0 2 . 7

Give **two** improvements the students could make to the method to give more valid results.

[2 marks]

1

2

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The students then carried out a valid investigation.

Table 1 shows the students' results.

Table 1

Bean plant	Height of bean plants in cm	
	Acid soil	Neutral soil
1	8	11
2	6	12
3	4	11
4	10	17
5	7	19
Mean	7	X

02.8

Calculate mean value X in Table 1.

[2 marks]

X = _____ cm

02.9

What conclusion can the students make about the effect of acid soil on the growth of bean plants?

[1 mark]

16

Turn over ▶



The theory of evolution by natural selection was suggested by Charles Darwin in 1859.

Evidence from fossils supports Darwin's theory.

03.1

What evidence supports the theory of evolution by natural selection?

Tick (✓) **one** box.

Knowledge of how DNA controls inheritance

Knowledge of how the dinosaurs became extinct

Knowledge of how the Earth was formed

Knowledge of what causes global warming

[1 mark]



03.2

Figure 3 shows a fossil fly preserved in amber.
The fossil formed when the amber solidified with the fly trapped inside.

Figure 3



Why has the fly been preserved?

Tick (✓) one box.

- The amber has been kept at a constant temperature. ☐
- The fly was soft-bodied. ☐
- There was no oxygen in the amber. ☐

[1 mark]

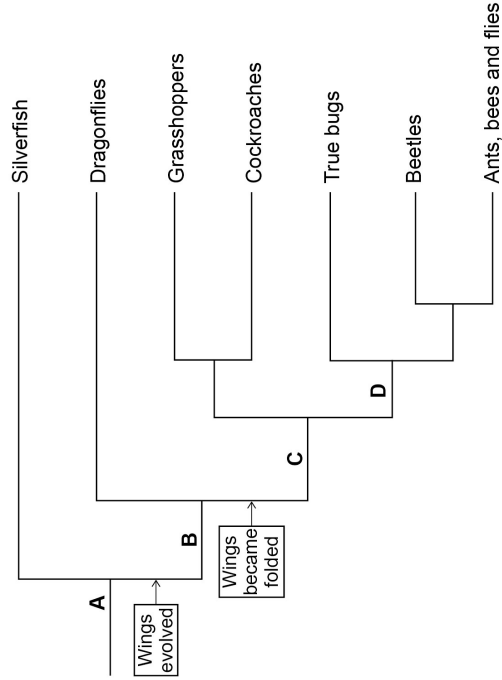
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Figure 4 shows a simplified evolutionary tree for the insect group of animals.

Figure 4

Present day insects



Which present day insect evolved first?

[1 mark]

03.3

Animals A, B, C and D were ancestors of present day insects.

Which animal is the most recent ancestor of both grasshoppers and beetles?

[1 mark]

Tick (✓) one box.

- A ☐ B ☐ C ☐ D ☐

Name the group of present day insects which have wings which do not fold.

[1 mark]

03.5



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03.6

The house fly has the binomial name *Musca domestica*.

Table 2 shows part of the classification for the house fly.

Table 2

Classification group	Name
Kingdom	
Phylum	arthropoda
Class	
Order	diptera
Family	muscidae
Genus	
Species	

Complete Table 2.

Choose answers from the box.

[3 marks]

animalia	domestica	Musca	insecta
----------	-----------	-------	---------

Question 3 continues on the next page

Turn over ▶



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03.7

Carl Woese proposed the 'three-domain system' of classification.

Which domain are insects in?

[1 mark]

Tick (✓) **one** box.

Archaea	☐
Eukaryota	☐
Prokaryota	☐

9



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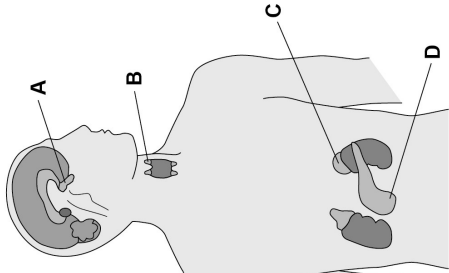


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The endocrine system is made up of glands which secrete hormones.

Figure 5 shows the position of endocrine glands in the human body.

Figure 5



04.1

Which letter shows the pancreas?

[1 mark]

Tick (✓) **one** box.

A	☐	B	☐	C	☐	D	☐
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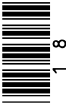
04.2

Which letter shows the thyroid gland?

[1 mark]

Tick (✓) **one** box.

A	☐	B	☐	C	☐	D	☐
---	--------------------------	---	--------------------------	---	--------------------------	---	--------------------------



04.3

Hormones travel from the gland where they are made to the target organ where they have an effect.

How do hormones travel from the gland to the target organ?

[1 mark]

When blood glucose concentration becomes too high, hormone **X** from the pancreas causes a decrease in the glucose concentration.

04.4

Name hormone **X**.

[1 mark]

04.5

In what **two** ways does hormone **X** cause a decrease in blood glucose concentration?

Tick (✓) **two** boxes.

[2 marks]

Glucose is broken down.

☐

Glucose is converted to glycogen.

☐

Glucose is excreted by the kidneys.

☐

Glucose moves from the blood into the cells.

☐

Glucose moves into the small intestine.

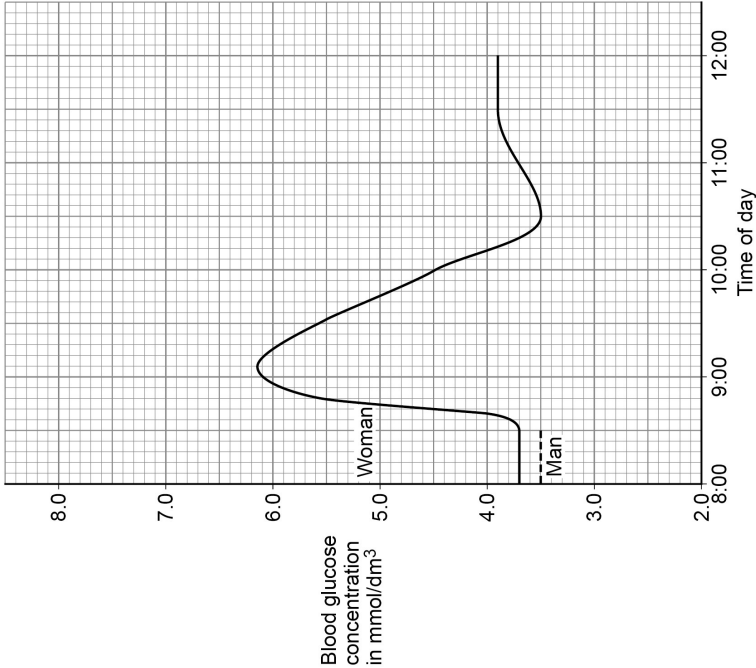
☐

Turn over ▶



Figure 6 shows the blood glucose concentration in a woman.

Figure 6



04.6

Suggest what time of day the woman ate her breakfast of sugar-coated cereal.

[1 mark]

Time of day =



The man in **Figure 6** has Type 2 diabetes but he has **not** been treated.

0 4 . 7

The man ate:

- the same type and amount of breakfast cereal as the woman
- at the same time as the woman.

Suggest what his blood glucose concentration would be at 9:00

[1 mark]

Blood glucose concentration = _____ mmol/dm³

0 4 . 8

The man:

- is an obese office worker
- does not exercise
- eats sugary snacks at his desk.

Give **two** lifestyle changes a doctor might recommend to the man to help him control his diabetes.

[2 marks]

1 _____

2 _____

Describe how a **low** blood glucose concentration would lead to a person feeling weak.

[2 marks]

12

Turn over ►



IB/M/Jun22/8464/B/2F

This question is about the cycling of water and carbon in ecosystems.

0 5

0 5 . 1

Which reaction produces water?

[1 mark]

Tick (✓) **one** box.

Aerobic respiration

☐

Anaerobic respiration

☐

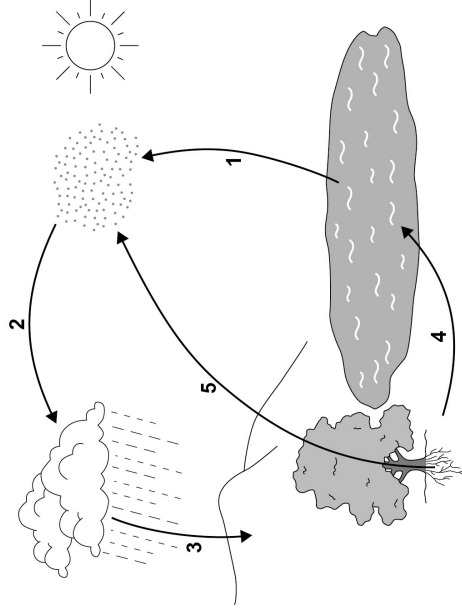
Photosynthesis

☐

The water cycle provides water for plants and animals on land before the water goes into lakes and seas.

Figure 7 represents the water cycle.

Figure 7



IB/M/Jun22/8464/B/2F

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0

5

.

2

 Name the processes 1 to 5 shown on **Figure 7**.

[5 marks]

- 1
- 2
- 3
- 4
- 5

0

5

.

3

 In 2007 the population of the world was 6 000 000 000
A study found that 4.5% of the population had severe water shortage.

Calculate how many people had severe water shortage.
Give your answer in standard form.

[3 marks]

Number of people (in standard form) =

Question 5 continues on the next page

Turn over ►



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box

0

5

.

4

 Why do more people have severe water shortage now than in 2007?

[2 marks]

Tick (✓) **two** boxes.

- Climate change has increased the area of deserts.
- Each person drinks less water.
- More water is used to grow crops.
- Sea levels have risen because the ice caps are melting.
- Some countries have built de-salting factories for seawater.

Leaves on a tree contain carbon compounds.
In autumn the leaves fall to the ground.

0

5

.

5

 Microorganisms in the soil recycle carbon from the leaves so that the carbon is used for new plant growth.

Explain how.

[4 marks]



0	5	6
---	---	---

What is **one** benefit of fallen leaves for living plants?

Tick (✓) **one** box.

Energy is released for living plants.

1

Insect pests in the soil are killed.

1

Nitrates are released into the soil.



Oxygen is supplied to root cells.



Turn over for the next question

16

6	0
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Water pollution is a problem for humans and wildlife.

Explain how human activities are polluting rivers, lakes and seas.

[6 marks]

[illegible]

END OF QUESTIONS

6

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Additional page, if required.
Write the question numbers in the left-hand margin.

Question number

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IB/M/Jun22/8464/B/2F



Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	any one from: - it might harm the embryo / baby / mother - it might cause a miscarriage - they do not want to make a choice about having an abortion - it is against their religious beliefs	ignore cost ignore harmful / dangerous unqualified allow against their religion	1	AO3 4.6.1.4 4.6.1.5

Total Question 1

11

Question	Answers	Mark	AO / Spec. Ref.
02.1	Level 2: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1 4.7.2.1 RPA 7
	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 - place quadrat randomly / systematically - description of how randomness is achieved or - description of how systematic placement is achieved - count number of buttercups in quadrat - record number - repeat quadrat (in another location in the same wet soil area) (repeat) at least 5 times - calculate a mean number of buttercups per quadrat - the area of the wet soil area is 100 m² - estimate the buttercup population using the area of the quadrat		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	an abiotic factor		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	any two from: • light (intensity) • temperature • competition • herbivores / grazing • pollinators • trampling / mowing • wind (direction / strength) • soil pH or soil type • ions / minerals / nutrients in the soil • pathogens • herbicides	ignore rain / water / weather allow shade ignore sun allow other plants growing there allow pests or named pest allow insects or named pollinator allow named mineral allow infection ignore disease unqualified allow pesticides	2	AO2 4.7.1.2 4.7.1.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(the) dependent		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5 mark with 02.6	0.25 (m ²)		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6 mark with 02.5	8 ÷ 0.25 32 (buttercups per m ²)	allow ecf from question 02.5 allow 8 × 4	1 1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any two from: • repeat • same volume of water • same mass / volume of soil • more acidity / pH levels • same number of bean seeds • same spacing / depth of seeds • same species / variety / type of bean seeds • same size boxes • same light (intensity) • same temperature	allow same amount of water allow same amount of soil } if neither marking point awarded, allow put them in the same place eg greenhouse	2	AO3 4.7.1.2 RPA7

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	$\frac{11+12+11+17+19}{5}$ or $\frac{70}{5}$ 14 (cm)		1	AO2 4.7.1.2 RPA7
			1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	bean plants grow less well (in acid soil) or bean plants are shorter (in acid soil)	allow converse	1	AO3 4.7.1.2 RPA7

Total Question 2	16
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	knowledge of how DNA controls inheritance		1	AO1 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	there was no oxygen in the amber		1	AO2 4.6.3.1 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	silverfish	ignore A	1	AO3 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	C		1	AO2 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	dragonflies	ignore A / B	1	AO3 4.6.3.2

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6		all correct for 3 marks allow 2 marks for 2 or 3 correct allow 1 mark for 1 correct allow animals allow insects ignore italics and upper / lower case letters	3	AO2 4.6.4
	animalia			
	insecta			
	Musca			
	domestica			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	eukaryota		1	AO2 4.6.4

Total Question 3

	9
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	D		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	B		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(in / through / via) blood(stream)	allow (in / through / via) plasma allow (in / through / via) blood vessels allow (in / through / via) arteries / veins / capillaries	1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	insulin		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	glucose is converted to glycogen		1	AO1 4.5.3.2
	glucose moves from the blood into the cells		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	8:30 (am)	allow 8:15 – 8:35 (am) allow time written in words	1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	any value in the range ≥ 6.5 to ≤ 20 (mmol/dm ³)		1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	any two from: - low carbohydrate diet - exercise (regime) - lose body mass	allow low calorie / fat / sugar diet allow eat fewer (sugary) snacks allow description of exercise allow lose weight allow (metformin) tablets to reduce blood glucose	2	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.9	(less) respiration (so) less energy released / transferred or less muscle contraction	do not accept energy produced / made / created	1 1	AO1 4.5.3.2 AO2 4.4.2.1

Total Question 4	12
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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	aerobic respiration		1	AO1 4.4.2.1 4.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	1. evaporation	allow evaporate(s) / evaporating	1	AO1 4.7.2.2
	2. condensation	allow condense(s) / condensing	1	
	3. precipitation	allow rain(ing) / rainfall allow named precipitation ignore precipitates	1	
	4. draining / drainage	allow run-off / percolation / infiltration allow groundwater / underground flow	1	
	5. transpiration		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$6\,000\,000\,000 \times \frac{4.5}{100}$	allow $6\,000\,000\,000 \times 0.045$	1	AO2 4.7.2.2
	270 000 000		1	
	2.7×10^8		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	climate change has increased the area of deserts		1	AO3 4.7.2.2
	more water is used to grow crops		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	decay / decomposition of leaves	allow leaves are broken down ignore aerobic / anaerobic ignore respiration by worms / detritivores / insects / leaves	1	AO2
	respiration (by microorganisms / decomposers)		1	AO1
	respiration releases carbon dioxide or microorganisms release carbon dioxide		1	AO1
	carbon dioxide is used in photosynthesis (for new plant growth)		1	AO1 4.7.2.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	nitrates are released into the soil		1	AO2 4.7.2.2 4.4.1.3

Total Question 5	16
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Question 6

Question	Answers	Mark	AO / Spec. Ref.
06	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	AO3 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	

06 cont.	Indicative content Increase in world population - sewage (released into rivers / lakes / seas) - causes algae to grow - algae block light - causing plants to die and decompose - leading to lack of oxygen in the water (sewage) could contain pathogens Need to produce more food for world's population - fertilisers (used on farms to increase crop yield, leach into rivers / lakes / seas) - causes algae to grow - leading to lack of oxygen in the water - herbicides / pesticides (used on farms to increase crop yield, run into rivers / lakes / seas) - build-up in food chains Increasing demand for products / energy - toxic chemicals or named toxic chemicals (run into rivers / lakes / seas) - from factories / industry or power stations - build-up in food chains - chemicals may cause mutations or chemicals may act as hormones - radiation leaks from nuclear (power stations) (oil) spills from extraction / rigs / tankers in oceans - acid rain formation - acidification of lakes - increased carbon dioxide emissions causes acidification of oceans Buildup of waste products - litter / plastics (thrown in rivers / lakes / seas) - example of effect on living organisms, such as plastics consumed or plastics build up in stomach or plastics get stuck around beaks (most) plastics are not biodegradable - build-up of microplastics in water animals Consequence of the above is that organisms living in rivers / lakes / seas are harmed / die For Level 3 students need to consider different types of pollution	4.7.3.2 4.7.2.1
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Total Question 6	6
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