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Introduction

These exemplar answers have been chosen from the summer 2018 examination series.

OCR is open to a wide variety of approaches and all answers are considered on their merits. These exemplars, therefore, should not be seen as the only way to answer questions but do illustrate how the mark scheme has been applied.

Please always refer to the specification https://www.ocr.org.uk/qualifications/gcse/gateway-science-suite-combined-science-a-j250-from-2016/ for full details of the assessment for this qualification. These exemplar answers should also be read in conjunction with the sample assessment materials and the June 2018 Examiners’ report or Report to Centres available from Interchange https://interchange.ocr.org.uk/Home.mvc/index

The question paper, mark scheme and any resource booklet(s) will be available on the OCR website from summer 2019. Until then, they are available on OCR Interchange (school exams officers will have a login for this and are able to set up teachers with specific logins – see the following link for further information http://www.ocr.org.uk/administration/support-and-tools/interchange/managing-user-accounts/).

It is important to note that approaches to question setting and marking will remain consistent. At the same time OCR reviews all its qualifications annually and may make small adjustments to improve the performance of its assessments. We will let you know of any substantive changes.
Question 1

Exemplar 1

1. Look at the diagram of the carbon cycle.

Which process is shown by the arrow labelled X?

A. Decomposition
B. Evaporation
C. Photosynthesis
D. Respiration

Your answer: D

Examiner commentary

This question proved to be one of the more challenging multiple-choice questions. Many candidates incorrectly answered C for photosynthesis, as they did not look carefully at the direction of the arrow.
Question 4

**Exemplar 1**

1 mark

4 Human waste can contain bacteria called *E. coli*. Human waste is found in sewage.

Which zone of the river will have the **highest** levels of *E. coli*?

**Your answer**

C

**Examiner commentary**

An accessible question with the majority of candidates selecting the correct answer.
Question 6

Exemplar 1

6 The more salt you eat, the more salt will be found in the urine you make...

The graph shows the relationship between the amount of salt in urine and blood pressure.

Which statement is supported by the data?

A High blood pressure leads to an increased risk of developing heart disease.

B Less salt in the diet can lead to higher blood pressure.

C Less salt in the diet can lead to lower blood pressure.

D Low blood pressure leads to an increased risk of developing heart disease.

Your answer [C] [1]

Examiner commentary

Correctly answered by many candidates with a small number incorrectly assuming that the graph directly supported a link between high blood pressure and heart disease.
Question 7

Exemplar 1

7 Sperm are made by meiosis.

Look at the diagram of meiosis.

At which stage A, B, C or D is the chromosome number halved?

Your answer

Examiner commentary

This proved to be the most accessible multiple choice question with the majority of candidates correctly interpreting the diagram to work out the number of chromosomes.
Question 9

Exemplar 1

9 Genes control eye colour.

The allele for brown eyes (B) is **dominant** over the allele for blue eyes (b).

Look at the genetic cross.

\[ Bb \times BB \]

Choose the possible outcome of offspring from this cross.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Offspring genotype ratio</th>
<th>Phenotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>A All BB</td>
<td>1:0</td>
<td>All brown eyes</td>
</tr>
<tr>
<td>B BB and Bb:</td>
<td>1:1</td>
<td>All brown eyes</td>
</tr>
<tr>
<td>C BB and Bb:</td>
<td>3:1</td>
<td>Brown eyes and blue eyes</td>
</tr>
<tr>
<td>D Bb and bb</td>
<td>3:1</td>
<td>Brown eyes and blue eyes</td>
</tr>
</tbody>
</table>

Your answer [B] [1]

Examiner commentary

This proved to be the most challenging multiple choice question. Candidates clearly found the genetic cross difficult to construct and incorrectly chose one of the 3:1 ratios, as they were familiar.
Question 10

Exemplar 1 1 mark

10 Phylogeny is the study of evolutionary links.

Which of the following is important to make molecular phylogenetic links?

A Behavioural features
B DNA sequencing
C Habitat analysis
D Phenotypical features

Your answer [B] [1]

Examiner commentary

An AO1 question correctly answered by about half the candidates.
**Question 11(a)(i)**

*Exemplar 1*  

1 mark

11 (a) Look at the diagram of the water cycle.

Complete these sentences about the diagram.

Choose words from the list.

- combustion  
- evaporation  
- photosynthesis  
- precipitation  
- run-off  
- respiration  
- transpiration

(l) Arrows labelled A represent the process of precipitation. [1]

**Examiner commentary**

This question was quite well answered by many candidates, with incorrect answers being spread amongst the distractors.

**Question 11(a)(ii)**

*Exemplar 1*  

1 mark

(ii) Arrows labelled B represent the process of evaporation. [1]

**Examiner commentary**

The candidate correctly makes the link between the water in the lake and evaporation.
Question 11(a)(iii)

Exemplar 1

(iii) Arrows labelled C represent the process of transpiration. [1]

Examiner commentary
This candidate did not make the mistake of assuming that the arrow from the trees must indicate photosynthesis. They correctly chose transpiration.

Question 11(b)(i)

Exemplar 1

(b) Look at the diagram showing the food web in the lake.

Examiner commentary
A range of answers were seen to this question. This candidate interpreted the food chain diagram correctly.
Question 11(b)(ii) Exemplar 1

(ii) When plant material is decomposed by fungi, there is an increase in temperature. Complete the sentences to explain why.

Choose words from the list.

endothermic  excretion  exothermic  respiration  photosynthesis

During decomposition fungi release energy from the plants by the process of ...{\color{green}respiration}... .

This process releases energy as heat because the reaction is ...{\color{green}exothermic}... .

[2]

Examiner commentary

Many candidates incorrectly linked excretion to the release of energy. This candidate correctly chose respiration followed by exothermic.
Question 11(c)(i)

Exemplar 1  

1 mark

(c) Dogfish and minnows are fish that live in lakes.

Dogfish build nests to lay their eggs in. Minnows lay their eggs in the same nests as dogfish.

The dogfish protect the nest from predators.

Minnows move in and out of the nest. This helps to remove harmful bacteria and get oxygen to the eggs.

Dogfish usually eat minnows. When the dogfish have eggs they do not eat minnows.

(i) Dogfish have two different interactions with the minnows.

Write down the names of these two types of interactions.

Describe when each interaction takes place.

Interaction 1 Parasitism

When the Dogfish eats the minnow

Interaction 2 mutualism

When the minnows move in and out the nest

Examiner commentary

The candidate correctly stated that the minnows are showing mutualistic behaviour by moving in and out of the nest and scored a mark for this. However, they confused parasitism for predation, so did not score the second mark.
Question 11(c)(ii)

Exemplar 1

1 mark

(ii) One of the interactions benefits both minnows and dogfish. Explain how.

Because the dogfish protects both their eggs and the minnows, the minnows clean out the nest.

Examiner commentary

The answer correctly states that the dogfish protects the eggs and gains credit for this. To gain the second mark the candidate needed to explain that this stops the eggs from being eaten.
12 Farmers use fertilisers to improve crop yields.

The graph shows how the mass of one fertiliser affects maize yield.

(a) What mass of fertiliser would you recommend to produce the best yield?

Examiner commentary

This answer gains full marks because the candidate has correctly identified the mass of fertiliser as 160kg/hectare and has also appreciated that adding any more fertiliser would have no effect. This second marking point was missed by many candidates.
**Question 13(a)**

**Exemplar 1**

13 (a) Complete these sentences about the hormone FSH.

- FSH is secreted by the .................................................. gland.
- FSH causes an ........................................................ to mature in the ovary.
- FSH stimulates the ovaries to release the hormone ..................................

**Examiner commentary**

Although there are errors in spelling in this answer, the terms are clearly identifiable and correct.
Question 13(b)

Exemplar 1  

2 marks

(b) FSH hormone can be genetically engineered.

The human gene for FSH is transferred into an animal cell.

Look at the diagram of a cell.

The gene is put inside one of the structures labelled in the diagram.

Which structure is the gene put inside?

Choose from A, B, C, or D. .................A .........................

State why the gene is put there.

Put in (A) the nucleus of the animal cell because that's where the genome is (all the genetic material of an organism).

Examiner commentary

The candidate identifies the correct structure in the cell and follows this with a correct reason.
Question 13(c)

Exemplar 1

5 marks

(c)* Beta carotene is the substance that makes carrots orange. Humans use beta carotene to make vitamin A. Vitamin A is needed for good vision.

‘Golden’ rice is a genetically modified (GM) crop. ‘Golden’ rice is made when the gene for beta carotene is added to rice.

Scientists do not know if the levels of beta carotene in ‘Golden’ rice will have any other effects on people eating the rice.

In some countries many people survive on a diet of mainly rice with no vegetables.

Do you think ‘Golden’ rice should be made to provide food for these people?

Include arguments for and against ‘Golden’ rice in your answer.

No, I don’t think ‘Golden’ rice should be made to provide food for these people. If there is a question on whether or not something could potentially have bad side effects on these people then it shouldn’t be given to them.

However, ‘Golden’ rice does contain vitamin A which helps with vision. Also, people in undeveloped countries could benefit greatly with more food. Especially when considering that some countries populations live solely on rice and so they could live solely on rice and nothing else. It helps with cost, but people should have a balanced diet. So, in conclusion, I’m against these people being given golden rice because it’s potentially unsafe and could promote an unbalanced diet.

Examiner commentary

To obtain Level 3, candidates needed to state how golden rice can provide beta carotene for people and give an argument for and against the use of golden rice. They then need to come to a conclusion as to whether the rice should be provided. This answer includes an argument against, i.e. possible bad side effects and an argument for, i.e. helps with vision and a conclusion.
Question 14(a)

Exemplar 1  
2 marks

14 (a) Some children can inherit a rare kidney condition called ARPKD. It is caused by a recessive allele.

A pregnant woman has ARPKD. The baby’s father is heterozygous for ARPKD.

What is the probability of their baby having ARPKD?

Complete the genetic diagram to explain your answer.

Use the letters:

- R for the dominant allele
- r for the recessive allele.

Examiner commentary

Some candidates struggled to complete the genetic diagram and others completed it correctly but could not work out the probability. This answer successfully achieves both steps.
Question 14(b)(i)

Exemplar 1

2 marks

(b) (i) It is estimated that 1 in 70 people in the UK is a carrier of ARPKD.

The estimated population of the UK in 2011 was 63.2 million.

Estimate the number of people in the UK in 2011 who were carriers.

Answer = ........................ [2]

Examiner commentary

In this calculation candidates are required to estimate the number of people by rounding the population to 63 million and dividing by 70 to give the answer 0.9 million. Other answers, such as 900 000 as seen here, are clearly acceptable. Many candidates made errors trying to convert 63.2 million to thousands.
Question 14(c)

Exemplar 1

(c) ARPKD can lead to kidney failure. People with kidney failure can use a dialysis machine.

The diagram shows how a dialysis machine works.

A molecular model can be used to explain how the dialysis machine removes urea.

The dialysis machine removes urea but not sugar.

Examiner commentary

This answer correctly explains that sugar molecules are too large to fit through the membrane and gains one mark for this. However, like many other candidates this is only a partial explanation because there is no mention of why urea is removed.
Question 14(d)

Exemplar 1  

0 marks

(d) The kidneys in people with ARPKD have not developed normally.

Stem cells could be used to repair the damaged kidneys.

Discuss reasons for and against using stem cells to treat ARPKD:

Reasons for it will repair the damaged kidneys making them normal again..

Reasons against it will give a plant characteristic which for a human is not needed.

[3]

Examiner commentary

There were few specific answers to this question, with many candidates simply repeating the fact that stem cells can repair the damaged kidney as seen in this answer. The candidates reason against confused the term ‘stem’ with the plant structure.
Question 15(a)

Exemplar 1

15 Three students model the determination of sex in humans.

They toss a coin 18 times and record the result.

The table shows the results and the ratio of the total heads : total tails.

<table>
<thead>
<tr>
<th>Toss</th>
<th>Outcome</th>
<th>Total heads</th>
<th>Total tails</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Heads</td>
<td>1</td>
<td>0</td>
<td>1:0</td>
</tr>
<tr>
<td>2</td>
<td>Heads</td>
<td>2</td>
<td>0</td>
<td>2:0</td>
</tr>
<tr>
<td>3</td>
<td>Tails</td>
<td>2</td>
<td>1</td>
<td>2:1</td>
</tr>
<tr>
<td>4</td>
<td>Heads</td>
<td>3</td>
<td>1</td>
<td>3:1</td>
</tr>
<tr>
<td>5</td>
<td>Heads</td>
<td>4</td>
<td>1</td>
<td>4:1</td>
</tr>
<tr>
<td>6</td>
<td>Heads</td>
<td>5</td>
<td>1</td>
<td>5:1</td>
</tr>
<tr>
<td>7</td>
<td>Tails</td>
<td>5</td>
<td>2</td>
<td>5:2</td>
</tr>
<tr>
<td>8</td>
<td>Tails</td>
<td>5</td>
<td>3</td>
<td>5:3</td>
</tr>
<tr>
<td>9</td>
<td>Heads</td>
<td>6</td>
<td>3</td>
<td>2:1</td>
</tr>
<tr>
<td>10</td>
<td>Heads</td>
<td>7</td>
<td>3</td>
<td>7:3</td>
</tr>
<tr>
<td>11</td>
<td>Tails</td>
<td>7</td>
<td>4</td>
<td>7:4</td>
</tr>
<tr>
<td>12</td>
<td>Tails</td>
<td>7</td>
<td>5</td>
<td>7:5</td>
</tr>
<tr>
<td>13</td>
<td>Heads</td>
<td>8</td>
<td>5</td>
<td>8:5</td>
</tr>
<tr>
<td>14</td>
<td>Tails</td>
<td>8</td>
<td>6</td>
<td>8:6</td>
</tr>
<tr>
<td>15</td>
<td>Heads</td>
<td>9</td>
<td>6</td>
<td>3:2</td>
</tr>
<tr>
<td>16</td>
<td>Heads</td>
<td>10</td>
<td>6</td>
<td>..........</td>
</tr>
<tr>
<td>17</td>
<td>Tails</td>
<td>10</td>
<td>7</td>
<td>10:7</td>
</tr>
<tr>
<td>18</td>
<td>Tails</td>
<td>10</td>
<td>8</td>
<td>5:4</td>
</tr>
</tbody>
</table>

(a) The ratio for 16 is missing.

Calculate the ratio for 16 tosses.

Answer = \(6:3\) [1]

Examiner commentary

In common with the majority of candidates, this answer gives the correct ratio.
**Question 15(b)**

Exemplar 1  

(b) None of the ratios match the expected ratio of males to females you would show in a genetic cross.

Here are three statements about the results:

Student A – The ratio after five tosses is closest to the expected outcome.

Student B – The ratio after ten tosses is closest to the expected outcome.

Student C – The ratio after eighteen tosses is closest to the expected outcome.

Which statement is correct?

Examiner commentary

In this answer the correct student is chosen and this gains credit. However, the explanation is incorrect as there is no reference to the 'expected outcome' referred to in the question. It is important that candidates appreciate the importance of a large sample size in genetic crosses.

**Question 15(c)**

Exemplar 1  

(c) The students want to improve the method to get a result that matches the expected ratio.

Write down one way to improve the method.

...toss the coin a few more times...

Examiner commentary

As with this answer, most candidates correctly stated that the coins should be tossed more times. This was even the case when candidates could not correctly answer the previous question.
Question 16(a)

16 The picture shows a mealybug insect.

![Mealybug Image]

This mealybug is a pest for orange tree growers.

The scientists compared the number of mealybugs found on two trees, **tree A** and **tree B**.

For each tree they:

- Collected a sample of mealybugs from the tree
- Counted the number of mealybugs in each sample
- Marked the mealybugs
- Released the mealybugs back onto the tree they were collected from.

The next day another sample was collected from each tree.
Exemplar 1

3 marks

(a) Describe how the scientists should collect and mark the mealybugs.

Include the equipment they need to use.

You may include a diagram with your answer.

They should use a pooter to collect the mealybugs from the tree. At first, suck up as many as you can in a 1 minute. Then mark each one on the back with environmental paint and put back. Repeat this process again from the tree. Then the following day, return and repeat again.

Examiner commentary

This candidate clearly understands the use of a pooter and the marking needed in the capture/recapture technique. This was quite rare across the cohort and may indicate a general lack of ecological practical work.
Question 16(b)

Exemplar 1

1 mark

(b) Write down three precautions that should be taken when deciding how to mark the mealybugs.

1. Try not to be too heavy handed

2. Make sure the pen isn’t sharp so it will not harm them.

3. Rub it off before setting them back.

Examiner commentary

This answer gains credit for the comment about making sure that the mealybugs are not harmed. However, the comment about removing the mark tends to indicate a lack of understanding of the capture-recapture method.
Question 16(c)(i)

Exemplar 1

(c) The table shows the results for tree A.

<table>
<thead>
<tr>
<th>Total number of mealybugs collected on day 1</th>
<th>Total number of mealybugs collected on day 2</th>
<th>Number of marked mealybugs collected on day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>60</td>
<td>18</td>
</tr>
</tbody>
</table>

(i) Estimate the population size of mealybugs on tree A.

Use the formula:

\[
\text{Estimated population size} = \frac{150 \times 60}{18}
\]

Answer = \( \text{500} \) [1]

Examiner commentary

The majority of candidates could substitute into the equation and obtain the correct answer as shown here.
Question 16(c)(ii)

Exemplar 1

(ii) When using this method to estimate population, the scientists make several assumptions.

One assumption is that there was no immigration of mealybugs between day 1 and 2.

Suggest two other assumptions they would make.

1. That the mealybugs just live in one habitat.

2. That the mealybugs haven’t produced offspring between day 1 & 2.

Examiner commentary

The first assumption stated here could be covered by the example given, i.e. there was no immigration. If the answer was more specific, i.e. the mealybugs have not left the habitat, then it would have scored this mark. The assumption about no reproduction is correct.
Question 16(d)(i)

Exemplar 1

1 mark

(d) The number of mealybugs on each tree may be affected by the light intensity.

The scientists measured the light intensity for each tree at midday on day 1 of their investigation. Light intensity is measured using a light meter.

Examiner commentary

Candidates should have made a comparative statement e.g. there are more on tree A because it received less light. This candidate provided a comparative statement about the light intensity, which was credited.
Question 16(d)(ii)

Exemplar 1

(ii) Errors can occur when taking light meter readings.

Explain how errors occur and write down one way to take more precise readings.

Errors can occur due to reflection for shading, e.g., if you
stood over the meter in a certain way it could block light.
To improve, stand further away and not near media...

Examiner commentary

This answer correctly focuses on a possible error when taking the light meter readings and clearly suggests how to avoid it. Both marks are therefore scored. Many incorrect answers focused on repeatability and the number of readings.
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