**Scientific Method**

Q 2015 9

1. (a) (i) What is the purpose of a hypothesis in the scientific method?

(ii) Explain what is meant by double-blind testing in scientific experimentation.

1. A scientist wished to investigate the effect of the concentration of iodine on the rate of growth of tadpoles (young frogs). He acquired 100 tadpoles of the same age, all of which had hatched from the fertilised eggs of one female. He used water from the pond in which the tadpoles had hatched, and a stock solution of iodine.
   1. Why do you think that it was important that all the tadpoles came from the same mother?
   2. At the start of the investigation the scientist divided the tadpoles into four groups of 25, one of which was to be the control.
      1. Why is a control essential in scientific experiments?
      2. Suggest why he used 25 tadpoles in each group.
      3. Suggest how this investigation would have been carried out.
   3. Suggest **two** factors that the scientist would have kept constant during the investigation.

MS 2015 9

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| **9.** (a) | |  | **5 + 1** |
| **9.** (a) | | (i)  (ii) | To form the basis of a prediction **or** to give a starting point for an experiment **or** (to attempt) to explain an observation  Neither the experimenter nor the test group knows who gets what (or described) |
| **9.** | (b) | **9 + 9 + 6(1)** | |
| 1. (b) (i) So they are genetically similar **or** they are likely to respond in the same way (to iodine)    1. 1. To (provide a standard or baseline to) compare with the experiment       1. A larger sample makes allowance for illness (or death)   **or** to make the results more statistically significant   * + 1. Different concentrations of iodine (solution) / made up using pond water / 25 tadpoles in each (solution) / leave for a time / record changes in tadpoles /   (control) no iodine ***Any Three***   * 1. Temperature / amount of food / oxygen concentration / light (exposure) /   volume of water / duration of exposure ***Any Two*** | | | |

Q 2014 9 a

1. (a) (i) Give **one** example of a limitation of the scientific method.

(ii) Where do scientists usually publish the results and conclusions of their investigations?

MS 2014 9

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| (a) | (i) | (The extent of) our basic knowledge **or** the basis of investigation **or** |  |
|  |  | our ability to interpret results **or** application to the natural world in |  |
|  |  | state of change **or** accidental discoveries | **3** |
|  | (ii) | Scientific journal(s) | **3** |

Q 2013 9 a

(a) (i) Explain the importance of *double-blind* testing in scientific experimentation.

(ii) How does a *hypothesis* differ from a *theory*?

MS 2013 9

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| **9.** (a) (i) Avoidance of bias  (ii) Hypothesis can develop into a theory **or** explained | **3**  **3** |

Q 2012 7 a

(a) In relation to the scientific method, explain each of the following:

1. Data
2. Replicates.

MS 2012 7

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| **7.** (a) (i) Observations **or** results **or** other | **3** |
| (ii) Repeats (or copies) of experiment | **3** |

Q 2011 7 a, b

1. a) In relation to the scientific method, explain each of the following.
2. Experiment.
3. Theory.
4. Scientists investigated the effect of a certain mineral on the growth of wheat.

Use your knowledge of biology and laboratory procedures to answer the following questions.

* 1. Suggest a reason why the seeds used were all taken from one parent plant.
  2. The compost in which the wheat plants were grown was sterilised at the start of the investigation.
     1. Suggest a way in which the scientists may have sterilised the compost.
     2. State **one** reason why it was important to sterilise the compost.
  3. Why did the scientists divide the young wheat plants into two equal groups?
  4. During the investigation the scientists kept the two groups of plants under identical conditions. Why was this?
  5. Name **two** conditions you think the scientists would have kept constant during the investigation.
  6. Why did the scientists repeat the investigation several times before publishing their results in a scientific journal?

MS 2011 7

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| **7.** | (a) | (i) | Test of hypothesis **or** test of prediction | **3** |
|  |  | (ii) | Hypothesis (or explained) supported (by experiment) | **3** |
|  | (b) | (i) | To minimise (genetic) variation | **3** |
|  |  | (ii) | 1. Heat (or method of heating) **or** named chemical **or** irradiation (or named) 2. To kill organisms **or** to prevent contamination **or** to eliminate competition **or** to eliminate disease **or** described | **3** |
|  | **3** |
|  |  | (iii) | As control (or described) | **3** |
|  |  | (iv) | To have only one variable (or explained) | **3** |
|  |  | (v) | Temperature / Light **/** pH / CO2 / humidity / other minerals / H2O ***Any 2*** | **2(3)** |
|  |  | (vi) | To ensure (statistical) reliability | **3** |

Q 2010 8 a

(a) Answer parts (i) and (ii) in relation to the scientific method.

(i) What is a hypothesis?

(ii) Why is a control normally used when carrying out an experiment?

MS 2010 8 a

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| (a) | (i) | Educated guess **or** (possible) explanation | **3** |
|  | (ii) | Comparison (with experiment) | **3** |

Q 2008 3

1. Answer the following, which relate to the scientific method, by completing the blank spaces.
   1. As a result of her observations a scientist may formulate a …

. She will then progress her investigation by devising a series of ……… and then carefully analysing the resulting ………………………………

* 1. Why is a control especially important in biological investigations?
  2. If a scientist wished to determine the effect of a certain herbicide on weed growth she would include a control in the investigation. Suggest a suitable control in this case.
  3. The use of replicates is an important aspect of scientific research. What, in this context, are replicates?
  4. Suggest where a scientist may publish the results of her investigations

MS 2008 3

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| **3.** |  | **3(1) + 3(4) + 5** |  |
|  | (a) | hypothesis |  |
|  |  | experiments |  |
|  |  | data **or** information **or** findings **or** outcomes |  |
|  | (b) | for comparison **or** reference to (biological) variability |  |
|  | (c) | no herbicide **or** implied |  |
|  | (d) | repeat of experiment |  |
|  | (e) | (scientific) journal **or** named journal [*accept* Internet] |  |

Q 2005 2

1. Explain each of the following terms in relation to the scientific method.
   1. Hypothesis
   2. Control
   3. Data
   4. Replicate
   5. Theory

MS 2005 2

## 3(2) + 2(7)

1. A (possible) explanation (for an observation) or explained e.g. assumption
2. (Set up for) comparison or explained
3. Measurements or observations or information gathered
4. A repeat of an experiment or procedure or explained
5. A supported hypothesis or explained