# WESTMINSTER SCHOOL
# THE CHALLENGE 2018

# BIOLOGY

Thursday 3 May 2018

Time allowed: 30 minutes

**Write your answers in the spaces provided.**

**Please write in black or blue ink.**

For examiner use only

| | |
|---|---|
| Total Mark | |

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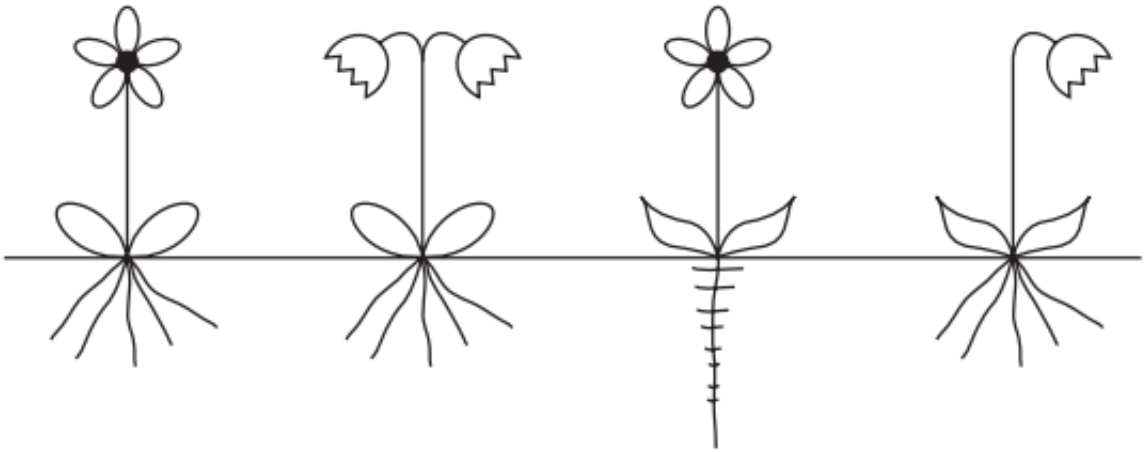
**B1** The following are multiple choice questions. Choose the option that you consider to be correct and write either **A**, **B**, **C** or **D** on the line provided. There is no negative marking.

(a)

Keys are used in biological identification.

Which statement may appear in a key and **alone** could identify one of the plants in the diagrams?



**A** The plant has a single deep root with small branches.

**B** The plant has many similar roots, arising from a single point.

**C** The plant has one flower on the stem.

**D** The plant has pointed leaves.

(a) Answer .....

(b)

A person has bleeding gums.

This could be caused by a lack of which nutrient?

**A** calcium

**B** iron

**C** vitamin C

**D** vitamin D

(b) Answer .....

(c)

Next time you feel the flu coming on, you should think twice before reaching for painkillers because they could do more harm than good by increasing the transmission of flu. Obviously painkillers can make you feel better by reducing muscle pains and headaches, but they also lower fever. Fever is thought to be an antiviral weapon, because many viruses find it hard to replicate at temperatures higher than the normal human body temperature. Some studies have shown that lowering fever can prolong viral infections and increase the amount of the virus that can be passed on to others.

Which one of the following, if true, strengthens the above argument?

**A** Overuse of painkillers can reduce their effectiveness in curing headaches.

**B** Taking painkillers increases the likelihood that flu sufferers will return to work while still infectious.

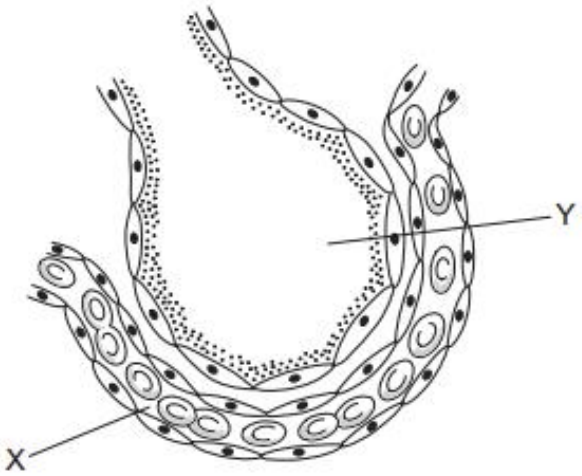
**C** The studies of the effect of lowering fever were carried out on animals, not humans.

**D** The most effective defence against flu is an annual anti-flu injection.

(c) Answer .....

(d)

The diagram shows a section through an alveolus and a capillary.




Why does carbon dioxide move from X to Y?

**A** Air has a lower concentration of carbon dioxide than blood.

**B** Carbon dioxide moves more freely in air than in blood.

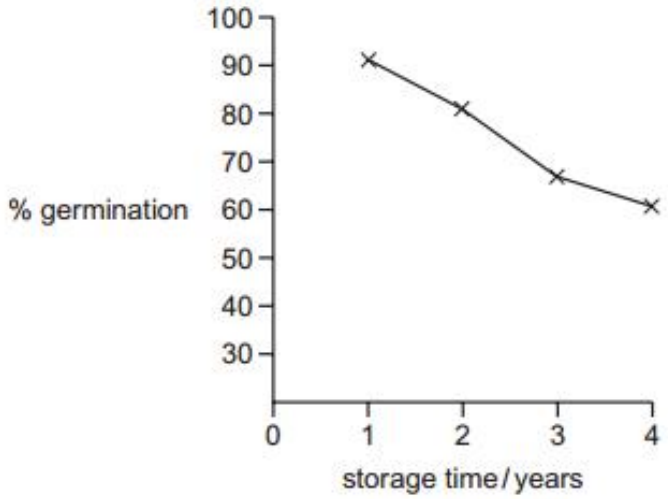
**C** Carbon dioxide must replace oxygen.

**D** Diffusion of carbon dioxide can only be out of the blood.

(d) Answer .....

(e)

The graph shows the effect of storage time on the germination of some seeds.




What can be concluded from this graph?

**A** Older seeds do not germinate.

**B** Older seeds germinate better than younger seeds.

**C** Younger seeds always germinate.

**D** Younger seeds germinate better than older seeds.

(e) Answer .....

(f)

The table lists some processes which take place during reproduction in flowering plants and mammals.

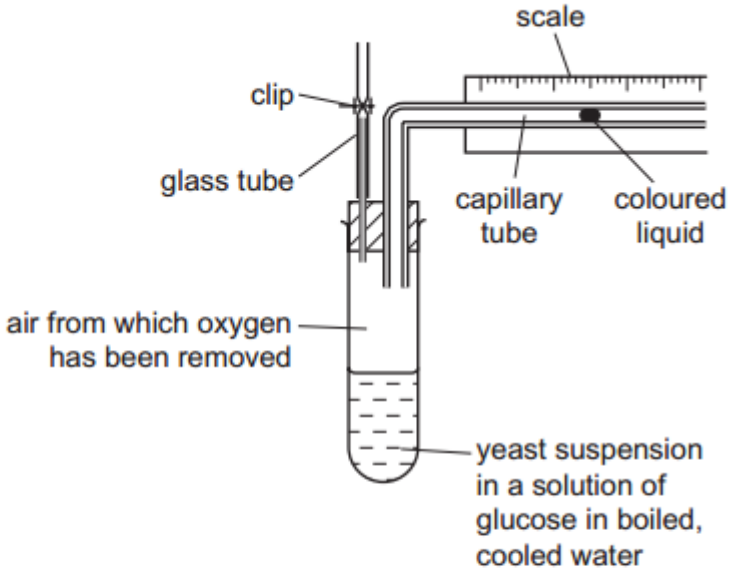
Which row is correct?

| | fertilisation needed | implantation needed | pollination needed |
|---|---|---|---|
| **A** | flowering plants and mammals | mammals only | flowering plants only |
| **B** | flowering plants and mammals | flowering plants and mammals | mammals only |
| **C** | mammals only | mammals only | flowering plants only |
| **D** | flowering plants and mammals | mammals only | flowering plants and mammals |

(f) Answer .....

(g)

The diagram shows apparatus used to investigate anaerobic respiration in yeast.




What happens to the coloured liquid?

**A** moves rapidly to the left

**B** moves slowly to the left

**C** moves to the right

**D** stays still

(g) Answer …….

[Total: 7]

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**B2** Enzymes are proteins, which act as biological catalysts, in that they increase the rate of a given reaction without themselves being altered or used up as part of that reaction. The specific part of the enzyme in which the reaction occurs is known as the active site. **Figure 2.1** is a diagrammatic representation of a model known as the 'lock and key' model, which is one proposed explanation for how enzymes act as biological catalysts.

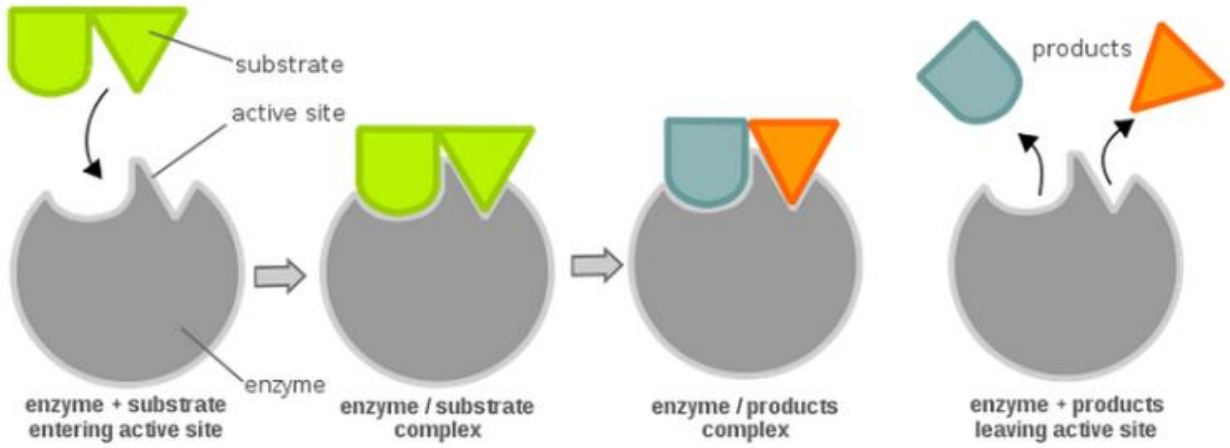


**Figure 2.1**

(a) Using **Figure 2.1** suggest why this is referred to as the 'lock and key' model.

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…….. [1]

An enzyme, hydrolyses, or breaks down, sucrose (the substrate) into its two constituent parts: glucose and fructose (the products). The presence of these two sugars (glucose and fructose) change the colour of potassium manganate solution from pink to colourless.

Owen investigated whether the concentration of sucrose solution affected the activity of the enzyme by recording the time taken to decolourise potassium manganate solution. Owen's results can be seen in **Table 2.2**. All other variables were standardised.

| percentage concentration of sucrose solution | time to decolourise potassium manganate(VII) solution/s |
|---|---|
| 0.5 | 158.0 |
| 1.0 | 84.0 |
| 1.5 | 74.0 |
| 2.0 | 32.0 |
| 2.5 | 22.0 |

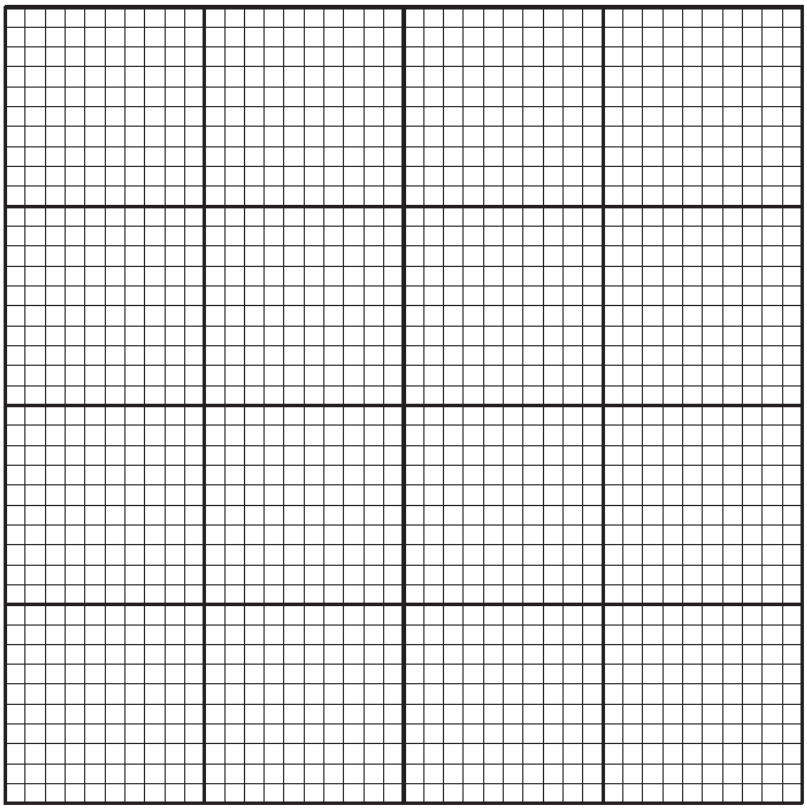
**Table 2.2**

(b) Identify the independent and dependent variables in this experiment.

Independent variable ……

Dependent variable …… [1]

(c) Plot a graph of Owen's data shown in **Table 2.2**.



[4]

(d) Estimate the time to decolourise potassium manganate solution at 1.75% sucrose concentration. Show on your graph how you obtained the time to decolourise potassium manganite solution.

*time* …… [2]

(e) Owen standardised all other variables in the experiment. Suggest one such variable and explain why it should be standardised.

……

…….. [2]

(f) Owen was discussing his experiment with another student, Leon, who concluded that “as the concentration of sucrose increased the time taken to decolourise the potassium manganate solution decreased proportionally. For example at 2.5% sucrose concentration it took 22 seconds for the solution to decolourise, but at 1.5% concentration it took 74 seconds.”

(i) Identify one strength of Leon’s conclusion.

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(ii) Identify one weakness of Leon’s conclusion.

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…….. [1]

[Total: 12]

**B3** Speciation is the process by which a new species arises, this occurs when a group within a species separates from other members of its species and develops its own unique characteristics. During the formation of the Grand Canyon two groups of an original population of squirrels were separated from each other on either side of the canyon, and now two different species of squirrel can be found on the north (**Fig 3.1** Kaibab squirrel) and south (**Fig 3.1** Abert squirrel) rims of the canyon.

The habitat of the Abert squirrel extends across an area of over 5000 square miles. In contrast, the Kaibab Squirrel's habitat is confined to the Ponderosa pine forest type of the Kaibab Plateau north of the Grand Canyon in Arizona, an area of about 638 square miles.


**Figure 3.1**

Ref: Figure 16-3, Biology: Life on Earth (8th Edition Pearson)

(a) State two features of the squirrels that would allow them to be classified in the animal kingdom, rather than the plant kingdom.

1. ……..……

2. ……..….. [2]

(b) Suggest two differences that may exist between the Kaibab and Abert squirrels, and why these differences may have arisen.

1. ……..……

……..……

……..….. [2]

2. ……..……

……..……

……..….. [2]

(c) Suggest how scientists may distinguish between closely related species, and as such decide that a new species has arisen.

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(d) A new species of mountain lion was introduced to the north side of the Grand Canyon in an attempt to reduce the numbers mule deer in the area. However, this led to a dramatic fall in the population of Kaibab squirrels. Suggest why the fall in numbers was so dramatic.

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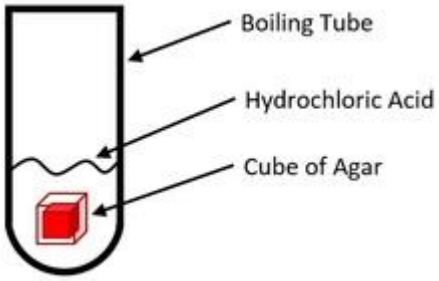
(e) Suggest two other factors which might lead to a decrease in the number of Kaibab squirrels.

1. ……

2. …….. [2]

[Total: 10]

**B4** Diffusion into a cell can be modelled using coloured agar cubes and a decolourising liquid, such as hydrochloric acid, that will diffuse into the agar. Agar can be coloured pink by staining with phenolphthalein, which changes from a pink colour to colourless as the acid diffuses into the agar block.



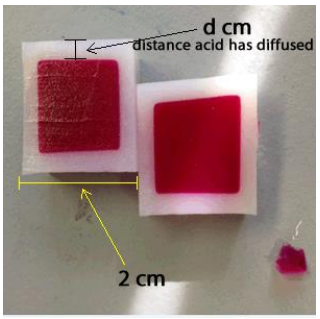




**Figure 4.1** – Using agar blocks to model diffusion

(a) Design an experiment you could carry out to investigate the effect of temperature on the rate of diffusion of hydrochloric acid in this agar block model.

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(b) Humans obtain oxygen by diffusion, from the air in the alveoli in the lungs into the blood, and plants can obtain oxygen from the soil, when it diffuses from air spaces into the root hair cell. State one adaptation shared by both alveoli and root hair cells that increase the rate of oxygen diffusion.

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…….. [1]

[Total: 4]

**[Total: 33]**