Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CANDIDATE NAME | | | | | | | | | |
| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | |



**BIOLOGY** **9700/52**

Paper 5 Planning, Analysis and Evaluation **February/March 2018**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

**1** Biological washing liquids are solutions that contain enzymes to help remove stains caused by biological molecules. One of these enzymes is lipase.

These washing liquids are concentrated solutions and need to be diluted with water to reach their 'working' concentrations.

A group of students was asked to find the 'working' concentration of the enzyme lipase for two different biological washing liquids, **A** and **B**.

The recommended dilutions for washing fabrics using these biological washing liquids are:

**A** – 20 $cm^3$ of washing liquid in 5 $dm^3$ water

**B** – 35 $cm^3$ of washing liquid in 10 $dm^3$ water.

The students found a website that lists the concentration of lipase in different biological washing liquids before they are diluted. These concentrations vary between 85 $mg\,cm^{-3}$ and 155 $mg\,cm^{-3}$.

**(a)** The students used the information from the website and the recommended dilutions to calculate the concentrations of lipase that could be present in 'working' concentrations of washing liquid.

The students calculated the maximum possible concentration of lipase in washing liquid **A** when diluted, as shown below.

The maximum possible concentration of lipase in washing liquid **A** before dilution is:

$$155\,mg\,cm^{-3}$$

Therefore, the maximum possible concentration of lipase in diluted washing liquid **A** is:

$$\frac{155\,mg\,cm^{-3} \times 20\,cm^3}{5000\ cm^3} = 0.62\,mg\,cm^{-3}$$

Complete the calculation below to show the minimum possible concentration of lipase in diluted washing liquid **B**.

The minimum possible concentration of lipase in washing liquid **B** before dilution is:

..... $mg\,cm^{-3}$

Therefore, the minimum possible concentration of lipase in diluted washing liquid **B** is:

$$\frac{\text{..... } mg\,cm^{-3} \times \text{..... } cm^3}{\text{..... } cm^3} = \text{..... } mg\,cm^{-3}$$

[1]

The students simulated fat-stained fabric by cutting 20 mm × 20 mm pieces of cotton fabric and soaking them in cooking oil. The fabric pieces were then allowed to dry.

The students diluted both washing liquids according to the recommended dilutions, added a piece of fat-stained cotton fabric to each and measured the activity of lipase using a pH probe and stop-clock. The students recorded the time taken for the pH to decrease from 7.9 to 6.5. The pH decreases because fatty acids are produced from the hydrolysis of fats by lipase.

Fig. 1.1 shows the apparatus the students used.

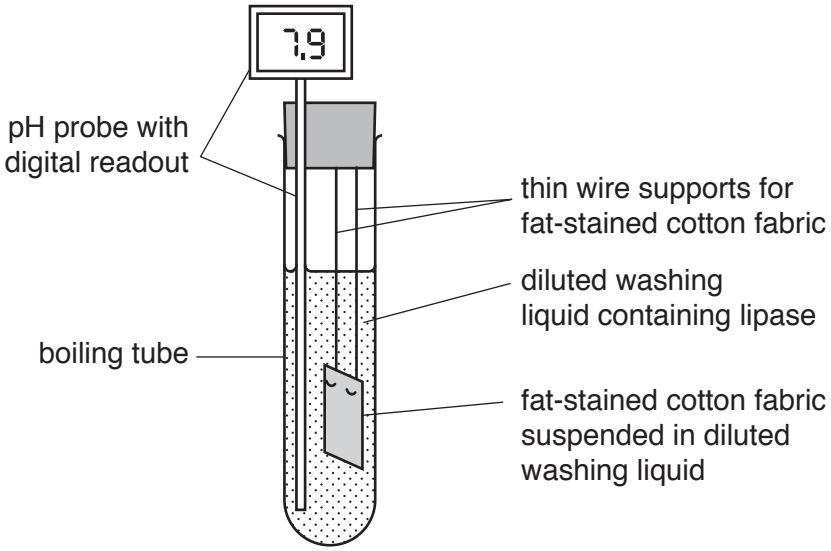


**Fig. 1.1**

Table 1.1 shows the results of two trials using each of the diluted washing liquids at the recommended temperature of 30 °C. This is lower than the optimum temperature of lipase, which is 60 °C.

**Table 1.1**

| trial | time for pH to decrease from 7.9 to 6.5 / min | |
|---|---|---|
| | diluted washing liquid **A** | diluted washing liquid **B** |
| 1 | 14 | 30 |
| 2 | 17 | 35 |

**(b)** To find the 'working' concentrations of lipase in diluted washing liquids **A** and **B**, the students decided to make a range of lipase concentrations from 700 $\mu$g cm$^{-3}$ to 200 $\mu$g cm$^{-3}$. They were provided with a stock solution of lipase with a concentration of 1000 $\mu$g cm$^{-3}$.

Describe how the students could dilute the stock solution to make solutions of lipase with a range of concentrations from 700 $\mu$g cm$^{-3}$ to 200 $\mu$g cm$^{-3}$. 100 cm$^3$ of each solution is required.

.....

.....

.....

.....

.....

.....

.....

.....[3]

**(c)** The students used the apparatus shown in Fig. 1.1 to investigate the effect of lipase concentration on the activity of lipase. They used the different concentrations of lipase that they had decided to prepare.

Identify the independent and dependent variables in this investigation.

*independent variable* .....

*dependent variable* .....
[2]

**(d)** Describe a method the students could use to find the effect of the different concentrations of lipase on the activity of lipase, using the apparatus shown in Fig. 1.1.

Your method should be set out in a logical order and be detailed enough for another person to follow. It should **not** repeat the details from **(b)** of how to dilute the stock lipase solution.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[7]

**(e)** The students used the results of their investigation to calculate the activity of lipase as the rate of release of fatty acids from fats. They then plotted a graph of their results.

**(i)** State how the rate of release of fatty acids from fats is calculated from the students' results.

.....

.....

.....[1]

**(ii)** Complete Fig. 1.2 to show the effect of lipase concentration on the rate of release of fatty acids from fats, by drawing the expected shape of the curve and labelling the axes, including units.

**Fig. 1.2**

[3]

**(iii)** Describe how the students would use this graph to find the 'working' concentrations of lipase in diluted washing liquids **A** and **B**.

.....

.....

.....

.....

.....[2]

**(f)** The students' results suggested that diluted washing liquid **A** had a higher concentration of lipase than diluted washing liquid **B**.

Suggest **one** reason why this conclusion may **not** be valid.

.....

.....[1]

[Total: 20]

**2** The eye has sensory receptors that convert light energy into nerve impulses. The ability of the human eye to detect separate stimuli one after another has been studied.

- The eye is able to distinguish separate stimuli from a flickering light up to a threshold frequency of about 16 flickers per second. This is referred to as a frequency of 16 hertz (Hz). 1 Hz = 1 flicker per second.
- Once the threshold frequency is reached, the eye can no longer distinguish the separate stimuli so they are detected as one continuous stimulus.
- The frequency at which this happens is called the critical flicker fusion threshold (CFFT).

To find a person's CFFT, a test is carried out.

- The person looks into a binocular eyepiece at two white lights that flicker simultaneously.
- The flickering frequency is started at 4 Hz and is gradually increased at a constant rate.
- When the person first notices that the flickering stimulus appears to have become constant they press a button, which gives their CFFT.
- This is repeated to give ten values for each person.

An investigation was carried out into the effect of alcohol on the CFFT of thirteen females aged from 18 to 35 years old. Before starting the investigation, the women were given time to become familiar with the equipment. The investigation was then carried out over two days.

Day 1 – the women were allowed 5 minutes to drink 250 $cm^3$ of pure orange juice. The CFFT was tested 40 minutes later.

Day 2 – the women were allowed 5 minutes to drink 250 $cm^3$ of orange juice containing 16 mg of alcohol. The CFFT was tested 40 minutes later.

The reason for carrying out the test 40 minutes after drinking alcohol is to allow time for the alcohol to reach its peak concentration in the blood.

Fig. 2.1 shows the results of this investigation.

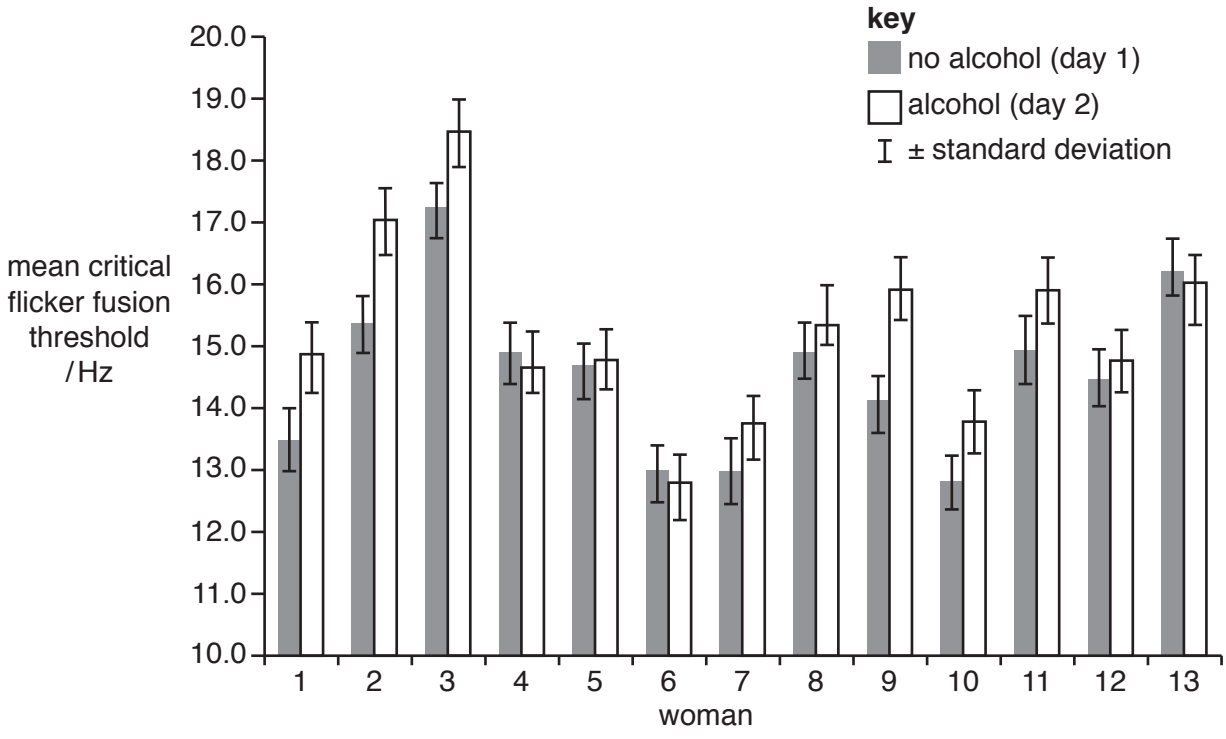


**Fig. 2.1**

**(a)** Identify **two** key variables that have been controlled in this investigation.

1 .....

2 .....
[2]

**(b)** Explain why the investigators calculated the standard deviation of the results for each person.

.....

.....

.....

.....[2]

**(c)** Identify **three** features about the CFFT from the data shown in Fig. 2.1.

.....

.....

.....

.....

.....

.....

.....

.....[3]

**(d)** Suggest **three** reasons why the results shown in Fig. 2.1 may **not** be representative of the whole human population.

1 .....

.....

2 .....

.....

3 .....

.....

.....
[3]

[Total: 10]

**BLANK PAGE**