Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
| | |

**Pearson Edexcel**
**International**
**Advanced Level**

Centre Number | | | | | |

Candidate Number | | | | |

# Tuesday 15 January 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **WBI03/01**

# Biology

## Advanced Subsidiary
## Unit 3: Practical Biology and Research Skills

**You must have:**
Calculator, HB pencil, ruler

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

### Information

- The total mark for this paper is 40.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Candidates may use a calculator.

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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Pearson

**Answer ALL questions.**

**1** Potatoes contain an enzyme involved in the synthesis of starch from glucose.

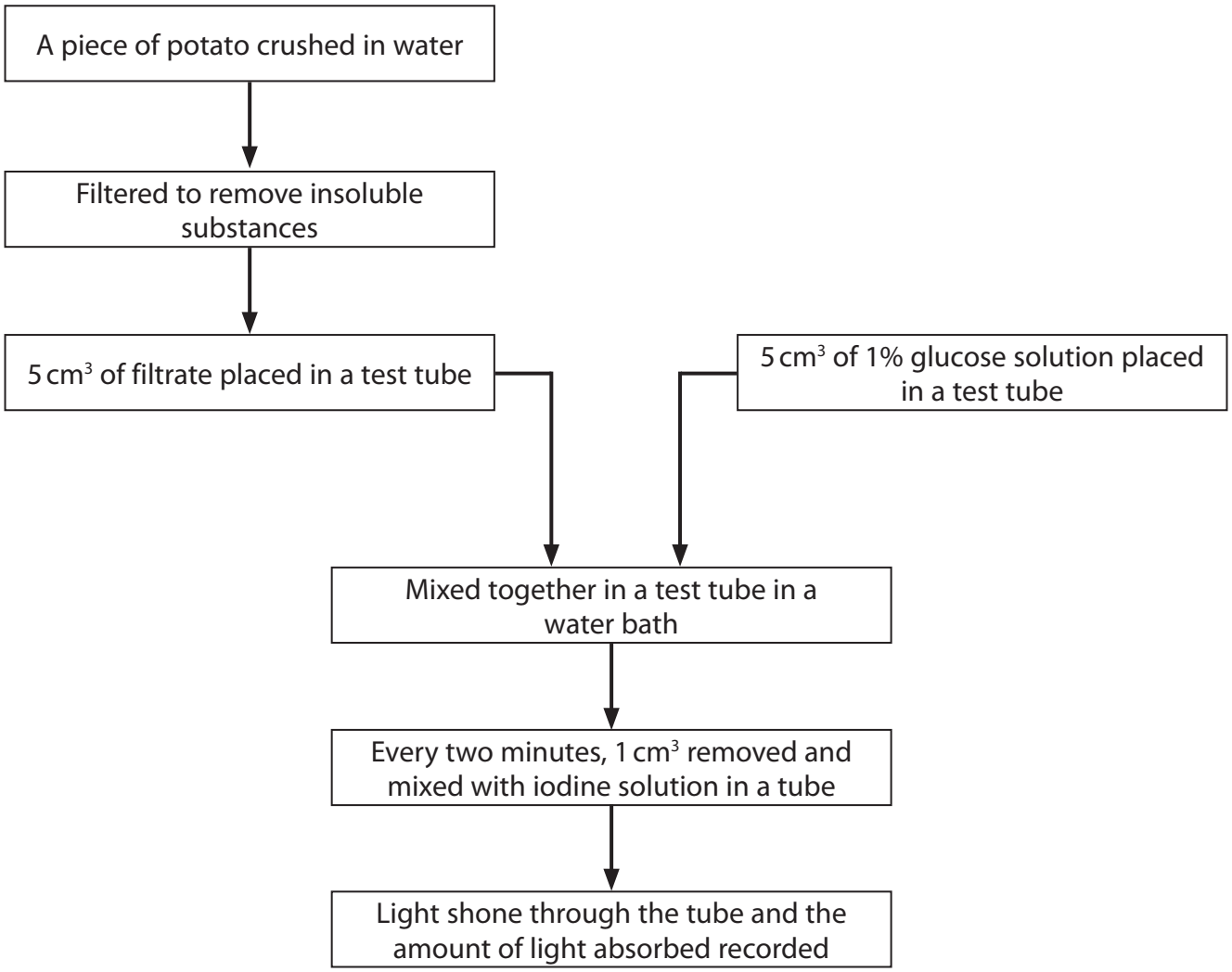
(a) Describe how starch is synthesised from glucose.

**(2)**

(b) A student investigated the synthesis of starch using an extract from potatoes.

The synthesis of starch can be monitored using iodine solution. Iodine solution is a yellow liquid that goes blue when mixed with starch. The more starch present, the darker the blue colour formed.

The flow chart below shows the method used by the student.



(i) Name the dependent variable in this investigation.

**(1)**

(ii) Suggest a suitable control for this investigation.

**(1)**

(iii) Suggest a suitable temperature at which to set the water bath.

**(1)**

(iv) Explain how the results of the investigation might be affected if the temperature was not kept constant.

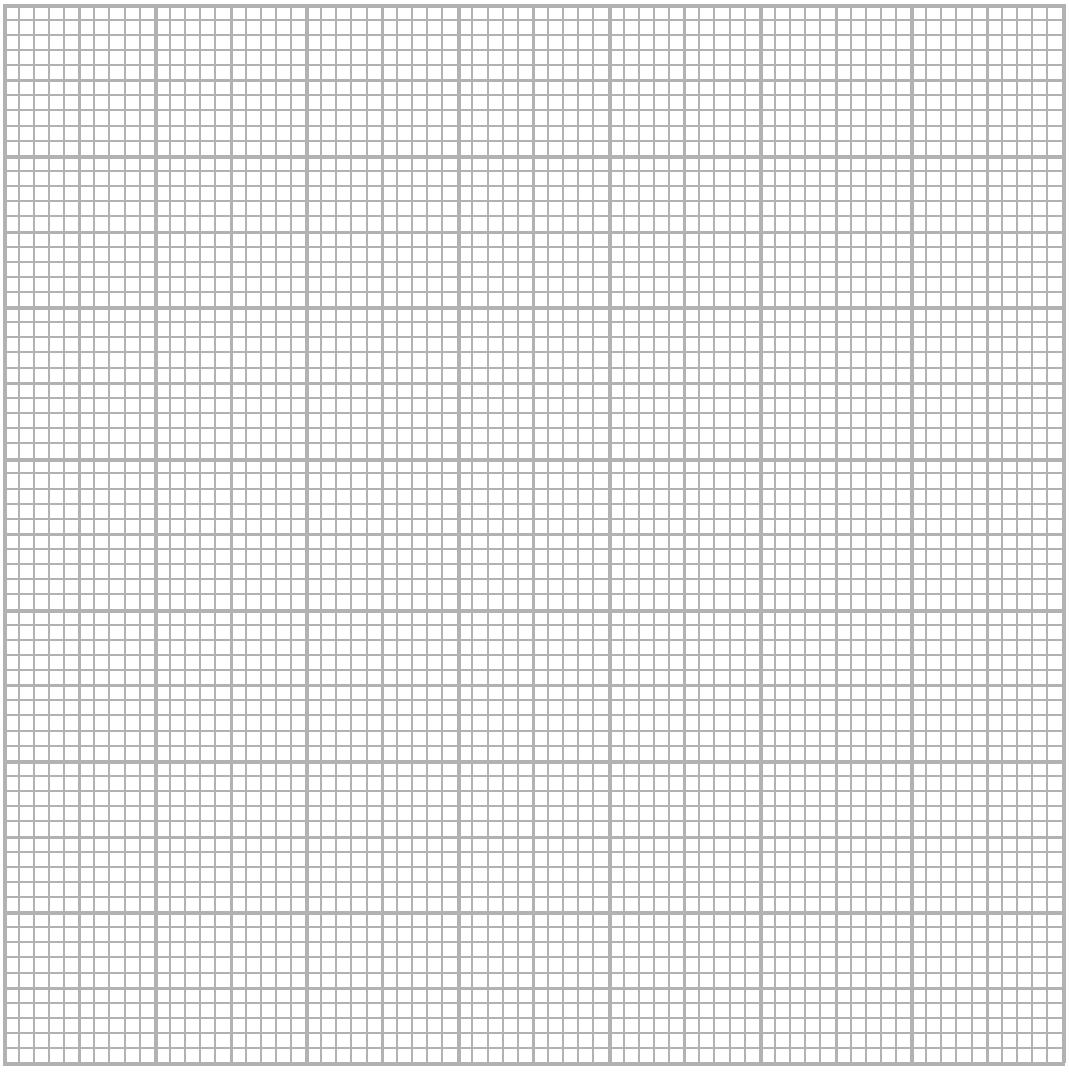
**(3)**

(c) The table below shows the results of this investigation.

| Time / minutes | Amount of light absorbed / a.u. |
|---|---|
| 2 | 3.0 |
| 4 | 5.5 |
| 6 | 8.4 |
| 8 | 10.0 |
| 10 | 10.4 |
| 12 | 10.5 |
| 14 | 10.5 |

(i) Plot a line graph of these results. Join the points with ruled, straight lines.

**(4)**



(ii) Using the results of this investigation, explain the relationship between time and starch concentration.

**(4)**

(iii) Describe how this investigation could be modified to measure variability in the results.

**(2)**

(d) The enzyme amylase breaks down starch.

The student obtained the data shown in the table for an investigation into starch digestion by amylase, using iodine solution.

| Time / seconds | Amount of light absorbed / a.u. |
|---|---|
| 0 | 6.0 |
| 30 | 3.0 |
| 60 | 1.6 |
| 90 | 0.9 |
| 120 | 0.2 |

Compare these results with the results for starch synthesis.

**(2)**

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**(Total for Question 1 = 20 marks)**

**2 Read the following extract from a student's unfinished issue report on the topic of breast cancer.**

1. Breast cancer arises when there are mutations within the cells of the breast tissue. The cells may split into abnormal cells at a fast rate, causing a tumour. If the tumour has the ability to grow and invade neighbouring cells and spread, then it is cancerous. Cancerous cells can travel through the blood vessels or lymph system (due to the breast and armpit tissue containing lymph nodes) and form in other areas of the breast tissue, and even to other areas in the body. If the cancer stays within the breast tissue, then it is non-invasive. Most cancers are invasive and travel around the body into normal, healthy tissues. Growing and spreading cancerous cells are life-threatening, and so many forms of treatment are being developed to help treat and prevent cancer.

2. Most breast cancers rely on oestrogen to grow and spread, these are called oestrogen-receptor positive (ER-positive) breast cancers. They contain protein receptors to which oestrogen attaches. This stimulates the cell to divide and the cancer to spread and grow. Therefore, hormone therapy is used to treat and prevent the growth and spread of cancer. The main hormone therapy treatments are Tamoxifen and Anastrozole.

3. Tamoxifen is an anti-oestrogen drug used to prevent ER-positive breast cancer from growing. Tamoxifen fits into oestrogen receptors and blocks oestrogen from reaching the cancer cells. This means the cancer either grows more slowly or stops growing altogether. Tamoxifen is a tablet that should be swallowed whole with a glass of water. The usual dose of Tamoxifen is 20 mg, and is taken once daily.

4. Anastrozole, another treatment that works by stopping the conversion of androgens into oestrogen, reduces the amount of oestrogen circulating in the body. This means that less oestrogen is available to stimulate the growth of ER-positive breast cancer cells. Anastrozole is a tablet (1 mg) taken once daily and should be taken at the same time each day.

5. There have been many studies into the use of and efficiency of Tamoxifen and Anastrozole. One study compared how well both of the drugs prevent the progression of cancer. This study evaluated the efficiency of Anastrozole 1 mg once daily, relative to Tamoxifen 20 mg once daily, in patients with tumours. In a randomised trial, there were 668 participants, 340 treated with Anastrozole and 328 with Tamoxifen. They were followed-up for 19 months. The Time to Progression (TTP) was measured. TTP is the length of time from the start of treatment for the cancer until it starts to get worse, or spread to other parts of the body. It is a measure of how well a treatment works. The results of this study showed that the TTP was similar for both treatments (8.2 months for Anastrozole and 8.3 months for Tamoxifen).

6. Anastrozole has a higher cost than Tamoxifen. An economic evaluation of Anastrozole versus Tamoxifen showed that, at an additional cost of $17 597 per year, Anastrozole treatment resulted in a mean survival of 12.96 years compared with 12.87 years for Tamoxifen.

7. Modern medical treatments are often expensive. In 2008, approximately 72% of cancer deaths occurred in low-income and middle-income countries. This is due to them not being able to afford treatment to manage or prevent cancer, unlike more economically developed countries. This is an issue, as everyone should have the right to medical treatment.

8. Tamoxifen also has a number of side effects including hot flushes, night sweats, vaginal discharge, vaginal dryness, vomiting, headaches, fatigue and skin rash. There are also some more serious risks with taking Tamoxifen.

9. There are many advantages of using Anastrozole over Tamoxifen when treating breast cancer. One of them is that Anastrozole, unlike Tamoxifen, is not associated with an increased risk of uterine cancer. In addition, incidences of blood clots and vaginal bleeding were reported in fewer patients treated with Anastrozole than with Tamoxifen (4.8% compared with 7.3% for blood clots and 1.2% compared with 2.4% for vaginal bleeding).

10. However, Anastrozole has disadvantages too, some common side effects of Anastrozole are hot flushes, joint and muscle pain, vaginal dryness, headaches and fatigue.

11. Another way for high-risk women to prevent breast cancer is to have a mastectomy. This is surgery to remove all breast tissue that could potentially develop breast cancer. Risk-reducing mastectomies are carried out on non-cancerous, healthy breasts to reduce the risk of breast cancer developing. By removing as much breast tissue as possible, a mastectomy can reduce the risk of developing breast cancer by up to 90%. A mastectomy also removes all cancerous tissue from the breast, which is important because if cancerous cells are left behind, there is a risk of the cancer growing back and spreading around the body. Mastectomies can cause bleeding and infections and formation of scar tissue. Women who have a mastectomy have a significant loss of sensation in the breast, which can have an impact on sexuality. Also, they will not be able to breastfeed. Women may also suffer depression and anxiety about their body image.

(a) (i) The main solution described in this report is the use of anti-oestrogen drugs. Explain how these drugs work.

**(3)**

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(ii) Comment on **one** alternative solution for the problem mentioned in this report.

**(3)**

(b) Using the information in paragraph 9, sketch and label a visual to show the incidence of blood clots and vaginal bleeding caused by Anastrozole and Tamoxifen.

**(3)**

(c) The data quoted in paragraph 6 are taken from a paper entitled *Economic Evaluation of Anastrozole Versus Tamoxifen for Early Stage Breast Cancer in Singapore*. It was published in 2012 and is on pages 46–53. It is written by multiple authors including Vivianne Shih and is in a journal called *Value in Health Regional Issues*.

(i) State **one** piece of information that is missing, that would enable a full reference to be written.

**(1)**

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(ii) Using the information above, write as full a reference as possible to this paper as it should have been presented at the end of the report.

**(3)**

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(d) Identify **three** side effects common to both Anastrozole and Tamoxifen.

**(1)**

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(e) Using the information in paragraph 6, calculate the cost of a year of additional survival when Anastrozole is used instead of Tamoxifen.

Show your working.

**(2)**

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(f) Paragraph 7 states that "everyone should have the right to medical treatment".

Discuss this ethical implication.

**(2)**

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(g) Suggest why Anastrozole has been recommended as the preferred treatment for women with breast cancer.

**(2)**

**(Total for Question 2 = 20 marks)**

**TOTAL FOR PAPER = 40 MARKS**