

Write your name here

Surname

Other names

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

Centre Number

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Candidate Number

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# Biology

**Advanced Subsidiary**

**Unit 3: Practical Biology and Research Skills**

Monday 7 May 2018 – Morning

**Time: 1 hour 30 minutes**

Paper Reference

**WBI03/01**

**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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**Answer ALL questions.**

- 1 The photograph below shows some water hyacinth plants. These plants contain a lot of cellulose. The cellulose is used for the industrial production of glucose.



Magnification  $\times 0.1$

In the production of glucose, cellulose from water hyacinths is mixed with the enzyme cellulase. Cellulase breaks down the cellulose to produce glucose.

In an investigation, different masses of cellulose were added to beakers and the volume made up to  $100 \text{ cm}^3$ , using distilled water. Cellulase was also added to each beaker.

After 15 minutes, the concentration of glucose in each beaker was determined.

- (a) (i) State the independent variable in this investigation.

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(ii) In this investigation, the optimum temperature for cellulase was used.

Explain how the optimum temperature was determined.

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(iii) Name **one** variable, other than temperature, that should be controlled in this investigation.

Describe how this variable could be controlled.

(2)

Variable

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How the variable could be controlled

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

Mass of cellulose / g	Concentration of glucose produced after 15 minutes / g cm <sup>-3</sup>	Rate of production of glucose / g min <sup>-1</sup>
0.25	0.31	0.020
0.50	0.44	0.029
1.00	0.59	0.039
1.50	0.73	0.049
2.00	0.80	

(i) Calculate the rate of production of glucose for a mass of 2.00 g of cellulose.

Show your working.

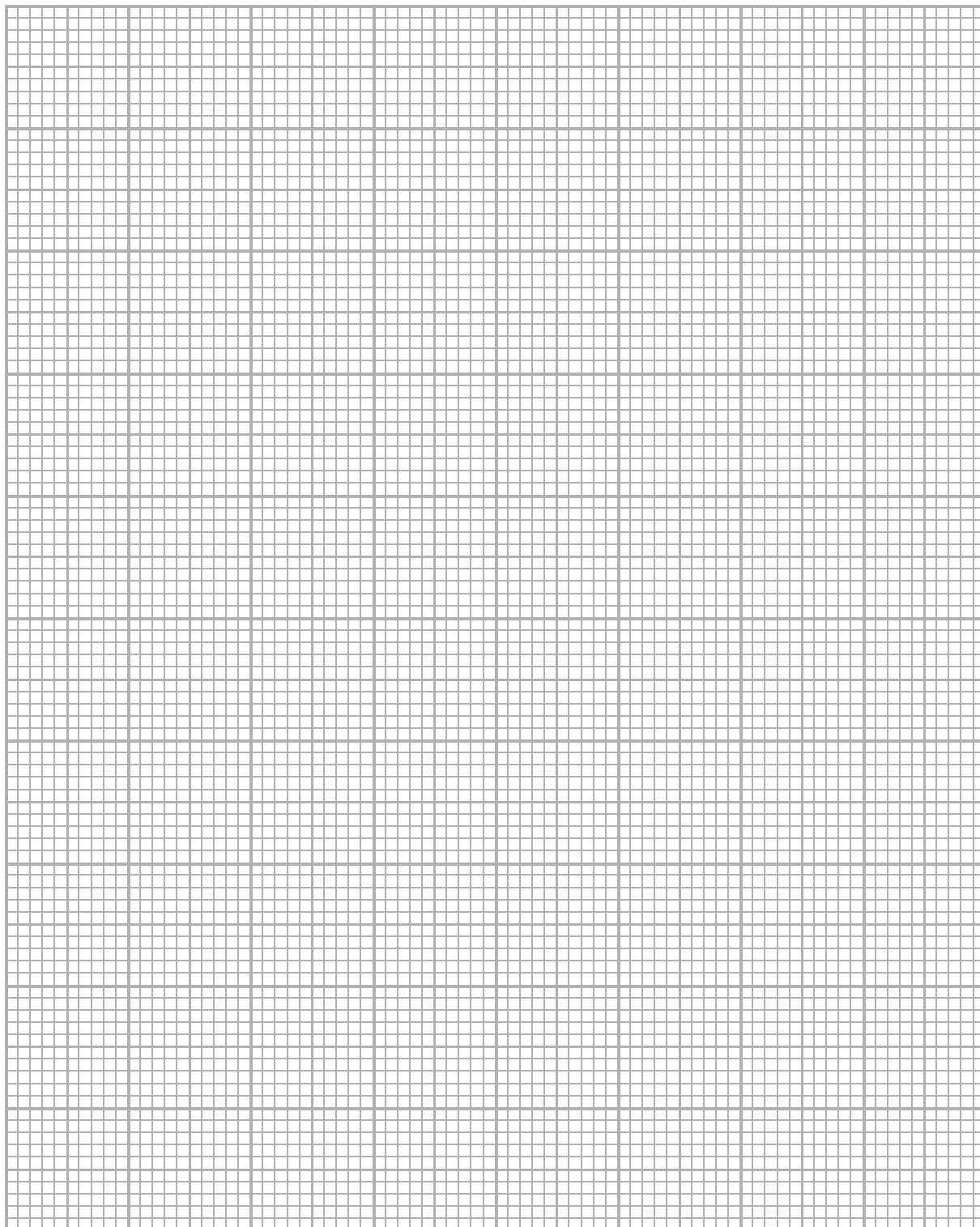
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(ii) Plot a graph to show the relationship between the mass of cellulose used and the rate of production of glucose. Join the points with ruled, straight lines.

(4)



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(c) Suggest how the variability of the results could be measured and shown on a graph.

(4)

Area with horizontal dotted lines for writing the answer.

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(d) In another investigation, the effect of cellulase concentration on the rate of glucose production was studied. The table below shows the results of this investigation.

Cellulase concentration / a.u.	Rate of glucose production / g min <sup>-1</sup>
1.0	0.35
3.0	0.43
6.0	0.59
9.0	0.71
18.0	0.71

Using the data in the table above, suggest conclusions that could be made about the cost effectiveness of using cellulase to produce glucose in industrial processes.

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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 high functioning autism spectrum disorder (HF-ASD).**

1. High functioning autism spectrum disorder (HF-ASD) is a developmental disorder. People diagnosed with HF-ASD are usually impaired in understanding signals and also responding to signals (e.g. answering back when someone calls their name). They are unable to understand or engage in social situations. Also, they avoid eye contact and don't interact with others spontaneously. They have average or above-average intelligence and normal language skills.
2. The cause of HF-ASD is unclear, but it is known to be affected by mutations in genes that control the formation of synapses between neurones. Some studies show structural abnormalities that have been identified in specific regions of the brain that may be a cause of HF-ASD.
3. Research on the effects of the hormone oxytocin in patients with HF-ASD has been carried out. Oxytocin is involved in the regulation of emotions. Oxytocin is specifically correlated with the development of voluntary social behaviour such as sexual activity, grooming, mother-infant attachment, approach behaviour and stress regulation.
4. Studies have shown that oxytocin can increase social behaviour in patients with HF-ASD. Elissar Andari investigated the effects of oxytocin on the behaviour of 13 patients with HF-ASD. These patients interacted with other players in a ball game. After inhalation of oxytocin, the patients displayed stronger, more secure cooperation with the good players. The patients also said they had increased feelings of trust and choice.
5. HF-ASD patients were unable to discriminate between the good and the bad players. They sent  $7.3 \pm 0.8$  balls to good players and  $7.1 \pm 0.7$  to bad players. In contrast, HF-ASD patients who were given oxytocin sent more balls to the good players as compared to the bad players. They sent, on average,  $9.0 \pm 0.8$  balls to the good players but only  $5.5 \pm 0.5$  to the bad players. Unaffected people sent more balls to the good players ( $12 \pm 1.1$ ) than to the bad players ( $5.2 \pm 0.4$ ). This experiment shows that oxytocin allowed the HF-ASD patients to respond more strongly to the good players and to distinguish between good and bad players, thus engaging in a social interaction.
6. The patients were kept free of any medication, other than oxytocin, for at least two weeks before and during the study. The result of not taking medication may have affected them as it disrupted their daily routine, which is important to those with HF-ASD. The parents gave consent but this doesn't clarify if the patients truly wanted to take part or not.
7. The oxytocin hormone used in the study (Syntocinon nasal spray) costs \$62 per  $5 \text{ cm}^3$  bottle. The concentration of oxytocin in Syntocinon is 10 IU (international units) per  $\text{cm}^3$ . Each of the 13 patients was given 24 IU for each experiment. The experiments were conducted twice.





8. Oxytocin is also known to relieve stress. It hinders the release of the hormone cortisol. Cortisol is known as the hormone responsible for stress. Oxytocin also reduces blood pressure, which is known to rise due to anxiety. This is very useful for patients with HF-ASD because in social situations they feel very anxious and stressed. The oxytocin would make the patients feel calmer and improve their sociability. However, a patient with HF-ASD would have to use the oxytocin every day in order to make sure that their daily routine isn't disrupted.
9. Applied Behaviour Analysis (ABA) is the most effective treatment for HF-ASD. ABA considers how the behaviour of patients is affected by positive or negative aspects of their environment. This approach has been used to treat many individuals on the autism spectrum (including HF-ASD). ABA rewards healthy behaviours of individuals with HF-ASD, so that patients will learn to repeat those behaviours. This is also called operant conditioning.
10. Cognitive Behavioural Therapy (CBT) helps people to regulate their fear and anxiety. This allows them to control their negative thoughts and improve their behaviour. Individuals diagnosed with HF-ASD usually exhibit fear and anxiety. CBT is matched to the personal needs of individuals. CBT shows no signs of hazard or danger towards the patients.



(a) (i) The problem discussed in this report is the condition HF-ASD.

Explain the main solution for this problem, proposed in paragraphs 3 to 8 of this report.

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(ii) Describe **one** alternative solution for this problem outlined in the report.

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(b) An issue report should contain visuals.

Draw a suitable visual that presents the results of Elissar Adari's investigation, described in paragraph 5, in a comparative way.

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- (c) The student made notes about the sources of all the information in the report. The note for Andari's study in this report is shown below.

The paper about the ball game was called Promoting social behaviour with oxytocin in high functioning autism spectrum disorders. It was written by someone called Elissar Andari who was helped by Jean-René Duhamela, Tiziana Zallab, Evelyn Herbrecht, Marion Leboyer and Angela Sirigu. I found it in a journal called Proceedings of the National Academy of Sciences where it was published on March 2, 2010. This journal consists of a number of magazines published over the year. All the magazines for the year make up a volume. This was Volume 107 Magazine number nine. The article was on pages 4389 to 4394.

- (i) Describe how and where this reference should be identified in the report. (2)

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- (ii) Using the information in this note, write a full reference to this paper as it should be presented at the end of the report. (3)

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(d) Some economic implications of this issue are discussed in paragraph 7.

(i) Calculate the cost of 1 IU of oxytocin in Syntocinon nasal spray.

Show your working.

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(ii) Using your answer to d(i), calculate the total cost of the oxytocin used in Elissar Andari's ball game investigation.

Show your working.

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(e) Identify **three** ethical implications of the study described in this report.

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

**TOTAL FOR PAPER = 40 MARKS**



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