OCR
Oxford Cambridge and RSA

Accredited

A Level Biology B (Advancing Biology)

H422/03 Practical skills in biology

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 1 hour 30 minutes

You may use:
- a scientific or graphical calculator

First name	
Last name	

Centre number						**Candidate number**				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

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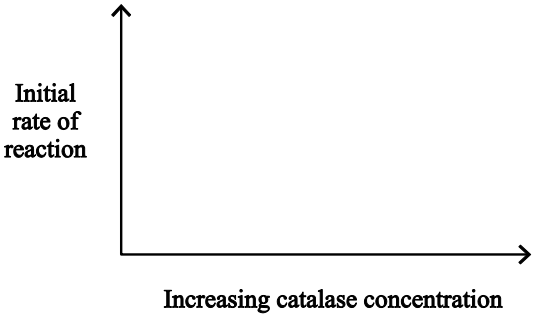
Answer **all** the questions.

1 Catalase is an enzyme that is often used in school laboratories. Catalase acts on hydrogen peroxide.

(a) On the axes below, sketch the curve you would expect if a reaction was carried out in optimum conditions with catalase and hydrogen peroxide.

Excess substrate is available.



[1]

(b) A student wanted to investigate the effect of substrate concentration on the rate of hydrogen peroxide breakdown.

There are many different sources of catalase, including ground liver and blended celery stalk. Both of these tissues could be used but each has advantages and disadvantages.

Evaluate the suitability of each of the tissues and justify which tissue is best for the student to use.

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..... **[3]**

(c) The student set up the investigation using a source of catalase as shown in **Fig. 1.1**.

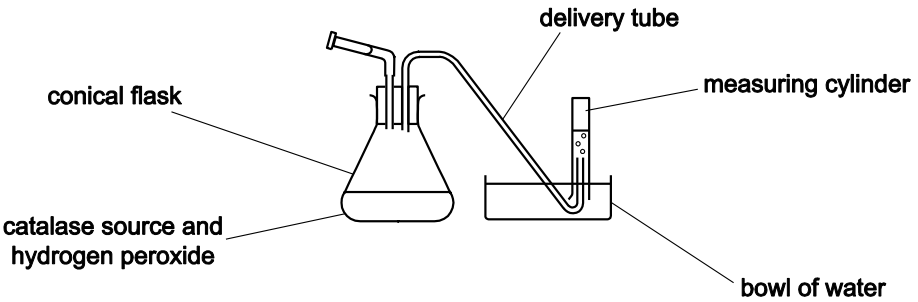

Fig. 1.1

The oxygen gas produced is collected in a 100 cm^3 measuring cylinder. The gas produced was measured at two minute intervals.

The student collected data for two different concentrations of hydrogen peroxide (H_2O_2):

- 2 arbitrary units H_2O_2
- 4 arbitrary units H_2O_2.

At the start of each test, 5.0 cm^3 of air was already present in the measuring cylinder.

Fig. 1.2 shows the results seen by the student.

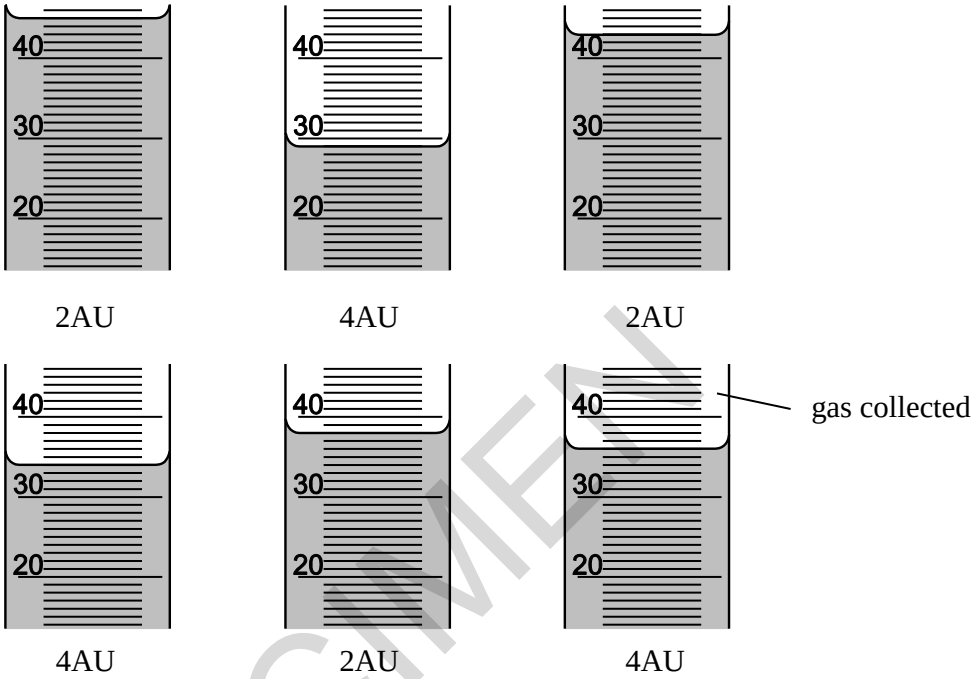

Fig. 1.2

Construct an appropriate table and enter:

- the **raw** data to the most appropriate level of precision for this apparatus
- the **mean values.**

[3]

(d) Catalase activity can vary between different tissues within the same organism. A second student carried out an investigation using catalase from different muscle tissues. All the samples were taken from the same individual organism.

The results are shown in **Table 1.1** below.

	Time for muscle tissue to produce 2 cm^3 oxygen from hydrogen peroxide (s)	
	Chicken leg muscle	**Chicken wing muscle**
1	76	98
2	78	96
3	84	85
4	86	78
5	94	102
6	79	104
7	83	116
8	85	94
9	78	89
10	86	112
Mean ($\bar{x}$)	82.9	97.4
SD (s)	5.4	11.7
Variance (s^2)		

Table 1.1

(i) Complete **Table 1.1**, by calculating the variance for each set of data.

[1]

(ii) The student decided to carry out a *t*-test to determine if the two sets of data were significantly different from each other.

Calculate the *t* value for the data in **Table 1.1**. Use the formula.

$$t = \frac{|\,\overline{x_1} - \overline{x_2}\,|}{\sqrt{\frac{S_1{}^2}{N_1} + \frac{S_2{}^2}{N_2}}}$$

Show your working.

t =..... **[3]**

(iii) The student stated that "*there is no significant difference in the time it took to collect 2 cm^3 oxygen so the activity of the catalase in both types of tissue was the same*".

Use **Table 1.2** below to decide if the student is correct. Explain your answer.

Degrees of freedom	**Level of probability**		
	0.05	**0.01**	**0.001**
1	12.71	63.66	636.6
2	4.303	9.925	31.60
18	2.101	2.878	3.922
20	2.086	2.845	3.850

Table 1.2

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..... **[3]**

(iv) Comment on the precision of the data obtained for the two types of muscle in **Table 1.1**.

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…… **[1]**

(v) Hydrogen peroxide is produced in cells as an intermediate compound when oxygen is converted to water. It can interact with and destroy other molecules in the cell. The enzyme catalase is present in cells to reduce the damage.

Muscles consist of bundles of muscle cells (fibres).

Suggest which muscle, chicken leg or chicken wing, contains cells with a high number of mitochondria.

Explain your suggestion.

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…… **[1]**

2 **(a)** Deaths from hypothermia in the UK have greatly increased.

(i) Give **two** visible symptoms that would suggest a patient has hypothermia?

…… **[1]**

(ii) What evidence would confirm hypothermia?

…… **[1]**

(iii) Between 2007 and 2011 the number of recorded cases of hypothermia were as follows:

Year	**Number of patients treated in hospital**	**Number of patients over-60 years of age**	**Number of patients who died within 30 days of being admitted**
2007	950	633	
2011	1876	1396	260

Table 2.1

In 2007, 14% of people with hypothermia treated in hospital died within 30 days of being admitted. Calculate how many people died as result of hypothermia in 2007.

Show your working.

Number of people who died …… **[2]**

(iv) What can be concluded about the susceptibility to hypothermia of people who are over the age of 60 years?

In your answer you should:

- analyse the data from **Table 2.1**
- suggest possible explanations for your conclusion.

You may use the space below if needed for any calculations.

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..... **[4]**

(b) Body temperatures vary between different organisms. One method of measuring body temperature uses fibre optic thermometers.

A fibre optic thermometer has a resolution of 0.1°C and a precision: ±0.8°C.

Calculate the percentage error of this thermometer for a temperature change of 5°C.

Show your measuring. Give your answer to one decimal place.

percentage error **……..%** **[2]**

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3* Aspirin (2-*O*-acetylsalicylic acid) is a drug commonly used in medicine.

Ingestion of more than 500 mg kg^{-1} of aspirin causes severe and possibly fatal toxicity.

Once in the body aspirin is gradually broken down in the liver into salicylic acid.

Salicylic acid is excreted through the kidney and leaves the body in the urine.

Estimates of the amount of aspirin remaining in the body can be made by determining the amount of salicylic acid in the urine. Salicylic acid reacts with a solution of iron(III) chloride to give a purple-coloured substance.

Write a <u>method</u> to determine the concentration of salicylic acid in a sample of urine.

Your method must be based on the assumption that you are provided with the following:

- a solution of 100 mg dm^{-3} salicylic acid
- a 1% solution of iron(III) chloride
- a colorimeter
- school or college laboratory resources.

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4 As the human population continues to grow there is an ever increasing need to increase food production.

(a) Alfalfa is grown mainly for animal feed as it is rich in protein, minerals and vitamins. The leaves can also be used as a dietary supplement in human nutrition.

Fig. 4.1 below shows the transverse section of an alfalfa leaf.

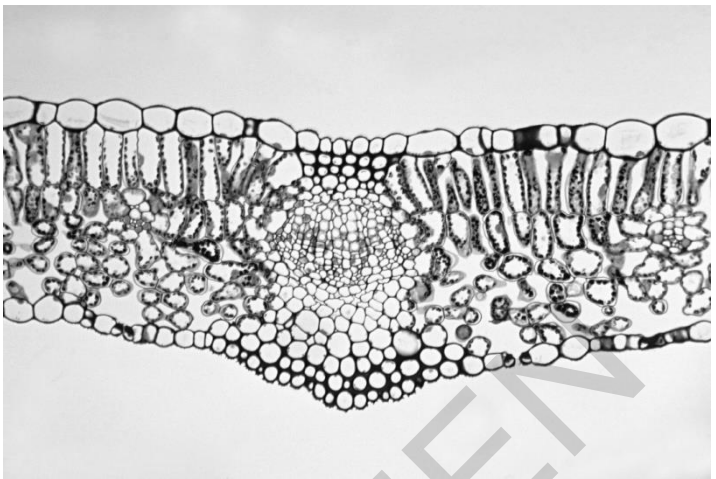

Fig 4.1

In the space below draw a labelled and annotated low power plan of the transverse section of the alfalfa leaf shown in **Fig. 4.1**.

[4]

(b) Other important crops within the UK include potatoes, sugar beet, oilseed rape, wheat and fresh fruits.

Table 4.1 below shows the UK production in tonnes per hectare for each of these crops in 2012.

Crop	Total production (thousand tonnes per hectare)
Potatoes	4553
Sugar beet	1144
Oilseed rape	2557
Wheat	13261
Fresh fruits	358

Table 4.1

Plot a graph on the grid provided to show this data in the most appropriate way.

[4]

(c) Plant cells can be studied using microscopy.

Fig. 4.2

Using a light microscope and a suitably calibrated graticule it is possible to calculate the field of view for each eyepiece lens. Each of the smallest divisions on the graticule shown at this magnification is 0.1 mm.

(i) For **Fig. 4.2**, calculate the diameter of the field of view.

diameter of field of view..... µm **[2]**

(ii) For **Fig. 4.2**, estimate the number of cells shown in the field of view.

number of cells ..... **[1]**

(iii) Using 3.14 as the value for π, calculate the density of the cells in the area shown in **Fig. 4.2**.

Show your working.

density of cells ..... **[3]**

5 Dairy farmers need the land used for grazing by their cows to be as free of weeds as possible.

In the UK, dock plants are the most common perennial weed in grassland grazed by dairy cows.

Dock seeds are able to **pass through** the digestive tract of **cattle** unharmed. Cattle do not graze near cowpats so dock plants survive and grow in abundance.

Nettles can be found in plant material fed to cattle and these also survive passage through a cow's digestive system. The plant chickweed grows well in soils with high nitrogen. Other plants commonly found in grassland are rye grass and white clover as these are present in the grass seed mix sown by farmers.

(a) **(i)*** A student plans to collect valid data to investigate the distribution of plants in a grazed grassland field.

Describe the limitations of using systematic sampling as a technique.

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…… **[6]**

(ii) Explain how using a point quadrat could affect the accuracy of data collected.

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…… **[2]**

(b) Patches of docks, nettles, thistles and other weeds develop over time in the grassland reducing the grazing area and the yield of plant material for use as cattle feed.

Evaluate the use of weed control in this grassland.

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…… **[3]**

END OF QUESTION PAPER

OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

A Level Biology B (Advancing Biology)

H422/03 Practical skills in biology

SAMPLE MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 60

This document consists of 16 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

- Read through the whole answer from start to finish.
- Decide the level that **best fits** the answer – match the quality of the answer to the closest level descriptor.
- To select a mark within the level, consider the following:
  Higher mark: A good match to main point, including communication statement (in italics), award the higher mark in the level
  Lower mark: Some aspects of level matches but key omissions in main point or communication statement (in italics), award lower mark in the level.

Level of response questions on this paper are **3** and **5(a)(i).**

11. **Annotations**

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. Subject-specific Marking Instructions

INTRODUCTION

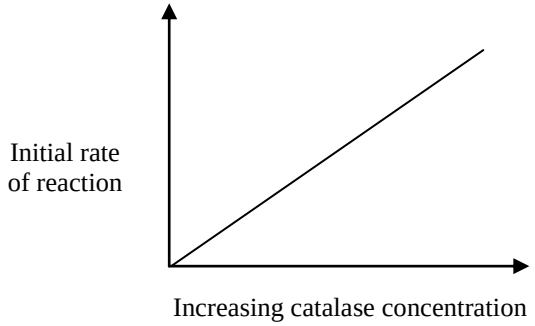
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Marks	Guidance
1	(a)		 ✓	1	
	(b)		*Award 1 mark for an advantage of either tissue and 1 mark for a disadvantage of either tissue to a maximum of 2 marks.* *Advantages of using liver* *idea of* more enzyme per gram **OR** easier to grind / blend ✓ *Advantages of using celery* cheaper **OR** slower activity may give more accurate results ✓ *Disadvantages of using liver* religious objections depending on animal source **OR** messy to prepare / AW ✓ *Disadvantages of using celery* may be out of season **OR** different parts of the plant have different activity levels ✓	3	In the absence of a justified decision regarding tissue choice award a maximum of 2 marks **DO NOT** award double marks for statements simply reversed for the other tissue

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(c)</td><td></td><td>Student gives reasoned argument / justification for final choice ✓
concentration of, hydrogen peroxide / H_2O_2, (AU) in first column
AND
volume of water displaced (cm^3) to the right of the IV, with each concentration of hydrogen peroxide recorded in separate row
AND
all cells surrounded by straight ruled lines ✓

all data for 2AU recorded correctly
AND
all data for 4AU recorded correctly ✓

both mean values calculated correctly
AND
recorded to, the same / one more decimal place, than raw data ✓</td><td>**3**</td><td>*Table should resemble:*
<table><tr><th rowspan="2">Concentration of hydrogen peroxide (AU)</th><th colspan="4">Volume of water displaced (cm^3)</th></tr><tr><th>1</th><th>2</th><th>3</th><th>Mean</th></tr><tr><td>2</td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td></td></tr></table>
OR
<table><tr><th>Concentration of hydrogen peroxide (AU)</th><th>Initial level of meniscus (cm^3)</th><th>End level of meniscus (cm^3)</th><th>Volume of water displaced (cm^3)</th><th>Mean volume of water displaced (cm^3)</th></tr><tr><td rowspan="3">2</td><td></td><td></td><td></td><td rowspan="3"></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td rowspan="3">4</td><td></td><td></td><td></td><td rowspan="3"></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table>
Figures to be checked on a printed paper at standardisation.</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>*variance for leg muscle*
29.16
AND
variance for wing muscle
136.89 ✓</td><td>**1**</td><td>Look for answer written outside of the table</td></tr>
</table>

Question			Answer	Marks	Guidance
		(ii)	*t value* 3.558 ✓✓✓	3	**DO NOT ALLOW** if negative sign is given If incorrect t value is given, marks can be given for intermediate stages as follows: *one mark for modulus calculation* 14.5 *one mark for denominator calculation prior to square rooting 16.605* **AWARD** ecf from either / both previous calculations
		(iii)	**Any 3 from:** $t_{critical}$ is 2.101 at 5% probability level ✓ the (calculated) value is greater than the critical value at the 5% (p = 0.05) significance level ✓ the (calculated) value is <u>also</u> greater than the critical value at the 1% (p = 0.01) significance level ✓ (therefore the student can) reject the null hypothesis ✓ the difference in enzyme activity is not due to random chance ✓	3	
		(iv)	precision of the leg muscle is greater (than the data for the wing muscle) **AND** as the SD for the wing muscle is higher than that of the SD for the leg muscle ✓	1	**ALLOW** use comparative use of figures
		(v)	(*chicken leg muscle*) *idea that* higher catalase activity so more, aerobic respiration / oxidative phosphorylation ✓	1	
			Total	16	

Question			Answer	Marks	Guidance
2	(a)	(i)	**Any two from:** bouts of (violent) shivering slow / shallow breathing pale skin ✓	1	Mark first two answers only
		(ii)	a core (body) temperature of less than 35°C ✓	1	
		(iii)	133 ✓✓	2	**DO NOT ALLOW** if answer is not a whole number **ALLOW** 1 mark for correct working 14 / 100 x 950
		(iv)	*Analysis* processing of data ✓✓ *Explanation (up to a maximum of 2 marks)* elderly more susceptible to hypothermia ✓ (probably) due to cost of energy bills rising ✓ ref to <u>fuel poverty</u>, resulting in choice between money for food or fuel / AW ✓ less, able to / likely, to move around ✓ AVP ✓	4	*Examples of data processing* Over 60s increase = (1396 / 633) x 100 = 220.5% increase General increase = (1876 / 950) x 100 = 197.5% increase Difference in % increase = 23.0% % of total admissions from the elderly 2007 950 – 633 = (317 / 950) x 100 = 33.1% 2011 1876 – 1396 = (500 / 1870) x 100 = 26.7% e.g. ref to arthritis

Question			Answer	Marks	Guidance
	(b)		16% ✓✓	2	**ALLOW** one mark for correct working (0.8 / 5) x 100
			Total	**10**	

Question			Answer	Marks	Guidance
3*			**Level 3 (7–9 marks)** Details of apparatus and a method to produce reliable data are provided to include the use of a dilution series to construct a standard curve. Most variables are identified, and the method states how most variables are controlled. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (4–6 marks)** The apparatus and a method to provide reliable results are provided although some details may be missing. There is an outline of standard curve construction. Some variables are identified and the method states how some variables are controlled. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–3 marks)** Apparatus and an outline method are suggested to provide some results but information, such as standard curve construction, may be missing. Some variables are omitted. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	9	**Indicative scientific points could include:** **Apparatus & method:** • cuvettes, test tubes • apparatus for volume measurement (pipettes, syringes) • distilled / deionised water • selection of appropriate filter (on colorimeter) • reference to zero or blank • details of quantitative preparation of dilution series (for salicylic acid) to include volumes and final concentration • standard curve construction • method of testing urine and obtaining a reading. **Variables:** • (curve) independent variable = dilution • dependent variable = colorimeter reading • correct units included • control variables e.g. filters (colorimeter), volumes, time, temperature. **Reliability:** • repeats (for dilutions and urine reading) • reference to quantitative processing of data e.g. calculation of means • reference to use of error bars on standard curve. **Risk Assessment:** • potential chemical hazards & control • potential electrical hazards & control • potential microbial hazards (urine) & control.
			Total	**9**	

Question			Answer	Marks	Guidance
4	(a)	(i)	*LP plan must only show tissue layers with no cell detail.* *In addition there should not be any shading or other detail within the plan.* 4 distinct layers shown **AND** drawn to appropriate scale ✓ area of vascular bundle shown **AND** labelled ✓ three tissues labelled correctly from list ✓ three tissues annotated correctly from list ✓ • cuticle, **and** visible detail • upper epidermis, **and** visible detail • palisade mesophyll layer, **and** visible detail • spongy mesophyll layer, **and** visible detail • vascular bundle, **and** visible detail • xylem tissue, **and** visible detail • phloem tissue, **and** visible detail	4	**DO NOT ALLOW** if cells to be drawn (ONLY areas of tissue to be drawn) **DO NOT ALLOW** for just labelling tissue annotation (description of visible feature needed) e.g. thin e.g. single layer of cells, absence of chloroplasts e.g. rectangular cells, presence of (many) chloroplasts, wider layer e.g. circular cells, less chloroplasts, thicker layer e.g. stained red, stained green e.g. stained red, angular inner lumen e.g. stained green

Question			Answer	Marks	Guidance
	(b)		bar chart drawn with equal width size bars, not touching ✓ X axis labelled as "Crop" **AND** Y-axis labelled as "Total production / thousand tonnes per hectare" ✓ equidistant vertical scale used so that plot area covers at least 50% of the y axis space ✓ <u>all</u> data plotted accurately ✓	4	**ALLOW** +/- 1 mm
	(c)	(i)	6 divisions = 0.6 mm 0.6 x 1000 = 600 µm ✓✓	2	**ALLOW** one mark for correct working
		(ii)	ALLOW value between 10 - 12 cells ✓	1	**DO NOT ALLOW** if whole number not given
		(iii)	*Area of field of view =* $\pi \times r^2$ Correctly calculated density ✓✓✓	3	**ALLOW** ecf from **(c)(i)** and **(c)(ii)** throughout Allow marks for working as follows: one mark for calculating the area of field of view – 3.14 x (300 x 300) = 282 600 μm^2 one mark for correctly calculating the radius – 600 / 2 The possible answers for density based on 10 / 11 / 12 cells depending on the answer to **(c)(ii)**: • 3.5 x 10^{-5} cells μm^{-2} (based on 10 cells) • 3.9 x 10^{-5} cells μm^{-2} (based on 11 cells) • 4.2 x 10^{-5} cells μm^{-2} (based on 12 cells).
			Total	**14**	

Question			Answer	Marks	Guidance
5	(a)	(i)*	**Level 3 (5–6 marks)** A broad range of limitations described in detail applying knowledge and understanding of sampling to the context, including the limitations of systematic sampling. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Some limitations described applying some knowledge and understanding of sampling to the context, including some of the limitations of systematic sampling. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** An attempt to describe a limitation with partial knowledge and understanding of sampling. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	6	**NOTE that the question has asked for <u>limitations,</u> not errors** ***Limitations to consider include:*** • systematic sampling not appropriate without a gradient e.g. variation in drainage across the site • idea that transects usually run in one direction and it would need to be done in more than one direction to cover the field • some species more easily counted/seen • some species less easily counted/seen/covered by grass or larger species/species may be small therefore not easily seen • similar species wrongly identified • experiment not replicated (in the same location) • experiment only recorded on one day • experiment only carried out at one point in time/season • grass/lichen/moss not identified to species level • plants counted even if only partially within the quadrat • reference to random sampling/bias in area covered.

Question			Answer	Marks	Guidance
		(ii)	**Any two from:** more objective / less subjective / less of an estimate (of frame or grid quadrat) ✓ only records what is, hit / touched ✓ could be less representative (as less area covered) ✓ may miss plants even though they are abundant ✓	2	**IGNORE** statements referring to accuracy without suitable qualification as outlined in the bullet points
	(b)		*Disadvantages (up to a maximum of 2 marks)* cost of purchasing appropriate weedkiller ✓ possible accumulation of chemicals up the food chain ✓ public perception of use of chemicals ✓ reference to environmental impact ✓ contamination of water supplies is leading to removal of pesticides from the market (pushing up feed prices) ✓ reduces biodiversity, if herbicide is not selective enough ✓ health & safety implications re: storage and application ✓ *Advantages (up to a maximum of 2 marks)* greater yield (of hay / silage) means less food needs to be bought in ✓ reference to impact of greater grazing ✓ increases biodiversity, if other species can now survive ✓ increased milk yield in herd / (*idea of* greater stocking rate) feed more cows on the same area of grassland ✓	3	
			Total	11	