GCE

Biology B

H422/02: Scientific literacy in biology

A Level

Mark Scheme for June 2025

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM 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 available in RM Assessor

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

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 RM Assessor 50% and 100% (traditional 40% 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 or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

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 is not an attempt at the question.

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

8. The RM Assessor **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 RM Assessor messaging system, or e-mail.

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, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.
    Once the level is located, award the higher or lower mark:
    The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
    The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.
    In summary:
    The skills and science content determines the level.
    The communication statement determines the mark within a level.

    Level of response questions on this paper are 2(a)(i) and 3(c).

11. **Annotations**

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given

Annotation	Meaning
I	Ignore
BP	Blank page

12. **Subject Specific Marking Instructions**

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
I	alternative and acceptable answers for the same marking point
✓	Separates marking points
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

13. **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)	(i)	aleurone (layer) ✓ produces / synthesises / secretes , enzymes **or** AVP ✓	2	 **ALLOW** named enzymes e.g. amylase e.g. where hydrolysis of starch occurs e.g. storage of lipid / protein / vitamins / minerals
1	(a)	(ii)	*formation* fusion of , pollen / sperm , nucleus with (two) polar , nuclei / bodies ✓ *function* storage of (named) , carbohydrate / lipid / protein (for developing embryo) ✓	2	 **IGNORE** gametes unqualified e.g. fusion of gametes **ALLOW** food source / starch store / food reserve
1	(a)	(iii)	more water can enter (embryo) ✓ *idea of* removing , ABA / (GA) inhibitor ✓ more oxygen can enter (embryo) ✓ (more) oxygen increases GA production ✓ (so) greater inhibition of ABA (by GA) ✓	max 2	 **ALLOW** faster uptake of oxygen **IGNORE** e.g. oxygen *causes* GA production without the idea of ‘more oxygen’ or ‘increased GA’

Question			Answer		Marks	Guidance
1	(b)	(i)	1	*appropriate DV* standardised method for determining germination ✓	max 4	e.g. number of days / time taken until emergence of , radicle / root e.g. number of days / time taken until roots reach 5mm **IGNORE** ref to shoot
			2	*appropriate IV* suitable range of temperatures ✓		**ALLOW** e.g. five temperatures ranging from 10 to 30º C should include at least **four** different temps **below 45 ^{0}C**
				any two from		
			3	use of , large / appropriate , (stated) number of (barley) seeds ✓		e.g. minimum 20 seeds (per temperature)
			4	method for controlling temperature ✓		e.g. incubator / incubate seeds **ALLOW** thermostatically controlled room **IGNORE** thermostatically controlled water bath
			5	other (named) variable(s) kept constant ✓		e.g. 15cm^3 of water / nutrient solution provided each day e.g. same age of seeds / seeds from same plant e.g. light intensity **IGNORE** same species **IGNORE** pH / buffer / carbon dioxide concentration
			6	*idea of* repetition of whole investigation twice more ✓		

1	**(b)**	**(ii)**	availability of water ✓ soil pH ✓ AVP ✓	**max 2**	**ALLOW** drought / flooding **IGNORE** rain unqualified / humidity e.g. salinity / osmotic stress / light frequency / depth of burial / light levels / light intensity **IGNORE** carbon dioxide concentration
1	**(b)**	**(iii)**	vernalisation ✓	**1**	**ALLOW** flowering
1	**(c)**	**(i)**	*idea that* germination is delayed ✓ (so) seeds can be , stored / transported ✓ **OR** *idea of* allowing crop management ✓ (so) avoids germination in unfavourable conditions / AW ✓ **OR** avoids germination in unfavourable conditions / AW ✓ (so) seed waste reduced / increases crop yield ✓ **OR** AVP advantage ✓ AVP linked explanation ✓	**max 2**	**ALLOW** (so) seeds do not need to be sown immediately **ALLOW** idea of optimising planting schedules **ALLOW** seasonal aspect e.g. avoids germinating in winter

1	**(c)**	**(ii)**	**1**	flooding causes , hypoxia / anoxia / lack of oxygen , (in soil) ✓	**max 4**	
			2	rice has subfamily 3 (enzymes) that will be activated in low oxygen conditions ✓		**ORA** for barley
			3	(therefore more) starch-digesting enzyme / amylase , activated / AW , in rice ✓		**ORA** for barley
			4	in rice , starch / amylose , will be , hydrolysed / broken down , to maltose / glucose ✓		**ORA** for barley
			5	AVP ✓		e.g. (this variety of) rice may not germinate at higher oxygen levels e.g. glucose / maltose (becomes) available for respiration e.g. glucose / maltose are respiratory substrates **IGNORE** ref to <u>anaerobic</u>
1	**(d)**	**(i)**	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 0.8(69565217) (%) award 2 marks** total uncertainty = 2 × 0.5(mm) = ±1(mm) ✓ percentage error = (1 ÷ 115) × 100 = 0.87(%) ✓		**2**	**ALLOW** 1.7(39130434) (%) for 2 marks (based on 1× smallest division)
1	**(d)**	**(ii)**	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 6 (mm min^{-1}) award 1 mark** rate = 180 ÷ 30 = 6 (mm min^{-1}) ✓		**1**	

1	**(d)**	**(iii)**	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 16 ($mm^3\ min^{-1}$) award 2 marks** rate = $\pi \times 0.75^2 \times 9.33$ ✓ rate = 16 ($mm^3\ min^{-1}$) ✓	**2**	**ALLOW** 2 marks for calculator value of 16.48747 or any correctly rounded value **ALLOW** 1 mark for $\pi \times 0.75^2 \times 9.33$

2	**(a)**	**(i)***	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** A comprehensive description of the steps in the process **AND** an attempt at suggesting an explanation for the change in response. *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)** A comprehensive description of the steps in the process **but does not include** an explanation for the change in response **OR** A description of some of the steps in the process **AND** an attempt at suggesting an explanation for the change in response. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** A basic description of some steps in the process **OR** an attempt at suggesting an explanation for the change in response. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	**Loss of communication mark- consider incorrect science and terminology** **e.g. incorrect substrate and product such as fibrin to fibrinogen** **Indicative scientific points may include:** **steps in the clotting process** • damage to blood vessels exposes collagen • leads to activation of platelets • clumping of platelets and release of thromboplastin • involvement of calcium ions • involvement of clotting factors / enzymes • release of thromboplastin by leucocytes • conversion of prothrombin → thrombin • conversion of fibrinogen → fibrin • soluble to insoluble (linked to fibrinogen and fibrin) • formation of mesh • role of fibrin fibres / mesh in trapping erythrocytes **explanation for change in response** • cascade amplifies the response • activation of enzymes amplifies the response • activation of enzymes increases the rate of response • ref to positive feedback / positive cascade • platelets attract more platelets • *idea that* an enzyme further down in process accelerates earlier step

2	**(a)**	**(ii)**	narrowing of blood vessel (lumen) reduces blood flow (to site of cut) ✓ *idea that* (clumping of proteins will) mimic , action of fibrin / mesh formation ✓	**2**	**ALLOW** arterioles for blood vessel **IGNORE** capillaries for blood vessel **IGNORE** ref to stops bleeding (as in stem of question) **IGNORE** constriction
2	**(b)**	**(i)**	LDH is released by damaged , cells / tissue ✓ concentration of LDH in the blood will depend on severity of the injury / AW ✓ can identify location of damaged , cells / tissues ✓	**max 2**	**IGNORE** level / amount / conc. for concentration **ALLOW** e.g. the higher the LDH concentration the more severe the damage / LDH concentration proportional to severity of tissue damage
2	**(b)**	**(ii)**	(in this male patient) LDH-4 is associated with kidney **and** pancreas ✓ cannot distinguish between , these organs / kidney and pancreas ✓	**2**	**DO NOT ALLOW** placenta (patient is male) **ALLOW ECF** if placenta mentioned **ALLOW** further tests would be needed to distinguish between these organs

3	**(a)**		**F** = islet of Langerhans ✓ **G** = exocrine / non-endocrine , cells / tissue ✓	**2**	**ALLOW** alpha / α **and** beta / β , cells **ALLOW** acinar cells / acinus
3	**(b)**	**(i)**	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 6.0 (mmol mol^{-1}) award 2 marks** rearrangement of equation: $\text{HbA1c (\%)} = \frac{\text{HbA1c (mmol mol}^{-1})}{10.929} + 2.14$ ✓ Substitution and evaluation: $\frac{42}{10.929} + 2.14 = 5.98 = 6.0$ (2 sig figs) ✓	**2**	**ALLOW** 5.98 for 1 mark
3	**(b)**	**(ii)**	prediabetes / high probability of developing type 2 diabetes ✓	**1**	**ALLOW** ECF from candidate's own value for part **(i)**

3	**(c)***		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** A comprehensive balanced evaluation with advantage**s AND** disadvantage**s** of semaglutide. *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)** An evaluation that includes an advantage **AND** disadvantage**s** of semaglutide. **OR** An evaluation that includes advantage**s AND** a disadvantage of semaglutide. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** An outline of advantage**s OR** disadvantage**s** of semaglutide. OR An outline of an advantage **AND** a disadvantage *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	**Loss of communication mark-** **consider irrelevant detail e.g. more than 50% irrelevant information about clinical trials / type 1 diabetes / other drugs** **OR** **consider lack of clarity e.g. not being clear about which are advantages / disadvantages** **Indicative scientific points may include:** **Potential advantages of semaglutide** • shows that controls diabetes better than some existing treatments • reduces risks associated with (Type 2) diabetes e.g. reduces likelihood of foot infection • enables patient to be more active • reduces impacts of obesity • weekly injection may be more convenient for patients than (daily) insulin injections • may reduce costs for the NHS • reduces burden on NHS resources • reduces risk of kidney failure • positive impact on lifestyle e.g. fewer injections is less time-consuming for patients **Potential disadvantages of semaglutide** • (usually more) expensive • (increases risk of retina damage so) loss of vision • tablets easier to manage / administer than injections • pain / discomfort of regular injections • long-term side-effects are unclear • possible nutrient deficiency • uncontrolled / too much weight loss

					• negative impact on lifestyle e.g. loss of earnings due to loss of vision

<table>
<tr>
<td>4</td>
<td>(a)</td>
<td>(i)</td>
<td>FIRST CHECK ANSWER ON ANSWER LINE
If answer (D) = 0.83 award 3 marks

<table>
<tr><th>Plant species</th><th>(n / N)^2</th></tr>
<tr><td>Black-eyed Susan</td><td>0.0390</td></tr>
<tr><td>Clover</td><td>0.0481</td></tr>
<tr><td>Blue vervain</td><td>0.0308</td></tr>
<tr><td>Common yarrow</td><td>0.0151</td></tr>
<tr><td>Ironweed</td><td>0.0236</td></tr>
<tr><td>Canadian milkvetch</td><td>0.0173</td></tr>
<tr><td>Totals</td><td>0.1739</td></tr>
<tr><td>D =</td><td>0.83
(2 sig. figs)</td></tr>
</table>
✓✓✓</td>
<td>3</td>
<td>Check table for candidate's answer for D if it is not on the answer line.

ALLOW for 1 mark
6 correct values for (n/N)^2
OR
correct total

ALLOW for 2 marks
correct value for D not to 2 sig. figs e.g. 0.8261</td>
</tr>
<tr>
<td>4</td>
<td>(a)</td>
<td>(ii)</td>
<td>supported because D , has increased / is greater than 0.61 ✓</td>
<td>1</td>
<td>ALLOW D value in 2022 is closer to 1
ALLOW ECF for answer to part (a)(i) e.g. decrease in biodiversity if their value for D is <0.61</td>
</tr>
</table>

4	**(a)**	**(iii)**	**1**	include , data / *D* value , for , 2019 / 2020 / 2021 ✓	**max 2**	**ALLOW** whether , data / *D* value , changed / fluctuated , in intervening years **IGNORE** ref to longer time period as time stated in question
			2	(named) statistical test to compare significance ✓		**ALLOW** *t*-test (unpaired) **DO NOT ALLOW** chi-squared / Spearman's rank correlation coefficient
			3	obtain data for other species ✓		**ALLOW** e.g. data for more plant species **or** other plant species
			4	ensure data collected at same , times of the year / month / season ✓		
			5	use identification key to ensure species are correctly recognised ✓		**ALLOW** photographic images / dichotomous for identification **ALLOW** identification guide

4	**(b)**			plant biodiversity in soybean field is low(er than solar farm) ✓ (so) few(er) , habitats / food sources / niches , for insects (in soybean field) ✓ AVP ✓	**max 2**	**ALLOW** ORA throughout **ALLOW** either part of soybean field for soybean field throughout e.g. impact of harvesting (soybean) e.g. impact of insecticides / pesticides (on soybean field) e.g. impact of human activity on maintenance of crops
4	**(c)**			*correct because* **1** weed species (may) have greater genetic diversity ✓ **2** weed species more likely to adapt to climate change ✓ **3** drought / flooding , may have less effect on weed species ✓ *incorrect because* **4** crop plants might grow more with higher , temperatures / concentrations of CO_2 ✓ **5** crop plants more likely to be , genetically modified / genetically engineered / selectively bred ✓	**max 3**	**ALLOW** ORA for MPs 1 to 3 based on crop plants **ALLOW** more likely to survive wide range of environmental conditions

5	**(a)**	**(i)**	*males* (binds to cells in testes and) triggers release of testosterone ✓ *females* (surge in LH) causes release of secondary oocyte (from mature follicle) ✓	**2**	**ALLOW** other correct roles e.g. stimulates Leydig cells **ALLOW** other correct roles e.g. stimulates formation of corpus luteum e.g. release of oestrogen **IGNORE** ovulation unqualified
5	**(a)**	**(ii)**	stimulates oestrogen production ✓ stimulates maturation of follicles ✓	**2**	**ALLOW** other correct uses e.g. causes induction of ovulation
5	**(b)**	**(i)**	**H** = zona pellucida ✓ **J** = (haploid) nucleus (of oocyte) ✓ **K** = corona radiata ✓	**3**	**ALLOW** glycoprotein layer **ALLOW** cell surface / plasma membrane **ALLOW** (layer of) follicle cell**s**
5	**(b)**	**(ii)**	**1** *idea that* the process , starts before birth / continues after puberty ✓ **2** oogonia grow to produce primary oocytes / AW ✓ **3** (meiosis starts and) pauses in prophase I ✓ **4** meiosis I , restarts / continues , to form secondary oocytes ✓ **5** diploid (oogonia) to haploid (secondary oocyte) ✓	**max 2**	**DO NOT ALLOW** formed during two meiotic divisions

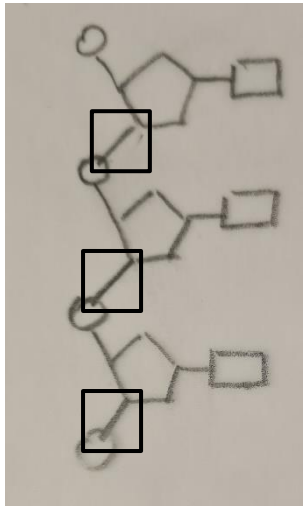
5	**(c)**	**(i)**	non-disjunction ✓ non-separation of , homologous chromosomes in meiosis I / sister chromatids in meiosis II ✓ (after meiosis) daughter cell / gamete , has two copies of chromosome 21 ✓	**max 2**	**ALLOW** bivalents for homologous chromosomes **ALLOW** anaphase I / anaphase II for meiosis I and meiosis II
5	**(c)**	**(ii)**	translocation ✓	**1**	**ALLOW** a description of translocation e.g. part of one chromosome breaks off and attaches to a different chromosome **ALLOW** mosaic Down's / description **IGNORE** mutation / inherited
5	**(d)**	**(i)**	increased risk of chromosomal abnormality ✓ mutations accumulate with age (of oocytes) ✓ *idea that* long time spent in prophase I results in more errors ✓	**max 2**	**MP1** linked to abnormal chromosomes not mutations e.g. increased risk of non-disjunction / translocation **ALLOW** rate of mutation increases

5	**(d)**	**(ii)**	genetic counselling to indicate risk factors due to family history / AW ✓ prenatal screening to , diagnose Down's syndrome / AW , in , embryo / fetus ✓ pre-implantation screening during IVF to identify healthy embryos / AW ✓	**max 2**	 **ALLOW** named e.g. 'karyotyping' e.g. AW identify fetal abnormalities **IGNORE** IVF unqualified
5	**(d)**	**(iii)**	genetic counselling can cause , anxiety / mental health issues ✓ (prenatal / pre-implantation / IVF) screening can lead to , abortion / discarding of embryos ✓	**max 1**	**IGNORE** ref to religious beliefs

6	**(a)**	**(i)**	(% of) G = C **and** (% of) A = T ✓ (this is) same / universal , in , all species / both eukaryotes and prokaryotes ✓ because of complementary base pairing ✓ correct use of data ✓	**max 3**	**ALLOW** G÷C=1 **and** A÷T=1 **ALLOW** (%) purines = (%) pyrimidines **ALLOW** ratio of purines to pyrimidines is 1:1 **ALLOW** 'similar' for = **ALLOW** e.g. A bonds / binds / pairs with T as they are complementary Data quotes to support MP1 e.g. in human A= 29.3% and T = 30.0% e.g. in human A÷T = 0.977 e.g. in *E.coli* G = 26.0% and C = 25.7%
6	**(a)**	**(ii)**	no complementary base pairing / AW ✓	**1**	**ALLOW** less complementary base pairing **IGNORE** only one strand of DNA
6	**(b)**		work at low temperatures / use ice-cold ethanol / use enzyme inhibitor(s) ✓ use (named) detergent ✓ add a protease ✓	**3**	**ALLOW** add protease (to break down enzymes)

6	**(c)**		DNA is more soluble at 50º C (at low ethanol concentrations) ✓ they were using (very) low concentrations of ethanol ✓ they should have used (at least) 20% ethanol ✓	**max 2**	**ALLOW** at 50ºC more DNA remains in solution / less DNA precipitates out e.g. 0-10 % for low concentrations **IGNORE** amount / conc. for concentration **ALLOW** DNA will not precipitate at % of ethanol used

<table>
<tr>
<td>7</td>
<td>(a)</td>
<td></td>
<td>
<table>
<tr><th>Structural feature</th><th>DNA</th><th>RNA</th></tr>
<tr><td>Pentose sugar</td><td>Deoxyribose</td><td>Ribose</td></tr>
<tr><td>Purine bases</td><td>Guanine
Adenine</td><td>Guanine
Adenine</td></tr>
<tr><td>Pyrimidine bases</td><td>Cytosine
Thymine</td><td>Cytosine
Uracil</td></tr>
</table>
✓
✓
✓
</td>
<td>3</td>
<td>One mark per correct row

IGNORE A / T / C / G</td>
</tr>
<tr>
<td>7</td>
<td>(b)</td>
<td></td>
<td> 
square / circle drawn / shaded around any phosphodiester bond ✓</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>(c)</td>
<td></td>
<td>(DNA) helicase ✓
hydrogen ✓
DNA polymerase ✓
condensation ✓</td>
<td>4</td>
<td></td>
</tr>
</table>

7	**(d)**	**(i)**	named check point e.g. S / G2 ✓ checks for , damaged / mutated , DNA ✓ triggers repair mechanism / DNA repair ✓ halts cell cycle ✓ AVP ✓	**max 2**	**ALLOW** DNA synthesis checkpoint for S **IGNORE** other checkpoints e.g. metaphase / G1 e.g. role of cyclin-dependent kinases / CDKs
7	**(d)**	**(ii)**	damaged DNA will bypass checkpoints ✓ dysregulation of the cell cycle ✓ increase in cell division ✓	**max 2**	**ALLOW** damaged DNA is replicated **ALLOW** uncontrolled cell cycle **ALLOW** cell proliferation
7	**(e)**		description of radiotherapy ✓ (cells with damaged DNA undergo) apoptosis ✓ (so) less cancer cells (so the tumour shrinks) ✓	**max 2**	e.g. ionising radiation damages / destroys (cancer) cells
7	**(f)**	**(i)**	multipotent ✓	**1**	

7	**(f)**	**(ii)**	easier / safer , to obtain ✓ less likelihood of transmitting infection ✓ cord blood can be , frozen / banked ✓ less likely to be rejected (because baby's immune system is less developed) ✓	**max 1**	**ALLOW** less invasive / doesn't require surgery **IGNORE** no rejection

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