GCE

Biology B

H422/03: Practical skills in biology

Advanced GCE

Mark Scheme for June 2019

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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.

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

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)		*any two of the following:* use a sharp pencil ✓ lines should be, (clear) continuous / non-overlapping / AW ✓ label lines could be, horizontal / justified / AW ✓ label lines should not have arrow (heads) ✓ has labelled structures which are not visible ✓ no shading should be included / AW ✓ add, (informative) title / annotation(s) ✓	2	e.g. cannot label Purkyne tissue **IGNORE** 'add left/right' **ALLOW** correct example of an annotation
1	(b)		correct area of artery shown is drawn showing 'angular' section ✓ sharp pencil **AND** drawn to appropriate scale **AND** minimum of 3 pencil lines drawn (no arrowheads) **AND** **no** internal detail or structures drawn ✓ 2 correctly labelled AND annotated layers ✓✓	4	*Annotation adds concise notes about the structures labelled on a biological drawing. It is often used to draw attention to features of particular biological interest, either structural (such as shape, size, colour) or functional.* Examples of labels AND annotations: • (*Top layer*) tunica intima / endothelial lining, thinner / smooth / pale purple • (*Middle layer*) tunica media is, thicker / dark(er) purple / contains smooth muscle / contains elastin fibres • (*Bottom layer*) tunica externa is, thinner / blue / contains elastin fibres / contains collagen fibres
			Total	6	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>mitosis ✓</td><td>1</td><td>DO NOT ALLOW binary fission</td></tr>
<tr><td>2</td><td>(b)</td><td></td><td>
<table>
<tr><th>Method used to detect cancer</th><th>What does the method involve?</th><th>What is the method suitable for?</th></tr>
<tr><td>Blood test</td><td>antibody test (ELISA)</td><td>blood</td></tr>
<tr><td>Mammography</td><td>low energy x-rays</td><td>breast (tissue) ✓</td></tr>
<tr><td>CT scan</td><td>x-rays ✓</td><td>whole body scans</td></tr>
<tr><td>Ultrasound ✓</td><td>high frequency sound waves</td><td>soft tissue</td></tr>
<tr><td>MRI scan</td><td>magnetic field and radio ✓ waves</td><td>soft tissue, bone, brain or spinal cord tumours</td></tr>
<tr><td>PET (scan) ✓</td><td>radioactive tracer and gamma waves</td><td>Produces three-dimensional images of any part of the body</td></tr>
<tr><td>Biopsies</td><td>needle, speculum or scalpel</td><td>tissues identified as possible tumours</td></tr>
</table>
</td><td>5</td><td>Both words correct for one mark</td></tr>
</table>

2	**(c)**	**(i)**	difference between the means is due to, chance / AW, **OR** the means will be, the same / equal / AW **OR** there is no significant difference between the means (of annual pregnancy rate) ✓	**1**	
2	**(c)**	**(ii)**	94.09	**1**	
2	**(c)**	**(iii)**	*t value* 10.206 ✓✓✓	**3**	**ALLOW** ecf from (c) (ii) **DO NOT ALLOW** if negative sign is given If answer is recorded to the incorrect number of decimal places (10.21 or 10.2) then award 2 marks maximum If answer is incorrect or missing allow marks for process stages as follows: • *one mark for modulus calculation* 7 • *one mark for denominator calculation prior to square rooting* 0.47045
2	**(c)**	**(iv)**	**Any three from:** calculated value/ 10.206 is greater than, the critical value /1.960, at the 5% significance level / p = 0.05 ✓ the (calculated) value is (also) greater than the critical value at the 1% significance level / p = 0.01 ✓ (so the researchers can) reject the null hypothesis ✓ the difference in mean annual pregnancy rates is NOT due to (random) chance ✓	**3**	**ALLOW** ecf from 2(c)(iii) **IGNORE** idea that the '10.206 is greater than the 1.96 and/or 2.56' unqualified **ALLOW** mp1 and mp2 for statements that clearly refer to the calculated value being larger than the critical value at 2 or more / all significant levels

2	**(d)**		***Maximum of 3 marks for any one side of the discussion*** *Positive* enables childless people to have children (which may improve mental wellbeing) ✓ provides eggs (through donation) to other women ✓ provides embryos for experimentation ✓ AVP ✓ *Negative* low success rate / AW ✓ costs a lot of money for relatively unproductive procedure ✓ destroys life (through the disposal of embryos) / AW ✓ physically stressful ✓ mentally stressful ✓ many, eggs / embryos, are 'wasted' ✓ requires a lot of, time / surgical facilities / highly qualified staff, which might be used on other procedures ✓ AVP ✓	**4**	**IGNORE** general comments about all fertility treatments e.g. single parent, unnatural process, 'playing God' e.g. unused embryos can be used to provide stem cells, selection of embryos without genetic fault **ALLOW** reference to data from question e.g. 23% and 16% success rates of the clinics / around one quarter of eggs resulting in pregnancy **IGNORE** references to multiple pregnancies (as the question specifies this type of IVF and states that only one embryo is transferred) **IGNORE** reference to higher risk of autism (as correlation is found in ICSI not this type of IVF) e.g. correct ref to increased risk of medical issues, (named) health risk(s) / side effects for mother from hormonal treatment, genetic defects passed on from faulty gamete used in IVF process
			Total	**18**	

3	**(a)**		***Mark first answer. One from the following:*** absolute value ✓ not / less, subjective ORA ✓ removes doubt over end point / colour of sample / AW ✓ *idea that method* gives different options for measuring DV (absorbance of filtrate, transmission of light and /or mass of residue) ✓	**1**		I**GNORE** "quantitative" or "quantitative method" as this is given in the Q **ALLOW** numerical value **DO NOT ALLOW** 'how much' / precise
3	**(b)***		***Summary of instructions to markers:*** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors,* ***Level 1****,* ***Level 2*** *or* ***Level 3****, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the* ***Communication Statement*** *(shown in italics):* o *award the higher mark where the Communication Statement has been met.* o *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***			
				6		**Indicative scientific points could include:** **Method** (further detail to that already given in the question) • use of (graduated) syringe(s) to measure volumes • use of filtrate in cuvette to obtain absorbance or transmission readings • all steps carried out for three mock body fluid samples **Accuracy** • colorimeter recalibrated for each sample • precipitate weighted to constant mass • top pan balance zeroed **Reliability** • repeats (min. three replicates for each of the mock body fluid samples AND each of the diluted glucose solutions)

Level 3 (5-6 marks)
Further details of a workable method to produce accurate **and** repeatable quantitative data are provided to include the calibration of the colorimeter. Details of safety are included. Some details of interpretation of glucose concentration are included.

There is a well-developed line of reasoning which is clear and logically structured and uses scientific terminology at an appropriate level. The information presented is relevant and substantiated.

Level 2 (3-4 marks)
Some further details of a workable method to produce repeatable quantitative data are provided. There is an outline of the use of the colorimeter. Details of safety are included. Details of interpretation of glucose concentration may or may not be included.

There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented in the most part relevant and supported by some evidence.

Level 1 (1–2 marks)
Limited further details of a workable method suggested to provide some results but some information may be missing. Safety is not included.

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.

Interpretation
- data table plotted on a calibration graph
- values for 3 samples interpolated from calibration curve

Risk assessment:
- potential hazards associated with Benedict's reagent
- potential hazards associated with boiling water
- general good practice in laboratory e.g. goggles, glassware

<table>
<tr><td>3</td><td>(c)</td><td></td><td>resolution ✓

accuracy ✓

limitation ✓</td><td>3</td><td></td><td>DNA precision</td></tr>
<tr><td>3</td><td>(d)</td><td>(i)</td><td>3 <u>separate</u> bars
AND
y-axis scale is equidistant
AND
use of appropriate scale so plot area (bars) occupies more than 50% of paper ✓

y-axis labelled ‘mean concentration of glucose mmol dm^{-3}’
AND
x-axis labelled ‘location of sample’
AND
each bar with a suitable label ✓

(separate) bars correctly plotted ✓

standard deviation bars correctly plotted ✓</td><td>4</td><td></td><td><table><tr><th>Location of sample</th><th>Mean concentration of glucose (mmol dm^{-3})</th><th>Error bars plotted at….</th></tr><tr><td>BC</td><td>15</td><td>13.0 and 17.0</td></tr><tr><td>PCT</td><td>4</td><td>3.3 and 4.7</td></tr><tr><td>DCT</td><td>3</td><td>2.5 and 3.5</td></tr></table>
ALLOW tolerance of plots +/- half a small square</td></tr>
<tr><td></td><td>(d)</td><td>(ii)</td><td>Mark first answer. One from:
<u>mean</u> glucose concentration in Bowman’s capsule is higher than normal value / AW ✓

presence of glucose in dct
OR
glucose levels in the PCT and DCT are very similar (so little glucose has been selectively reabsorbed) ✓</td><td>1</td><td></td><td>IGNORE presence of glucose in PCT unqualified (as glucose will be present in PCT as this is the site of selective reabsorption)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
4	(a)	(i)	apoptosis ✓	1	
4	(a)	(ii)	xylem ✓	1	**IGNORE** vascular tissue
4	(b)		*One from the following* protects the growing tip ✓ enables growth by covering the apical meristem in root ✓ protects the inner layer of cells (in the root tip) ✓ protects cells behind the cap ✓ prevent damage to, permanent tissue (in root tip) / AW, ✓	1	**IGNORE** protects root, protects plant
4	(c)		34 ✓✓	2	**ALLOW** one mark for 33.915 • **proportion** of cells at 5 days is 12/40 = 0.3 • 33% increase in the proportion is 1.33 x 0.3 = 0.399 (~40%) • 0.399 x 85 = 33.195 = 34 whole cells
4	(d)	(i)	domain ✓	1	

		(ii)	Award one mark for each correct row – ticks **and** crosses must be present (as per the stem of the question) **Feature** / **Present in animal cells** / **Present in plant cells** **Mitochondria** ✓ ✓ **Golgi apparatus** ✓ ✓ ✓ **Tonoplast** X ✓ ✓ **Ribosomes** ✓ ✓ ✓ **Cell wall** X ✓ ✓	**4**		**DO NOT ALLOW** hybrid ticks and crosses
			Total	**10**		

Question			Answer	Marks	Guidance
5	(a)		Award one mark for each correct row	5	

Description	Structure	Label	
Supplies blood to the ovary	central coiled blood vessel	F	
Contains receptors on plasma membranes for FSH	follicle / granulosa cells	A	✓
Releases oestrogen	follicle	A / C / E	✓
Contains a haploid nucleus	secondary oocyte / polar body	E	✓
Produces progesterone	corpus luteum / empty Graafian follicle / yellow body	D	✓
Gel layer composed of glycoproteins	zona pellucida	B	✓

IGNORE ovum

ALLOW granulosa cell

5	(b)*		***Summary of instructions to markers:*** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors,* ***Level 1****,* ***Level 2*** *or* ***Level 3****, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the* ***Communication Statement*** *(shown in italics):* o *award the higher mark where the Communication Statement has been met.* o *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***			
			Level 3 (5-6 marks) Detailed analysis of the micrograph is present. There is a consideration of the number of primary oocytes present in the ovary. Comments made about the varying stages of maturation evident in the micrograph. The relevance of the structures in determining the age of the patient is considered. Justified comments are made with reference to evidence supporting/undermining conclusion. *There is a well-developed line of reasoning which is clear and logically structured and uses scientific terminology at an appropriate level. The information presented is relevant and substantiated.* **Level 2 (3-4 marks)** Some analysis of the micrograph is present. Some consideration of the number of primary oocytes present or their varying stages of maturation evident in the micrograph is made. Their part in determining the age of the patient is attempted. Comment(s) are made with some reference to evidence supporting/undermining conclusion. *There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented in the most part relevant and supported by some evidence.*	**6**		**NOTE** without a second ovary with which to compare the micrograph in Fig 5.1, it is beyond the capability of an A level student to make this judgement. IGNORE comments that do not relate to evidence in the micrograph e.g. "AMH is only present in the ovary until menopause" as this can not be observed. **AO3.1** Analysis of the micrograph may include • there are approximately 20 follicles/oocytes present • high follicle density can be observed • there are follicles present in all stages of maturation • a corpus luteum / ruptured follicle is present • a post-menopause patient would be expected to have a (very) small number of follicles/oocytes **AO3.2** Judgements based on the micrograph may include • the number of follicles/oocytes visible represents only one 'slice' of the ovary i.e. (potentially) misrepresentative • 20 may or may not indicate a plentiful number of follicles/oocytes • it is not possible to determine whether the follicles will go on to mature successfully from this single image • the presence of follicles indicates that the patient has not passed menopause • presence of empty Graafian follicle/ corpus luteum

			Level 1 (1–2 marks) Little or no analysis of the micrograph is present. An attempt to describe the relevant structures present in the micrograph is made. A comment on the conclusion may be limited. No or little reference to evidence supporting/undermining conclusion (statement is supported or undermined). *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.			indicates patient is (potentially) ovulating • presence of corpus luteum indicates patient is (potentially) producing progesterone • *idea that* a firm conclusion can not be made in the absence of other micrographs to compare it to
			Total	**11**		

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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