Cambridge Assessment International Education

Cambridge O Level

BIOLOGY **5090/21**

Paper 2 Theory **October/November 2022**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6	Calculation specific guidance Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'. For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values. For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme. Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.
7	Guidance for chemical equations Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme. State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Mark schemes will use these abbreviations:

; separates marking points
/ alternatives
() contents of brackets are not required but should be implied
R reject
A accept (for answers correctly cued by the question, or guidance for examiners)
Ig ignore (for incorrect but irrelevant responses)
AW alternative wording (where responses vary more than usual)
AVP alternative valid point (where a greater than usual variety of responses is expected)
ORA or reverse argument
underline actual word underlined must be used by candidate
+ statements on both sides of the **+** are needed for that mark

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Question	Answer	Marks	Guidance
1(a)	urine ;	**1**	
	urea ;	**1**	**A** ammonia / excess water / excess minerals
1(b)	renal artery / A **+** brings urea / waste product to B / kidney **AW** ;	**1**	
	kidney / B **+** filters blood to remove urea / waste products ;	**1**	
	bladder / C **+** stores / keeps / collects urine ;	**1**	

Question	Answer	Marks	Guidance
2(a)	*max **four** from:* photosynthesis ; light absorbed by chlorophyll / chloroplasts ; water and carbon dioxide combined / reactants /**AW** ; glucose and oxygen formed ; glucose converted to sucrose / other sugars ; **AVP** e.g. water from soil / xylem vessels or carbon dioxide from air / stomata / air spaces ; *max **one** from:* in phloem ; by translocation / by active transport ;	**5**	
2(b)(i)	a change / alteration ;	**1**	
	in genetic material / DNA / chromosome / gene / nucleotides / bases ;	**1**	

Question	Answer	Marks	Guidance
2(b)(ii)	no seeds ; no sexual reproduction / asexual reproduction / vegetative propagation ; sexual reproduction / gametes **+** produce genetic variation **ORA** ; involves mitosis / does not involve meiosis ;	**3**	
2(c)	insects killed / insects removed from fields / insects decrease in numbers ; disrupts food chains / web ; reduction in numbers of non-insect organisms or species ; bioaccumulation of insecticide in food chains ; top predators killed ; less pollination ;	**3**	
2(d)(i)	nucleus ; cell membrane ; cell wall ; cytoplasm ;	**2**	**A** other correct structures, e.g. mitochondria / ribosomes
2(d)(ii)	spores / yeast cells blown by wind / spores / yeast cells transferred by animals / feeding on / use sugars from grapes ;	**1**	
2(d)(iii)	bread making ; making alcohol / ethanol / beer / wine ; biofuel production ; yeast supplement / probiotics / yeast extract ;	**2**	

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Question	Answer	Marks	Guidance
3(a)(i)	a gene is a section of DNA ;	**1**	
	an allele is a version of the gene ;	**1**	**A** an alternative form of a gene
3(a)(ii)	genotypes of parents: Tt × Tt ;	**1**	
	gametes: T, t, T, t ;	**1**	
	offspring genotypes: TT, Tt, Tt, tt ;	**1**	
	offspring phenotypes: straight, straight, straight, curly ;	**1**	
3(b)	*max **two** similarities from:* placenta ; umbilical cord ; provides nutrition / oxygen / food ; amniotic sac / amniotic fluid ; receives mechanical protection / offspring / fetus cushioned ;	**2**	
	*max **two** differences from:* shape of uterus / womb ; duration of pregnancy / gestation ; numbers of offspring higher in guinea pig ;	**2**	

Question	Answer	Marks	Guidance
4(a)(i)	a (biological) catalyst ; speeds up chemical reactions ; without being changed itself ;	**2**	**A** without being used up / can be reused
4(a)(ii)	made of protein / polypeptides / (chains of) amino acids ; have an <u>active site</u> ; has a specific shape / shape complementary to the substrate ;	**2**	
4(a)(iii)	starch ;	**1**	
	maltose / sugar / glucose ;	**1**	
4(b)(i)	enzyme is active from pH 6 to pH 8 ; optimum pH = 7.5 ; enzyme is active between 30 and 70°C ; optimum temperature = 60°C ; manufacturer can keep optimum / best / correct conditions ; so biofuel produced rapidly / efficiently / cost-effectively / maximum yield ;	**4**	
4(b)(ii)	combustion releases carbon dioxide ; greenhouse gas / contributes to global warming ; climate change ; a change described, e.g. melting glaciers / rising oceans / drought ; an impact of climate change, e.g. loss of habitat / redistribution of species / loss of agricultural land ;	**2**	

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Question	Answer	Marks	Guidance
5(a)	X = humerus ;	**1**	
	muscle = biceps ;	**1**	
5(b)(i)	respiration ;	**1**	
5(b)(ii)	respiring without oxygen ; lactic acid is produced ; accumulates in muscle / limits rate of metabolism ; can only be broken down once oxygen available / oxygen debt ;	**2**	**A** respiration is anaerobic

Question	Answer	Marks	Guidance
6(a)(i)	<u>spongy mesophyll</u> ;	**1**	
6(a)(ii)	*arrow 1* osmosis ; is the movement (of water molecules) from an area of higher water potential to lower water potential across a partially permeable membrane **AW** ; *arrow 2* evaporation ; is the change from liquid (water) to (water) vapour / gas ; *arrow 3* diffusion ; is the (net random) movement (of molecules) from a high to lower concentration / down a concentration gradient ;	**6**	**A** correct definition if linked to correct process but linked to the incorrect arrow.

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Question	Answer	Marks	Guidance
6(b)	the surface area of the leaf ; the greater the surface area of the leaf, the greater the surface for evaporation ; the thickness of the cuticle ; the thicker the cuticle, the greater the barrier for water molecules ; the number / density of stomata ; as density of stomata increase, more places for water to escape from ; size of stomata ; as size of stomata increases, so does area from which water can be lost ; sunken stomata / ridged epidermis / curled up leaves ; sunken stomata / ridged epidermis / curled up leaves increase humidity ; hairs / projections ; hairs / projections increase humidity ;	**3**	Maximum two marks for structural features only with no explanation.

Question	Answer	Marks	Guidance
7(a)	motor neurone ;	**1**	**A** effector neurone
	cerebrum ;	**1**	**A** cerebral hemispheres
	hypothalamus ;	**1**	
	CNS / brain / spinal cord **+** transfers nerve impulses from sensory to motor neurones ;	**1**	
	brain ;	**1**	
7(b)	light is refracted / bent by cornea ; ciliary muscles / body contract ; suspensory ligaments become slack ; lens becomes fatter **AW** ; light refracted / bent (more) by lens ; light / image focused / formed on retina ; light detected by light receptors in retina / rods / cones ; nerve impulses triggered ;	**5**	

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Question	Answer	Marks	Guidance
8(a)	all (the necessary) nutrients / food types / components ; in the correct quantities ; carbohydrates **+** fats / lipids **+** protein ; minerals **+** vitamins ; fibre /roughage ;	**4**	
8(b)	*underweight* tiredness / fatigue / lack of energy ; other described symptom, e.g. poor immunity / sick more often, hair thinning / loss / teeth and bone problems / less insulation ; kwashiorkor ; loss of muscle mass / lack of muscle growth ;	**2**	
	overweight extra mass / load on body / pressure on joints; causing joint / skeletal problems ; occlusion of coronary arteries / occlusion of arteries in brain ; increased risk of (coronary) heart disease / heart attacks; increased risk of stroke ; increased risk of diabetes ;	**4**	

Question	Answer	Marks	Guidance
9(a)	plasma ; dissolved (named) food substances ; other plasma component, e.g. urea, carbon dioxide, hormones, antibodies, fibrinogen ; red blood cells ; white blood cells / lymphocytes / phagocytes ; platelets ; reference to relative percentage of cellular components and plasma with one of the figures quoted ;	**5**	

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Question	Answer	Marks	Guidance
9(b)	concentration of glucose ; detection of diabetes ; concentration of urea ; detection of kidney disease ; concentration / number of red blood cells ; ability to deliver oxygen to tissues / indication of shortage of iron in the diet / indication of anaemia ; shape of red blood cells ; indication of sickle cell anaemia ; concentration / number of white blood cells ; reference to cancer / leukaemia / infection / infectious disease, e.g. AIDS ; concentration of cholesterol ; reference to occlusion of arteries / consequences of occlusion of arteries ; presence of specific antibodies ; detecting immunity / previous exposure to pathogen ; **AVP** ;;	**5**	Maximum three marks for factors that can be measured with no explanation.

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