OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

A Level Biology B (Advancing Biology)

H422/02 Scientific literacy in biology

SAMPLE MARK SCHEME

Duration: 2 hours 15 minutes

MAXIMUM MARK 100

This document consists of 20 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 **1(b)(ii)** and **4(d)**.

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)	(i)	mode = 2 ✓ mean = 3.11 ✓✓	3	 (2x9)+(2x8)+(3x11)+(6x7) / 35 = 3.11 **Award one mark** if a candidate has clearly taken the number of participants into account but has made an error in the calculation
		(ii)	*General points* *Idea of* valid conclusions would require information about the intensity of exercise ✓ *Idea that* (named) statistical test would confirm conclusion ✓ *Duration (up to a maximum of 2 marks)* positive correlation (suggests the conclusion is valid) ✓ many studies / repeats / AW, improves validity ✓ *idea of* relationship / correlation, clearer for cycling (than running) ✓ *Running vs cycling (up to a maximum of 2 marks)* *idea that* (conclusion is valid because) for a given duration, IL-6 increases more with running (than cycling) ✓ the number of participants varies, which makes comparison difficult ✓	4	**The general point marks can be scored for either section, but can only be scored once** **ALLOW** 'meta-analysis' for 'many studies' **ALLOW** calculated example
	(b)	(i)	**Any 3 from:** *Glucose uptake* (IL-6) increases / AW, insulin production ✓ (IL-6) increases / AW, insulin receptor sensitivity (on muscle cells) ✓ *Glucose production* (IL-6) increases / AW, glucagon production ✓ glycogen converted to glucose (in liver cells) ✓	3	 **ALLOW** acts like a hormone **ALLOW** glycogenolysis

Question			Answer	Marks	Guidance
		(ii)*	**Level 3 (5–6 marks)** Candidate's evaluation demonstrates excellent judgement of the data, providing conclusions that address all the significant issues. *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)** Judgement is made on a range of aspects of the data, but conclusions are not comprehensive. *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)** Simple conclusions are made, drawing on limited aspects of the data. *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	**Examples of relevant scientific points at L3 (in addition to points at L1 and L2)** *experimental & epidemiological evidence* • discussion of *in vitro* v *in vivo* experiments (e.g. the conflicting results in A and B; *in vitro* experiments might lack important factors, for example, found in *in vivo*) • discussion of the link between TNF and IL-6 (e.g. G and H. IL-6 could, for example, be high in certain cases because it has a defensive role against TNF) i.e. detailed links made between studies in Table 1.2 and impact on diabetes risk • in depth discussion of correlation v causation (e.g. C and D show correlation but not causation). *biological knowledge* • detailed understanding of the causes and symptoms of type 2 diabetes. **Examples of relevant scientific points at L2 (in addition to points at L1)** *experimental & epidemiological evidence* • discussion of correlation v causation • linking exercise, low baseline IL-6 and possible effects on diabetes risk • quite detailed links made, some in detail, between studies in Table 1.2 and the impact on diabetes risk. *biological knowledge* • good understanding of the causes and symptoms of type 2 diabetes.

Question			Answer	Marks	Guidance
					Examples of relevant scientific points at L1 *experimental & epidemiological evidence* • basic links made between studies in Table 1.2 and the impact on diabetes risk. *biological knowledge* • some understanding of the causes and symptoms of type 2 diabetes.
	(c)	**(i)**	*idea that* (gene is) replaced / disrupted / AW, with, artificial / synthetic / AW, DNA ✓	**1**	
		(ii)	**Any 1 from:** (mice have) similar, genome / DNA sequences, to humans ✓ (mice have) similar, metabolism / physiology, to humans ✓ (mice are) easy / cheap, to, house / manipulate / breed ✓	**1**	
	(d)		chemotaxis ✓ attraction of neutrophils (to site of infection) ✓ **OR** cause / stimulate, B cells / T cells, to, differentiate / proliferate ✓ cause / stimulate, B cells to release antibodies ✓ **OR** inhibit virus replication ✓ activation / AW, of T killer cells ✓	**2**	**ALLOW** (undergo) clonal expansion
			Total	**20**	

Question			Answer	Marks	Guidance
2	(a)		error = coenzyme, correction = prosthetic group ✓ error = tertiary, correction = quaternary ✓	2	**ALLOW** 'cofactor' for 'prosthetic group' **ALLOW** '3°' for 'tertiary' and '4º' for 'quaternary'
	(b)	(i)	selection pressure, (is) high altitude / risk of altitude sickness ✓ *idea of* individuals with, mutated gene / allele / Tibetan variant, will survive better at high altitude / have selective advantage ✓ *idea that* allele frequency for Tibetan EPAS1 increases over many generations ✓ natural selection ✓	4	
		(ii)	physiological ✓	1	**ALLOW** biochemical
		(iii)	**Any 2 from:** *idea of* less oxygen able to be transported in their blood ✓ (the potential for) less / reduced / AW, respiration ✓ partial pressure / concentration, of oxygen is lower at high altitude ✓	2	
		(iv)	(erythrocyte cell count using) haemocytometer ✓ measures / AW, concentration of (red blood) cells ✓ **OR** flow cytometry ✓ measures / AW, volume / morphology / concentration, of (red blood) cells ✓	2	**ALLOW** numbers of / types of protein in / amount of protein in, (red blood) cells

Question			Answer	Marks	Guidance
	(c)	(i)	Answer (in a range between) = 20 - 22 ✓✓ Units = % kPa^{-1} ✓	3	**1 mark can be awarded** if there is evidence that the candidate has identified the steepest part of the slope as (any value between) 3.6 - 4.6 kPa **ALLOW** % per kPa
		(ii)	lungs / alveoli ✓	1	
		(iii)	curve placed anywhere between the myoglobin and haemoglobin curves ✓	1	The fetal haemoglobin curve can merge with either of the other two lines after 10 kPa
		(iv)	myoglobin has, greater affinity / AW, for oxygen (at the same kPa) ✓ *idea that* oxygen will be transferred to myoglobin / muscle, from (adult) haemoglobin ✓	2	
			Total	18	

Question			Answer	Marks	Guidance
3	(a)		**Any 2 from:** (A and B are) codominant ✓ *idea that* both genes are transcribed ✓ *idea that* both antigen proteins are produced ✓	2	
	(b)	(i)	q = √ 0.000004 = 0.002 ✓ p = 1 – 0.002 = 0.998 ✓ 2pq = 2 x 0.998 x 0.002 = 0.003992 ✓ % to 1 significant figure = 0.003992 x 100 = 0.4 % ✓	4	**Correct answer of 0.4% scores all 4 marks** **ALLOW ecf** for MP 2-4
		(ii)	**Any 2 from:** small / decreased, gene pool ✓ inbreeding ✓ genetic drift ✓ population / genetic, bottleneck ✓	2	**ALLOW** decreased genetic variation **IGNORE** interbreeding **IGNORE** references to (increased) homozygous recessive genotypes because this is implied by information provided earlier in the question
	(c)		**Any 2 from:** *idea that* ideally sample sizes from each town should be, the same / more similar ✓ *idea of* avoiding bias / random selection ✓ *idea of* using the same, sampling method / approach, for each town ✓ calculation method described or named ✓ what gene loci will be analysed ✓	3	e.g. heterozygosity , proportion of polymorphic loci
			Total	11	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>Any 1 from:
crystal violet / methylene blue / iodine / potassium iodide / ethanol, is an irritant ✓
crystal violet is toxic / carcinogenic ✓
risk of burns when using heat source ✓
idea that bacterial species must be identified correctly to ensure they are not pathogenic ✓</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th></th><th>Bacterial cells</th><th>Palisade mesophyll cells</th><th></th></tr>
<tr><td rowspan="7">Differences</td><td>Smaller ribosomes</td><td>Larger ribosomes</td><td>✓</td></tr>
<tr><td>No membrane-bound organelles</td><td>Membrane-bound organelles</td><td>✓</td></tr>
<tr><td>No chloroplasts</td><td>Chloroplasts</td><td>✓</td></tr>
<tr><td>Circular DNA</td><td>DNA in chromosomes</td><td>✓</td></tr>
<tr><td>Cell wall contains peptidoglycan</td><td>Cell wall contains cellulose</td><td>✓</td></tr>
<tr><td colspan="2">Pili</td><td>No pili ✓</td></tr>
<tr><td rowspan="3">Similarities</td><td colspan="2">Cytoplasm / cytosol</td><td>✓</td></tr>
<tr><td colspan="2">Ribosomes</td><td>✓</td></tr>
<tr><td colspan="2">Plasma / cell surface, membrane</td><td>✓</td></tr>
</table>
</td><td>4</td><td>2 marks maximum for differences
2 marks maximum for similarities
1 mark maximum per row

ALLOW 70S ribosomes (bacterial) and 80S ribosomes (palisade mesophyll)</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Any 2 from:
(bacteria) hydrolyse / digest, cellulose ✓
(bacteria have) cellulase ✓
(bacteria found) in rumen ecosystem ✓
symbiosis / symbiotic relationship ✓</td><td>2</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
(d)*	**Level 3 (5–6 marks)** Candidate addresses all the ideas in the student's statement making clear connections between humans and bacteria and using examples to illustrate their answers. *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)** Candidate addresses some of the ideas in the student's statement making some connections between humans and bacteria and using at least one example to illustrate their answers. *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)** Simple comments about humans and bacteria made with connections not always made. Little exemplification. *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	**Examples of relevant scientific points:** **Benefits from the use of bacteria** • nitrogen cycling – including the role of putrefying, denitrifying, nitrogen-fixing and nitrifying bacteria. All benefitting food production • biotechnology – including genetic modification techniques that lead to benefits due to the production of drugs, insulin, the broadening of scientific research. Ideas might include the palindromic nature of recognition sequences for restriction enzymes and the need for reporter genes on plasmids. **Challenges from interactions with bacteria** • communicable diseases – including general mechanisms of pathogenicity of bacteria, causes, transmission, mode of infection, symptoms, treatment e.g. TB • the use of antibiotics and antibiotic resistance, including reference to TB and MRSA. **Examples of technical terms that could be used in answers:** Mycobacterium, communicable disease, prevalence, incidence, denitrification, saprotrophs, nitrification, named bacterial taxa, restriction enzymes, palindromic sequence, plasmid.
	Total	**13**	

Question			Answer	Marks	Guidance
5	(a)	(i)	(rate of) respiration , greater than / higher than , (rate of) photosynthesis ✓	1	**ALLOW** reverse argument
		(ii)	*Idea that* named factor is limiting (rate of) photosynthesis / light intensity is no longer limiting (rate of) photosynthesis ✓	1	**ALLOW** carbon dioxide and temperature as named limiting factors
	(b)	(i)	**Any 3 from:** *idea of* varying light intensity ✓ named control variable ✓ *idea that* hydrogencarbonate changes colour as , pH / CO_2 concentration , changes ✓ (hydrogencarbonate indicator is) yellow at , low pH / high CO_2 concentration ✓ (hydrogencarbonate indicator is) purple at , high pH / low CO_2 concentration ✓ AVP ✓	3	 e.g. same temperature / volume of hydrogencarbonate indicator solution / mass of plant e.g. use of colorimeter
		(ii)	0.03 (cm^3 min^{-1}) ✓✓	2	**ALLOW** correct calculator value or answer rounded correctly to any number of significant figures **AWARD 1 mark** for initial correct calculation (6 x (π x 0.06^2)) if the answer has not been divided by 2 to give a rate per minute.
	(c)	(i)	(product) ATP ✓ (role) provides / AW , energy ✓ **OR** (product) reduced NADP ✓ (role) donates hydrogen / provides reducing power / converts GP to TP ✓	2	**DO NOT CREDIT** produces energy **ALLOW** NADPH
		(ii)	sulphate / SO_4^{2-} ✓	2	

Question			Answer	Marks	Guidance
			nitrate / NO_3^- / ammonium / NH_4^+ ✓		
			Total	**11**	

Question			Answer	Marks	Guidance
6	(a)	(i)	(*lacks validity because*) *idea of* different plant species require different periods of darkness ✓ *idea of* no evidence that periods between 6.5 and 8.5 hours have been tested ✓ *idea that* exposure to far red light reduces the minimum darkness period ✓	3	**ALLOW** "conclusions can only apply to cocklebur"
		(ii)	**Any 4 from:** (high concentration of) P_R is required for flowering ✓ darkness , converts / AW , P_{FR} to P_R ✓ **C** red light , produces / AW . P_{FR} **AND** no flowers ✓ **D** *idea of* far red light , reverses / cancels , effect of red light ✓ **E** *idea of* far red light , produces / AW , P_R **AND** reduces critical period / length of darkness required ✓	4	**ALLOW** description of P_R as "the phytochrome produced by far red light / darkness" and a description of P_{FR} as "the phytochrome produced by red light."
	(b)		**Any 2 from:** *Idea of* stigmas , large and feathery / outside the flower ✓ dry / light, pollen grains ✓ large anthers / large amount of pollen produced ✓	2	
			Total	9	

Question			Answer	Marks	Guidance
7	(a)	(i)	iris ✓	1	
		(ii)	visible externally / AW ✓	1	
		(iii)	**Any 2 from:** (choroid), absorbs light, (giving) clearer image / AW ✓ (iris), absorbs light, (allowing) amount of light entering the eyeball to be controlled / AW ✓ protection from, UV / dangerous, radiation ✓	2	**ALLOW** choroid reduces light reflection (within eyeball)
	(b)	(i)	*idea of* changes in, base / nucleotide / triplet, sequence ✓	1	
		(ii)	mutation / AW, to proto-oncogene ✓ (leads to) faulty, receptor / growth factor ✓ (leads to) uncontrolled cell division ✓	3	**ALLOW** forms oncogene **DO NOT ALLOW** (cell) signalling molecule because this is referenced in the stem
			Total	8	

Question			Answer	Marks	Guidance
8	(a)	(i)	**Any 3 from:** *Idea that* levodopa is used, late in treatment plan / when symptoms become worse **OR** dosage of levodopa increased over time ✓ to delay / AW, onset of dyskinesia ✓ procyclidine / dopamine agonists, given in early stages ✓ *idea of* use of entacapone in late stages (with levodopa) needs to be monitored (to avoid worsening dyskinesia) ✓	3	
		(ii)	**Any 2 from:** binds / attaches, to receptor on postsynaptic, membrane / neurone ✓ sodium channels open ✓ sodium, moves / diffuses, into postsynaptic neurone ✓	2	
	(b)	(i)	**Any 3 from:** *idea that* 70 people is too low for a phase 3 trial (therefore reducing validity) / phase 3 trial should involve, hundreds / thousands, of people ✓ *idea that* (sample size of 70 people is) unlikely to differentiate new drug's performance from current drug (therefore reducing validity) ✓ blind trials (improve validity by), reducing / removing, bias (of patients) ✓ double blind trials (would be), improvement / AW, by removing bias of scientists ✓ *idea that* placebo cannot be used because it would be unethical in a phase 3 trial ✓	3	
		(ii)	**Any 2 from:** genetics ✓ head injuries ✓ age ✓ smoking ✓	2	
			Total	**10**	

Summary of updates

Date	Version	Change
January 2019	2.0	Minor accessibility changes to the paper: i) Additional answer lines linked to Level of Response questions ii) One addition to the rubric clarifying the general rule that working should be shown for any calculation questions