Candidate evidence

This document contains marking instructions and example candidate responses to various questions in the 2019 Human Biology Paper 2. Teachers and lecturers can work through the examples, allocating marks to each candidate response.
Teachers and lecturers should apply the general marking principles for Higher Human Biology, using them in conjunction with the detailed marking instructions provided for each example.
The associated commentaries illustrate the required marking standard.

Question 2(a)

Marking instructions

Question 2(a)

Each stage of PCR is temperature dependent.
Complete the table for stages 1 and 3.

Expected response	Max mark	Additional guidance
1. To separate/split the DNA/strands. **OR** To break hydrogen bonds. **OR** To break bonds between the bases. **(1)** 3. Any temperature between 70 and 80. **(1)**	**2**	Accept: to denature the DNA Unzipping/unwinding the DNA negates

Candidate response 1

(a) Each stage of PCR is temperature dependent.
Complete the table for stages 1 and 3. 2

Stage	Temperature (°C)	Reason
1	95	To break down DNA molecules
3	60	To allow replication of DNA

Candidate response 2

(a) Each stage of PCR is temperature dependent.
Complete the table for stages 1 and 3. 2

Stage	Temperature (°C)	Reason
1	95	To break the hydrogen bonds between bases
3	70-80	To allow replication of DNA

Question 3(b)(i)

Marking instructions

Question 3(b)(i)		
Some individuals cannot produce enough fully functioning enzyme 2. (i) In these individuals an altered form of enzyme 2 is produced due to a missense mutation. Suggest why this altered form of enzyme 2 works less well than the unaltered form.		
Expected response	**Max mark**	**Additional guidance**
It contains a different/wrong <u>amino acid</u> (in the enzyme). **OR** The shape of the enzyme/active site is changed.	**1**	Accept: the sequence of <u>amino acids</u> has changed/been altered Do not accept: the sequence of <u>amino acids</u> after the mutation has changed/been altered Do not accept: the amino acids are altered

Candidate response 1

(b) Some individuals cannot produce enough fully functioning enzyme 2.

(i) In these individuals an altered form of enzyme 2 is produced due to a missense mutation.

Suggest why this altered form of enzyme 2 works less well than the unaltered form. 1

One amino acid codon is replaced by another codon

Candidate response 2

(b) Some individuals cannot produce enough fully functioning enzyme 2.

(i) In these individuals an altered form of enzyme 2 is produced due to a missense mutation.

Suggest why this altered form of enzyme 2 works less well than the unaltered form. 1

Due to a mutation, amino acid sequence is changed which results in a non functional enzyme

Question 3(b)(ii)

Marking instructions

Question 3(b)(ii)		
Some individuals cannot produce enough fully functioning enzyme 2. (ii) Explain why these individuals are less tolerant of alcohol.		
Expected response	**Max mark**	**Additional guidance**
Acetaldehyde / the toxic compound builds up / cannot be broken down (quickly). **OR** They are less efficient / slower at breaking down acetaldehyde /the toxic compound. **OR** They are less efficient / slower at forming / cannot form the non-toxic compounds.	1	Do not accept: they cannot fully break down alcohol on its own

Candidate response 1

(ii) Explain why these individuals are less tolerant of alcohol. 1

their faulty enzyme cannot break down the toxic compound from the alcohol as well as the fully functiong enzyme can.

Candidate response 2

(ii) Explain why these individuals are less tolerant of alcohol. protein 1

it isn't broken down as fast which means it will build up if consumed in large amounts.

Question 4(a)

Marking instructions

Question 4(a)		
State **two** additional variables, other than those described above, that would need to be controlled during this investigation.		
Expected response	**Max mark**	**Additional guidance**
1. Concentration/volume/mass / dosage of supplement/placebo taken. 2. Time of day for exercise/taking the supplement/taking the placebo / testing. 3. Brand/type of supplement. 4. Other / additional (types of) exercise/training. 5. Number of times weight is lifted / number of repetitions / time spent on training / intensity of training. 6. Food/fluid/other supplements/medicines/drugs consumed. 7. Student health issues / smoking status / ethnicity **Any 2**	**2**	Only penalise the use of amount once. If candidate lists three or more variables and at least one is correct they can be awarded (**1 mark**). If all answers are correct award (**2 marks**)

Candidate response 1

(a) State **two** additional variables, other than those described above, that would need to be controlled during this investigation. **2**

1 amount of time per week on apparatus

2 additional exercise they're doing for their ~~sports~~ other sports.

Candidate response 2

(a) State **two** additional variables, other than those described above, that would need to be controlled during this investigation. **2**

1 Same time of training

2 dosage of protein supplement.

Question 4(b)(i)

Marking instructions

Question 4 (b)(i)

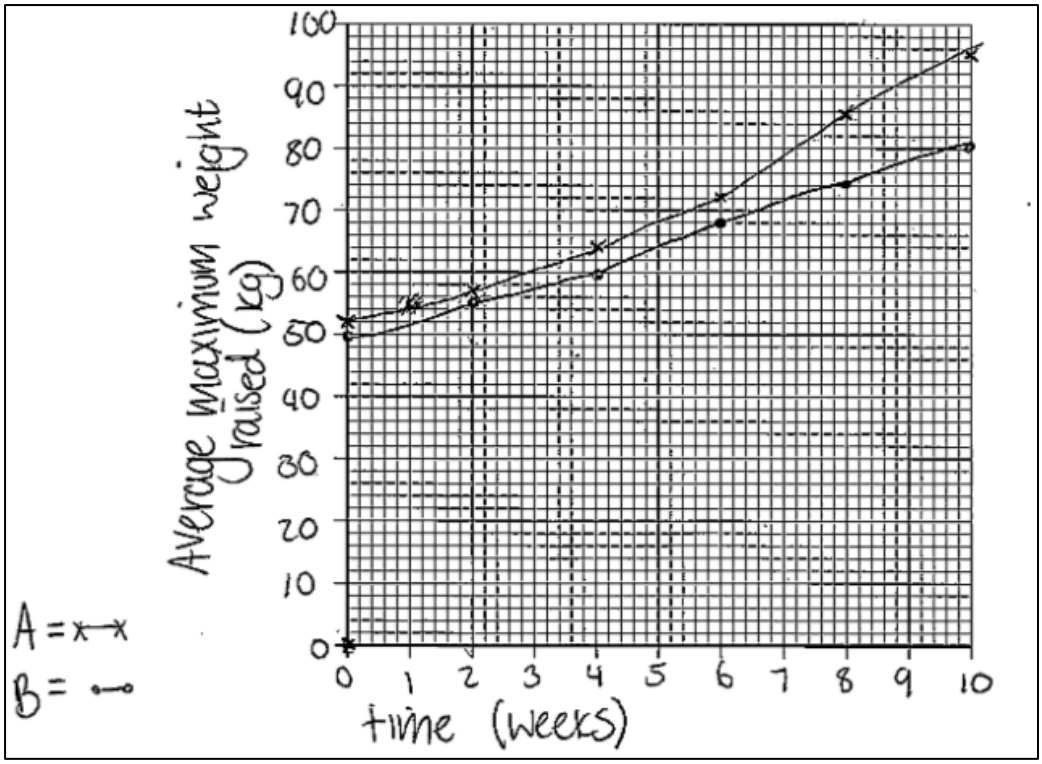
Draw a line graph to show **all** the data in **Table 1**.

Table 1

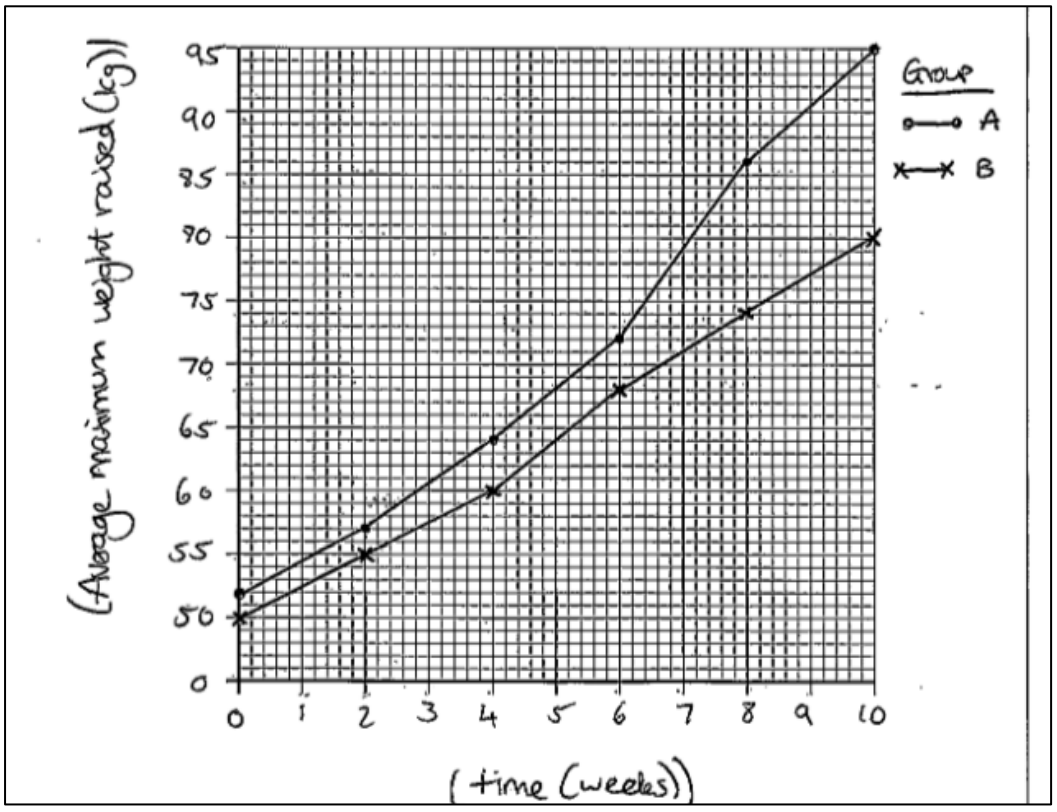
Group \ Time(weeks)	Average maximum weight raised (kg)					
	0	2	4	6	8	10
A	52	57	64	72	86	95
B	50	55	60	68	74	80

Expected response	Max mark	Additional guidance
Axes have correct scales and labels. **(1)** Points correctly plotted and lines drawn. **(1)** Labels or key added to distinguish between group A/protein supplement and group B /placebo. **(1)**	**3**	Scales using one large box for 2 weeks on the X-axis and one large box for 10 kgs on the Y axis are acceptable. Any 3 values to establish a linear scale. The x-axis scale must start at zero but a number at the origin is not essential. Data can be plotted outwith the numbered scale. Scale breaks are not acceptable. If the axes are transposed the candidate loses the scale mark. Lines must go through all points.

Candidate response 1



Candidate response 2



Question 4(b)(ii)

Marking instructions

Question 4(b)(ii)		
State the conclusion that can be drawn from these results.		
Expected response	**Max mark**	**Additional guidance**
The protein supplement improved the ability (of leg muscles) to raise weights. **OR** The protein supplement allowed students to lift heavier weights / more weight.	**1**	Do not accept: the protein supplement improved performance. Answer must not simply describe the results.

Candidate response 1

(ii) State the conclusion that can be drawn from these results. **1**

In conclusion, protein supplements do improve the ability of the upper leg muscles to raise weights.

Candidate response 2

(ii) State the conclusion that can be drawn from these results. **1**

protein supplements impove performace in sports activities such as weightlifting.

Question 6(a)(iii)

Marking instructions

Question 6(a)(iii)		
Describe how negative feedback control raises the concentration of testosterone in the blood if it has fallen to a low level.		
Expected response	**Max mark**	**Additional guidance**
(Low levels of) testosterone fails to inhibit the pituitary gland. **(1)** (An increased concentration of) ICSH is released (by the pituitary gland). **(1)** Interstitial cells produce testosterone. **(1)** **Any 2 from 3**	**2**	Accept: low levels of testosterone stimulate the pituitary gland. Use of FSH in addition to ICSH does not negate. Do not accept LH in place of ICSH.

Candidate response 1

(iii) Describe how negative feedback control raises the concentration of testosterone in the blood if it has fallen to a low level. 2

If testosterone levels are low the pituitary gland releases more ICSH so that more testosterone is produced by interstitial cells

Candidate response 2

(iii) Describe how negative feedback control raises the concentration of testosterone in the blood if it has fallen to a low level. 2

If testosterone levels have fallen the pituitary gland will produce more FSH and ICSH. This will increase testosterone levels

Question 9(d)(i)

Marking instructions

Question 9(d)(i)		
The glucose tolerance test indicated that this man had type 2 diabetes. Explain why production of insulin did not lower his blood glucose concentration in the first hour of the test.		
Expected response	**Max mark**	**Additional guidance**
Cells are less sensitive to insulin/resistant to insulin. **OR** Cells /they have fewer insulin receptors / have less sensitive insulin receptors/ less effective insulin receptors. **(1)** They cannot convert/convert less glucose to glycogen. **OR** Less glucose is taken into the cells. **(1)**	**2**	Accept: insulin receptors are desensitised. Answer must indicate the receptors are linked to insulin. Accept: that it will take longer to convert glucose into glycogen.

Candidate response 1

(d) (i) The glucose tolerance test indicated that this man had type 2 diabetes.

Explain why production of insulin did not lower his blood glucose concentration in the first hour of the test. 2

insulin receptors have become desensitized because of over exposure to it. After a while it starts to break down because the few remaining receptors sense it

Candidate response 2

(d) (i) The glucose tolerance test indicated that this man had type 2 diabetes.

Explain why production of insulin did not lower his blood glucose concentration in the first hour of the test. 2

because his ~~insulin~~ insulin receptors have both decreased in number and ~~sensitivity~~ sensitivity, so there is a failure to convert glucose to glycogen.

Question 11(a)(iii)

Marking instructions

Question 11(a)(iii)		
Use data from the table to describe the changes that occur in the heart rate as the caffeine concentration increases.		
Expected response	**Max mark**	**Additional guidance**
As the caffeine concentration increases from 0 to 0·8 g/l the heart rate increases and then it levels off/remains constant from 0·8 g/l to 1 g/l. **(1)** It increases from 135 to 270 bpm/by 135 bpm. **OR** It levels off/remains constant at 270 bpm. **(1)**	**2**	Accept: it increases to 0·8 g/l then it levels off/remains constant. Answer must indicate g/l for at least one figure. Answer must indicate bpm for at least one figure.

Candidate response 1

(iii) Use data from the table to describe the changes that occur in the heart rate as the caffeine concentration increases. 2

As the caffeine concentration increases from 0g/L to 1 g/L, the heart rate of the water flea increases from 135 bpm to 270 bpm.

Candidate response 2

(iii) Use data from the table to describe the changes that occur in the heart rate as the caffeine concentration increases. 2

As caffeine concentration increased from 0g/L to 0·5g/L the heart rate increased from 135 bpm to 270 bpm then remained constant after that.

Question 13(c)(ii)

Marking instructions

Question 13(c)(ii)		
Describe how T lymphocytes destroy infected body cells.		
Expected response	**Max mark**	**Additional guidance**
They cause the cells to produce self-destructive enzymes. **OR** They induce /cause apoptosis/(programmed) cell death.	1	Do not accept: T lymphocytes inject self-destructive proteins /enzymes into infected cells. Accept: cell suicide for cell death. Answer must indicate the role of T-lymphocytes so apoptosis on its own is incorrect.

Candidate response 1

(ii) Describe how T lymphocytes destroy infected body cells. 1

T lymphocytes destroy infected body cells by programmed cell death

Candidate response 2

(ii) Describe how T lymphocytes destroy infected body cells. 1

(insects with digestive enzymes) cause cell death ~~of~~ apoptosis of the ~~body~~ infected body cell.

Question 14B

Marking instructions

Question 14B		
Describe vaccination and discuss its role in establishing herd immunity in a Population.		
Expected response	**Max mark**	**Additional guidance**
Vaccination 1. Vaccination develops/provides immunity against a pathogen/disease. **OR** Vaccination produces memory cells against a pathogen. 2. Antigens from pathogens are used to create memory cells/immunological memory. 3. If a vaccinated individual becomes infected/exposed again, antibody production/the immune/the secondary response is greater/more rapid/prevents symptoms developing. 4. Vaccines can contain inactivated (pathogen) toxins/dead pathogens/parts of pathogens/weakened pathogens. 5. Antigens are usually mixed with an adjuvant. **OR** Vaccines usually contain/are mixed with an adjuvant. 6. An adjuvant makes the vaccine more effective/enhances the immune response.	**9**	Accept viruses or bacteria for pathogens. The terms vaccine/ vaccination/immunisation are interchangeable.
Herd immunity a. Mass vaccination programmes are designed to establish herd immunity (to a disease). b. Herd immunity occurs when a large percentage/high numbers of a population are immune/immunised/ vaccinated. c. Herd immunity reduces the spread of diseases. d. Herd immunity protects non-immune individuals as they have a lower probability/less chance of coming into contact with infected individuals. e. Diseases have a threshold for herd immunity. f. The threshold depends on the type of disease/the effectiveness of the		

vaccine/the density of the population. **Pt. f Any 2 for the mark** g. Herd immunity/vaccination may not be possible due to poverty. h. Herd immunity/vaccination may not occur due to vaccine rejection.		

Note: When marking extended responses, markers are expected to indicate on the response where marks are given. This is done by adding a tick and the associated number/ letter that corresponds to the mark in the marking instructions.

Candidate response 1

B) A vaccination is when a ~~[illegible]~~ inactive pathogen is placed into the body to allow white blood cells to become aware of it and fight it off without becoming ill. This will make you immune to the infection or disease you have been vaccinated against. Establishing herd immunity in a population is useful as if a virus is common in an area a large amount of the population can be vaccinated against it making it better for people who arent vaccinated as they will have less change of catching it.

Candidate response 2

Note: This candidate's response has been split up into four sections to make marking it more straightforward.

Section 1

B

- Vaccines can be ~~[illegible]~~ made with weakened pathogens, parts of pathogens, dead pathogens or inactivated pathogens.
- An adjuvent is often added to vaccines which increases effectiveness of vaccine for an enhanced immune response.
- Vaccines work by creating memory cells for that type of disease/infection.

Section 2

- Memory cells are B + T lymphocytes which are specific white blood cells with specific antibodies and receptors particular to antigenic markers on the surface of pathogens. These memory cells remain in the body from a previous attack from that pathogen.
- when a second invasion happens from that specific pathogens, lymphocytes rapidly give rise to a clonal population, and destroy the virus before the individual shows symptoms.

Section 3

- Herd immunity is established when a large percentage of the population is vaccinated, protecting individuals who aren't vaccinated as there is a low possibility of them coming into contact with an infected individual.
- Threshold is the percentage of immunised individuals above which a disease/virus can no longer persist.
- Threshold depends on the density of the population, effectiveness of the vaccine and type of disease.

Section 4

- Herd immunity may be difficult to establish due to poverty in the developing world and by rejection of the vaccine by a large number of the population.
- For herd immunity to be effective, only a minority of the population can be left unvaccinated.