

VICTORIAN CERTIFICATE OF EDUCATION

Year 2017

STUDENT NUMBER

Letter

Figures								
Words								

BIOLOGY

Trial Written Examination Units 3 and 4

Reading time: 15 minutes

Writing time: 2 hours 30 minutes

QUESTION AND ANSWER BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	40	40	40
B	10	10	80
			Total 120

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer book of 29 pages.
- Answer sheet for multiple-choice questions.

Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

 Kilbaha Education Quality educational content	VCE BIOLOGY 2017 Trial Written Examination
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MULTIPLE-CHOICE ANSWER SHEET

Student Name _____

Student Number _____

Signature _____

If your name or number on this sheet is incorrect, notify the Supervisor.
 Use a **PENCIL** for **ALL** entries. For each question, shade the box that indicates your answer.
 All answers must be completed like **THIS** example.

A	☐	☒	C	D
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Marks will **NOT** be deducted for incorrect answers.
NO MARK will be given if more than **ONE** answer is completed for any question.
 If you make a mistake, **ERASE** the incorrect answer. **DO NOT** cross it out.

ONE ANSWER PER LINE

ONE ANSWER PER LINE

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D
9.	A	B	C	D
10.	A	B	C	D
11.	A	B	C	D
12.	A	B	C	D
13.	A	B	C	D
14.	A	B	C	D
15.	A	B	C	D
16.	A	B	C	D
17.	A	B	C	D
18.	A	B	C	D
19.	A	B	C	D
20.	A	B	C	D
21.	A	B	C	D
22.	A	B	C	D
23.	A	B	C	D
24.	A	B	C	D
25.	A	B	C	D
26.	A	B	C	D
27.	A	B	C	D
28.	A	B	C	D
29.	A	B	C	D
30.	A	B	C	D
31.	A	B	C	D
32.	A	B	C	D
33.	A	B	C	D
34.	A	B	C	D
35.	A	B	C	D
36.	A	B	C	D
37.	A	B	C	D
38.	A	B	C	D
39.	A	B	C	D
40.	A	B	C	D

SECTION A – Multiple-choice questions

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** for the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Question 1

The components that make up a uracil nucleotide are

- A. Nitrogenous uracil base, deoxyribose sugar, phosphate
- B. Deoxyribose uracil base, nitrogenous sugar, phosphate
- C. Ribose sugar, nitrogenous phosphate, uracil base
- D. Phosphate, nitrogenous base uracil, ribose sugar

The next 2 questions refer to the following diagram

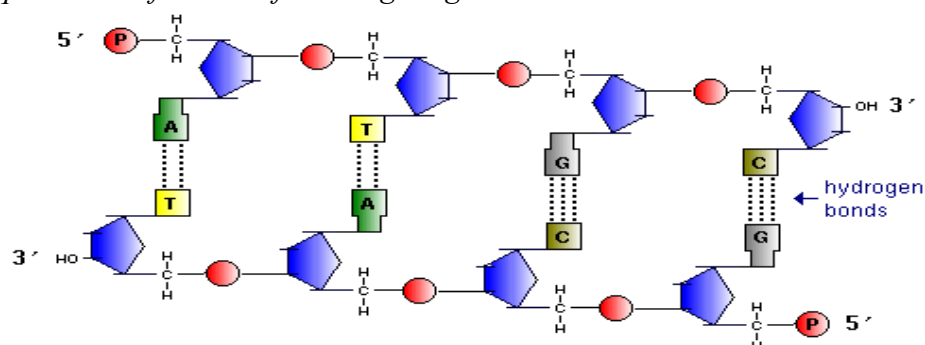


Diagram: <http://arbl.cvmbs.colostate.edu/hbooks/genetics/biotech/basics/nastruct.html>

Question 2

The molecule represented is

- A. Antiparallel
- B. Using ribose as its 5 carbon sugar
- C. Stronger across the complementary base pairs compared to along each polynucleotide chain
- D. Only located in the nucleus of eukaryotic cells

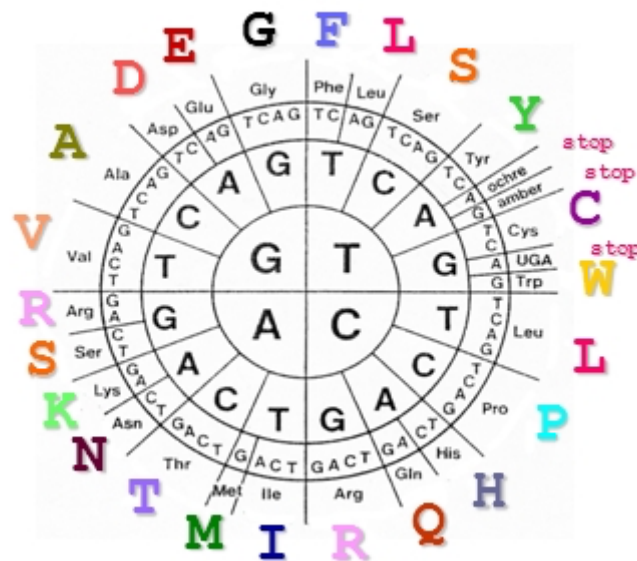
Question 3

If the top strand is the template strand to be used for transcription

- A. The mRNA strand would have the sequence of 5' UACG 3'
- B. The mRNA strand would have the sequence of 5' GCAU 3'
- C. The tRNA anticodon would have the sequence of 3' CGUA 5'
- D. The complimentary strand is used to coordinate mRNA synthesis

The next 3 questions refer to the following information

The following table is a DNA triplet wheel. The triplets are read from the inside to the outside of the wheel. The letters around the outside represent the amino acids for easier sequencing



From: <http://education.expasy.org/bioinformatique/Diabetes.html>

Question 4

There are many more triplets than there are amino acids. This illustrates the

- A. Complexity of the code
- B. Degeneracy of the code
- C. Simplicity of the code
- D. Differences between DNA and mRNA

Question 5

A protein has the amino acid order of

KVESL

The DNA sequence could be

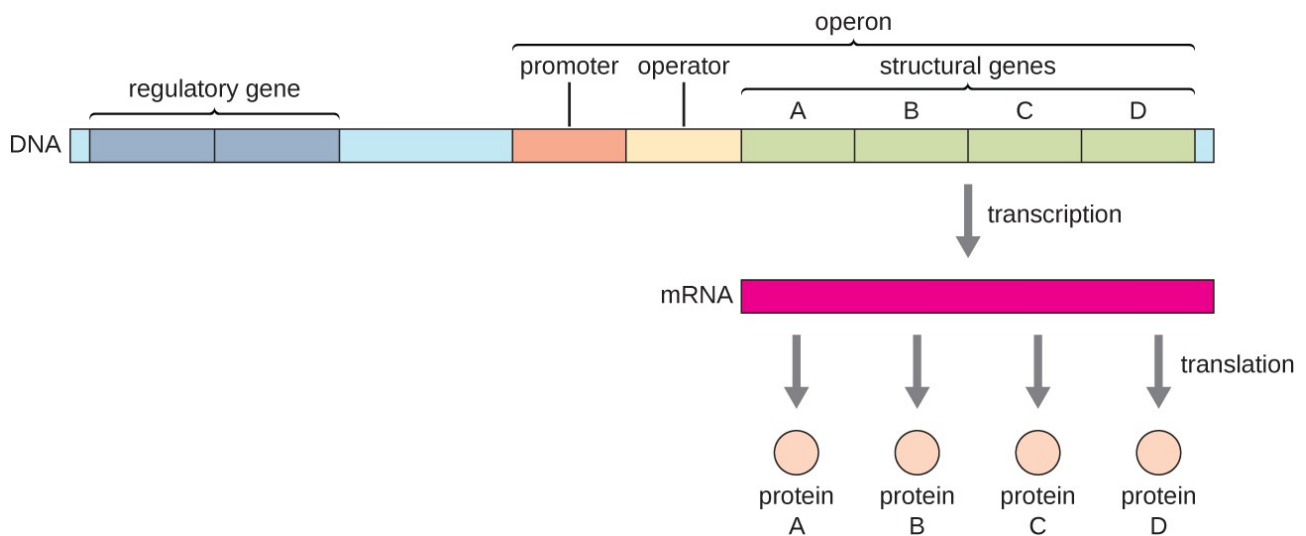
- A. AAAGTTGAACCCTTG
- B. AAAGTAGAATCATTG
- C. TTTGTCGAATCATTA
- D. GGGGTGGAGTCGTTA

Question 6

The tRNA 'stop' anticodon for the DNA triplet of TGA would be

- A. ACU
- B. ACT
- C. UGA
- D. GAU

The next 2 questions refer the following general diagram of gene control in bacteria called an operon.



Link: <https://courses.lumenlearning.com/microbiology/chapter/gene-regulation-operon-theory/>

Question 7

In the context of the operon, the function of the regulatory gene is to

- A. Produce a protein called a repressor
- B. Bind to the operator section of the operon
- C. Allow the translation of the structural genes
- D. Produce a repressor that binds to the promoter when tryptophan levels are high

Question 8

RNA polymerase binds to

- A. Protein C
- B. The promotor
- C. The operator
- D. The DNA between the regulatory gene and the operon

Question 9

Which of the following chemicals is a protein?

- A. Restriction endonuclease
- B. Ribosomal Ribonucleic acid
- C. Neurotransmitters
- D. Glucose

Question 10

The diagram below is of a protein showing the various ways (Q, R and S) the tertiary structure is held together

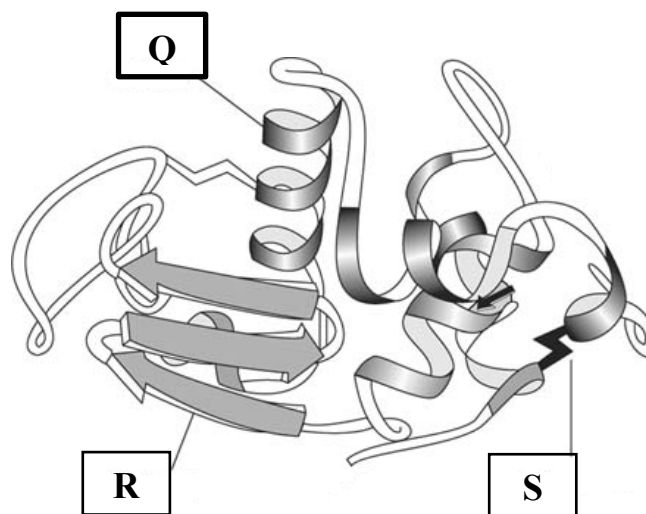


Diagram modified from:

<https://www.cliffsnotes.com/study-guides/biology/biochemistry-i/protein-structure/secondary-structure>

Q, R and S are

- A. Q: β pleated sheet, R: disulphide bond, S: α helix
- B. Q: α helix, R: disulphide bond, S: β sheet
- C. Q: β pleated sheet, R: α helix, S: disulphide bond
- D. Q: α helix, R: β pleated sheet, S: disulphide bond

Question 11

An enzyme that joins breaks in the phosphodiester backbone of DNA is called

- A. DNA ligase
- B. Restriction endonuclease
- C. RNA polymerase
- D. DNA polymerase

Question 12

A linear strand of DNA and a plasmid are mixed with *EcoRI*. The linear strand has 3 binding sites and the plasmid has 2 binding sites for *EcoRI*. The resultant number of strands would be

- A. 3
- B. 4
- C. 5
- D. 6

The diagram illustrates a DNA-protein complex. A DNA strand, shown as a black line with vertical tick marks representing base pairs, enters from the left (labeled 'a') and exits to the right (labeled 'b'). The DNA passes through a light blue, irregularly shaped protein complex. Within the protein, the DNA forms a loop. A specific segment of this loop is highlighted in orange and labeled '20 nt' (20 nucleotides), with a '5'' end indicated. Another segment of the DNA is highlighted in red and labeled '3'' at its end. A purple segment of the DNA is labeled 'e'. A bracket labeled 'g' encompasses the orange segment and the '20 nt' label. A bracket labeled 'f' encompasses the red and purple segments. Two pairs of scissors are shown cutting the DNA at points labeled 'c' and 'd'. A label 'b' also points to the protein complex.

<https://kilbaha.com.au/>

Question 16

The purpose of using plasmids with antibiotic resistance genes as vectors for bacterial transformation experiments is to

- A. Ensure the bacteria that are not transformed are resistant to antibiotics
- B. Allow only the transformed bacteria to survive in an environment without the antibiotic
- C. Allow biotechnologists to move genes from one plasmid to another plasmid
- D. Provide a method of transferring genes of interest from a test tube into a bacterium

Question 17

The functioning of an enzyme is sometimes referred to as lock and key mechanism. With this in mind, an irreversible competitive enzyme inhibitor would best be described to work like

- A. Having a key that could fit into any lock
- B. Jamming a similar shaped key into a particular lock
- C. Wearing out the lock so the key no longer works in it
- D. Changing the shape of the lock so the key doesn't fit

Question 18

At low light intensities there is a point where the rate of gas exchange around a leaf is zero. The best reason to explain this is

- A. Respiration rate is greater than photosynthesis rate
- B. Photosynthesis rate is greater than respiration rate
- C. Photosynthesis rate is the same as respiration rate
- D. The plant is only respiring

Question 19

The most abundant protein on earth is called RUBISCO (Ribulose-1,5-bisphosphate carboxylase), which is involved in the light independent reaction of photosynthesis. It would be true to say that

- A. RUBISCO is located in the matrix of the chloroplast
- B. RUBISCO is located in the stroma of the chloroplast
- C. RUBISCO is located in the grana of the chloroplast
- D. RUBISCO is embedded in the thylakoid membrane

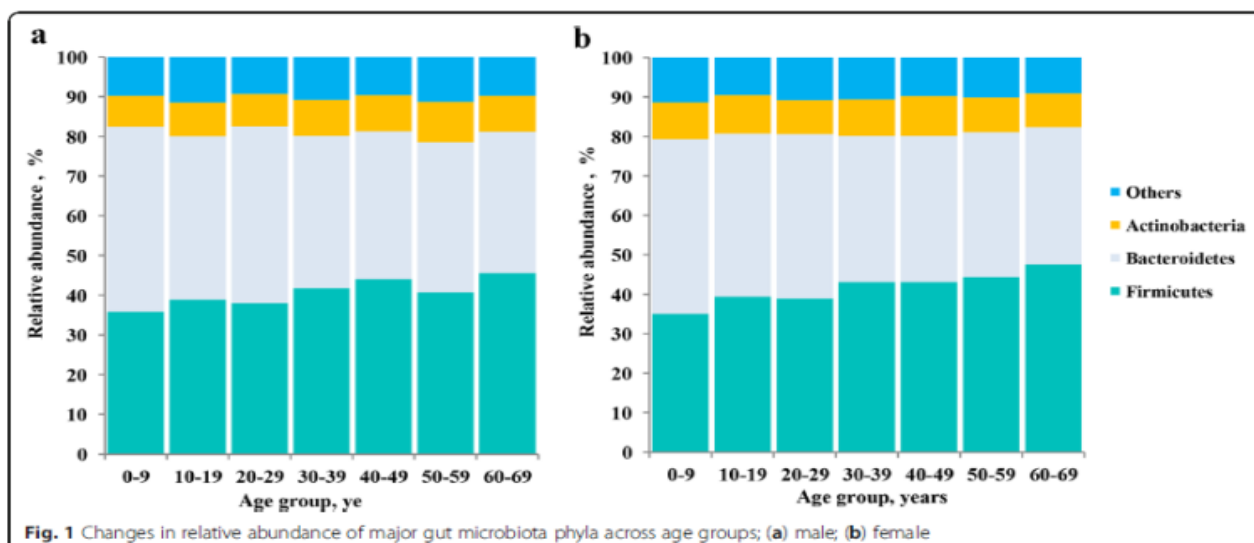
Question 20

The cellular location of the Electron Transport Chain is

- A. Matrix
- B. Cristae
- C. Grana
- D. Stroma

The next 2 questions refer to the following graphs

The following bar graphs show the difference in gut microbiome between males (a) and females (b)



Link: <https://bmcmicrobiol.biomedcentral.com/track/pdf/10.1186/s12866-020-01903-7.pdf>

Question 21

The abundance of Firmicutes in the gut microbiota in 30-39 year old women is

- A. 40%
- B. 42%
- C. 44%
- D. 46%

Question 22

A 1:1 ratio between *Firmicutes* and *Bacteroidetes* is thought to help maintain a constant weight in individuals. Any change in this can lead to obesity or inflammatory bowel syndrome. Based on the information provided, the best gut health with respect to *Firmicutes* and *Bacteroidetes* would be

- A. 0-9 year old females and 20-29 year old males
- B. 60-69 year old males and females
- C. 10-19 year old females and 0-9 year old males
- D. 30-39 year old males and females

Question 23

A non self antigen would be found on

- A. Normal body cells
- B. Cancerous cells
- C. Undifferentiated cells
- D. A pathogen

Question 24

A cellular pathogen would include

- A. The meningococcal bacillus
- B. HIV
- C. Prions
- D. The influenza virus

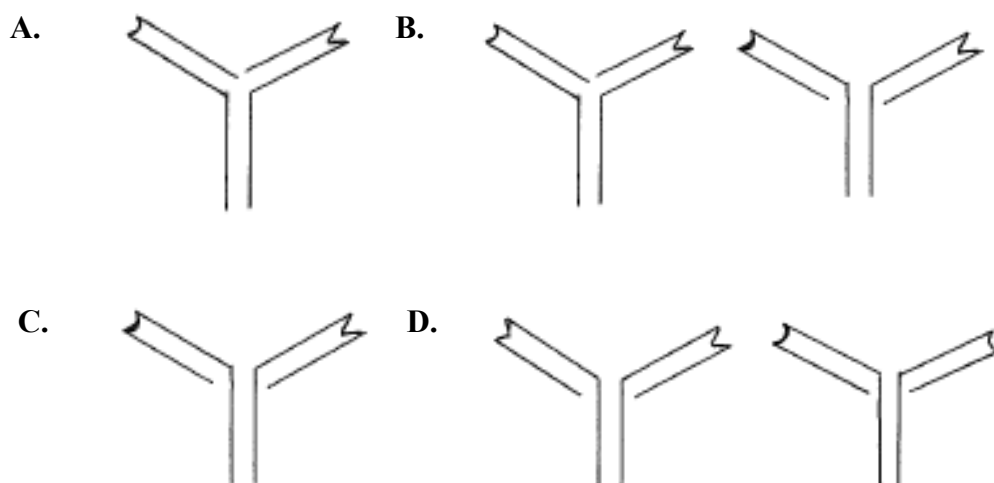
Question 25

A typical action of cells involved in the specific immune response would be

- A. Naïve B cells differentiation into helper cells
- B. Naïve T cells differentiating into plasma cells
- C. B memory cells stimulating the production of T memory cells
- D. Specific antigens on the surface of antigen presenting cells being recognised by a specific naïve B cell

Question 26

When the body is exposed to 2 antigens on the surface of a cell, the correct antibody structure in response could be represented by (● and ▲)



Question 27

Vaccination programs in Australia are subsidised by the government to reduce the impact that many common diseases have on society. Several diseases that vaccines are available for include

Vaccine	Disease(s) vaccine prevents	The number of antigens present in the vaccine
1	Influenza (2017)	4
2	Human Papilloma Virus (HPV)	4
3	Measles, mumps and Rubella (MMR)	3
4	Polio (IPV)	1

If an individual received vaccines 1 to 4, the number of naïve B cells that would undergo clonal expansion would be

- A. 0
- B. 1
- C. 4
- D. 12

Question 28

A cellular response that could directly lead to inflammation is

- A. Mast cells releasing antibodies
- B. Macrophages releasing cytokine
- C. The stimulation of complement proteins
- D. Apoptosis of viral infected cells

Question 29

Fern has just been born and is breastfeeding from her mother who recently contracted Covid. As a result of this situation Fern is protected against that strain of Covid. This is an example of

- A. Natural passive immunity
- B. Natural active immunity
- C. Artificial passive immunity
- D. Artificial active immunity

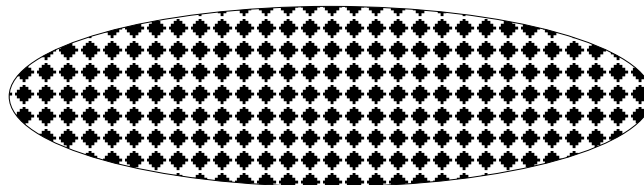
Question 30

A frameshift mutation leads to a new protein that provides an advantage to an individual in a new environment. As a result, this particular mutation becomes more prevalent in the population. The factor that has changed is the

- A. Allele frequency
- B. Gene pool
- C. DNA sequence
- D. All of the above

Question 31

A population of black and white animals are evenly spread throughout an environment as illustrated in the diagram below.



A small portion of only black animals colonise a new area and the population is illustrated in the diagram below.



This is an example of

- A. Genetic drift
- B. Mutations
- C. Artificial selection
- D. Gene flow

Question 32

There have been many significant events that have occurred during Earth's Geologic history such as

1. The appearance of eukaryotic cells
2. The first terrestrial animals
3. The appearance of prokaryotic cells
4. The development of multicellular individuals
5. The evolution of modern humans

The correct order of these events from the most ancient to the most recent is

- A. 1, 2, 3, 4, 5
- B. 1, 3, 4, 2, 5
- C. 3, 4, 1, 5, 2
- D. 3, 1, 4, 2, 5

Question 33

There is a strong correlation between a genetic disorder called sickle cell anaemia and the location of malaria in Africa, which is illustrated in the diagram below.

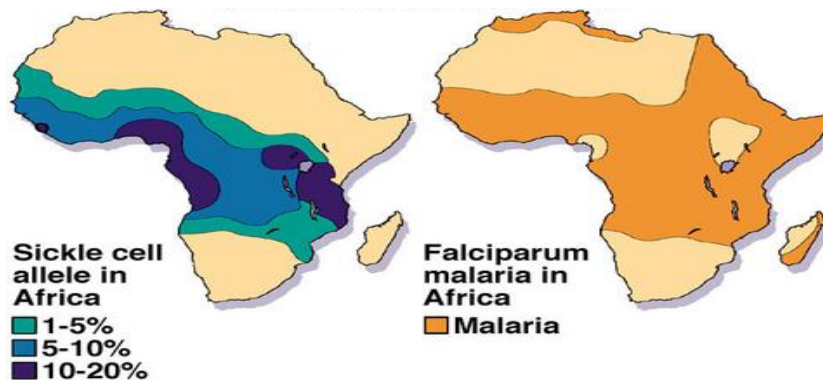


Diagram from:

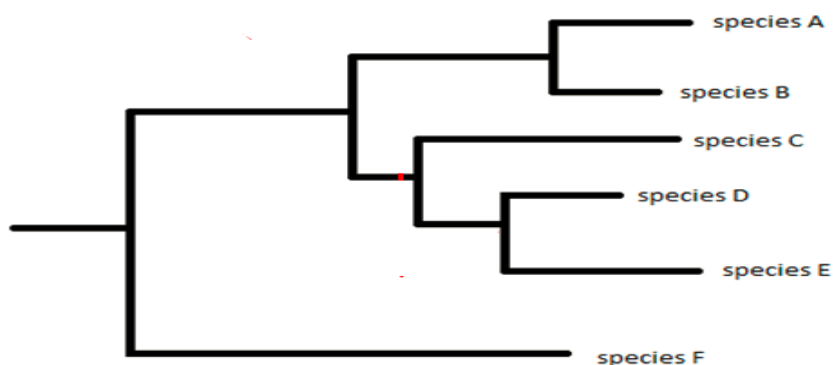
http://highered.mheducation.com/sites/0073403466/student_view0/chapter13/art_quizzes.html

It would be true to say that

- A. Malaria caused a change in the genomes of people in the area where the disease is apparent
- B. Individuals with the sickle cell allele are at a selective advantage over those without the allele anywhere in Africa
- C. The selective agent is *Falciparum malaria*
- D. The correlation between malaria and sickle cell anaemia would have been unchanged for as long as humans have been present in Africa

Question 34

The following phylogenetic tree displays how 6 species (A to F) are related through time



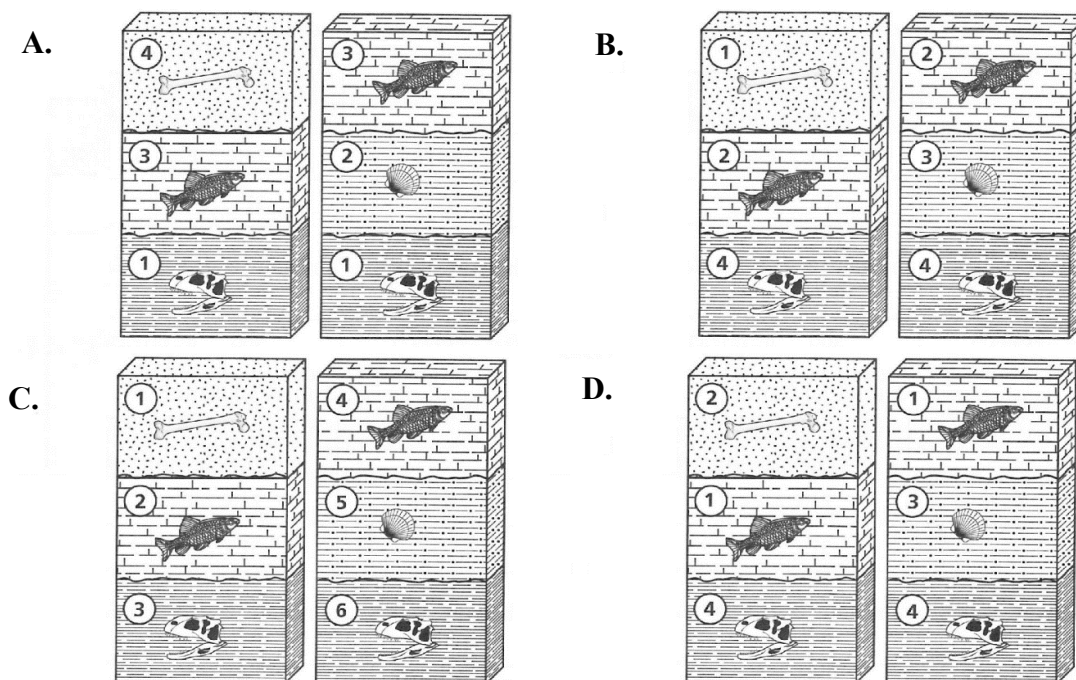
From: <https://archosaurmusings.wordpress.com/2008/12/18/how-to-read-a-phylogenetic-tree/>

It would be reasonable to conclude that

- A. Species D and E are more closely related to each other than any other paired combinations of species in the phylogenetic tree
- B. Species A and B would display more DNA homology than species C and B
- C. Species E and F have a different common ancestor
- D. Species D, E and F are extinct

Question 35

Fossils were found in 2 areas and the strata was then correlated to determine the relative age of the fossils within each layer. The diagram that depicts the order of age (1 = youngest) of the fossils is displayed in



Modified from: <http://legacy.belmont.sd62.bc.ca/teacher/geology12/photos/misc/GEOTIME/>

Question 36

The first hominin to integrate fire into their cultural practice were

- A. Homo sapiens
- B. Homo neanderthalensis
- C. Homo erectus
- D. Homo habilis

Question 37

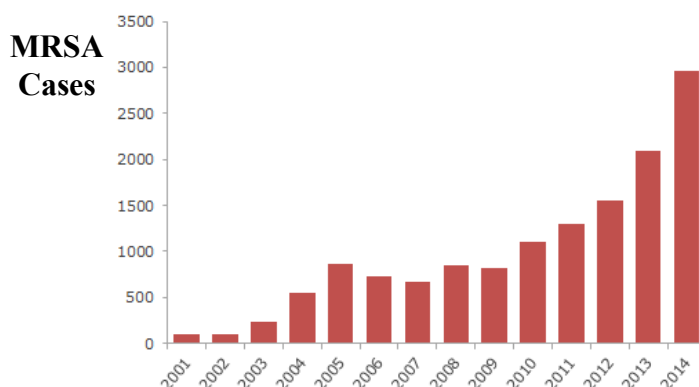
Bipedalism and large cranial capacity are 2 features that separate the Homo genus from other hominins. To answer the question ‘Did bipedalism evolve before large cranial capacity?’ anthropologists would look for evidence such as

- A. Fossils containing a central foramen magnum with small cranial capacity to pre-date those with a foramen magnum to the rear of the skull with a large cranial capacity
- B. Fossils containing a small bowl shaped pelvis and small skull to pre-date those with an elongated pelvis with large skull.
- C. Fossils having an equal arm leg ratio with small skulls pre-dating those with longer arms than legs with large skulls
- D. Fossils containing a foramen magnum to the rear of their small skull to pre-date those with a more central foramen magnum to the rear of their larger skull.

The next 2 questions refer to the following information

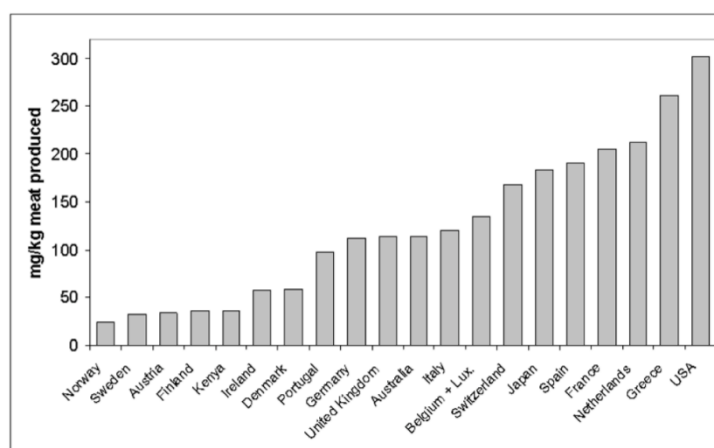
MRSA (methicillin resistant *staphylococcus aureus*) is a growing problem due to the overuse of antibiotics such as methicillin in medicine as well as agriculture. Once MRSA appears in humans it is almost impossible to treat and it is highly infectious.

The information below illustrates why there is a growing concern for MRSA from 2001 to 2014 in one American state



From: <http://www.ssi.dk/English/News/EPI-NEWS/2015/No%2023%20-%202015.aspx>

There appears to be a relationship between MRSA and meat production and the following graph shows the antibiotic use in agriculture in different countries in 2014.



From: <https://blogs.scientificamerican.com/disease-prone/files/2011/11/ABx-use-graph.png>

Question 38

It is reasonable to state that

- A. MRSA cases have increased exponentially between 2001 and 2014
- B. There were over 1000 cases of MRSA in 2008
- C. The result in 2004-2006 would be due to the increased use of methicillin in Europe
- D. There would be more MRSA cases in Australia than in France

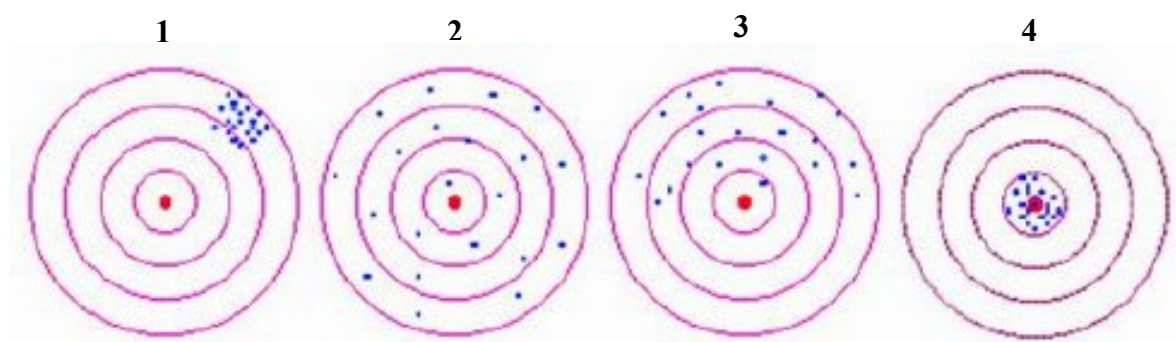
Question 39

The mg/kg meat produced in the different countries is referring to

- A. The total amount of meat produced in each country in the sample
- B. The number of kilograms of antibiotics used in each country during 2014 in the sample
- C. The number of milligrams of antibiotics used for each kilogram of meat produced during 2014 for each country in the sample
- D. The proportion of meat produced in each country during 2014 in the sample compared to the availability of antibiotics

Question 40

An experiment was carried out several times by four biologists (1 to 4) to see which one was best able to follow instructions. The centre of each section would infer 100% accuracy in their experimental technique and the number of dots represents the number of times each biologist carried out the experiment



From: <http://www.kdnuggets.com/2010/12/predictive-model-reliability-variability.html>

It would be true to say that

- A. Biologist 1 reliably generated results; however, the data was imprecise.
- B. Biologist 2 reliably followed the method, which generated data without bias and precision
- C. Biologist 3 did not reliably follow the method and as a result, generated imprecise results
- D. Biologist 4 was far too precise and so must have fabricated the data

SECTION B – Short Answer Questions

Question 1 (Total 7 marks)

Insulin is a protein that is very important for the regulation of glucose levels and is produced in β cells in the islets of Langerhans of the pancreas.

- a) Describe the organelles within a cell that are involved in the manufacture, internal transport and eventual secretion of the insulin protein.

(2 marks)

The functional insulin protein is comprised of 2 polypeptides; the A chain is comprised of 21 amino acids and the B chain is comprised of 30 amino acids.

- b) (i) At what level of protein structure is insulin functional?

(1 mark)

- (ii) How does a gene code for the correct number and the correct sequence of amino acids?

(2 marks)

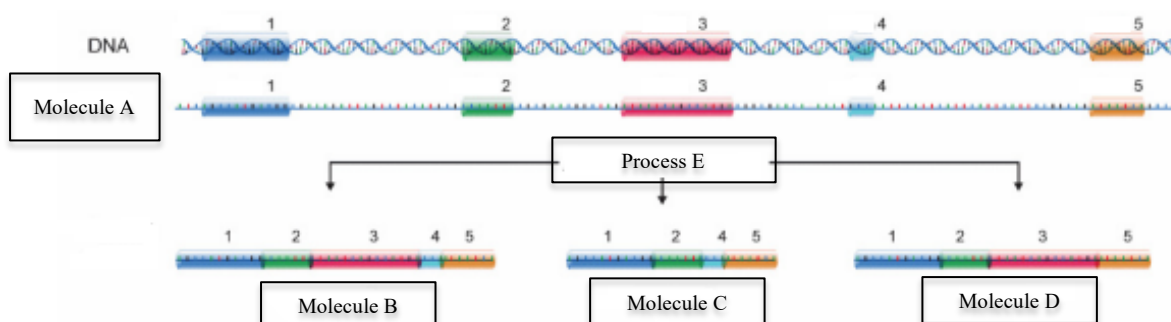
Amino acids are joined together in a condensation reaction that forms a peptide bond that joins them together.

- c) In the space provided below draw a diagram illustrating how amino acids are joined together in a condensation reaction. In your answer draw, simple diagrams of 2 amino acids showing how they bond together.

(2 marks)

Question 2 (Total 7 marks)

The diagram below illustrates an important process occurring in the nucleus of most eukaryotic cells. Molecules A, B, C and D as well as Process E are clearly shown.



Link for all diagrams in this question:

[https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3A Biochemistry Free and Easy \(Ahern and Rajagopal\)/05%3A Flow of Genetic Information/5.05%3A RNA Processing](https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3A_Biochemistry_Free_and_Easy_(Ahern_and_Rajagopal)/05%3A_Flow_of_Genetic_Information/5.05%3A_RNA_Processing)

a) Name:

Molecule A: _____

Molecules B, C and D: _____

Process E: _____

(3 marks)

The resultant protein molecules produced after process C are shown below



Protein X



Protein Y



Protein Z

b) (i) Name the process that forms these molecules

(1 mark)

(ii) Which of the molecules X, Y and Z corresponds to Protein B

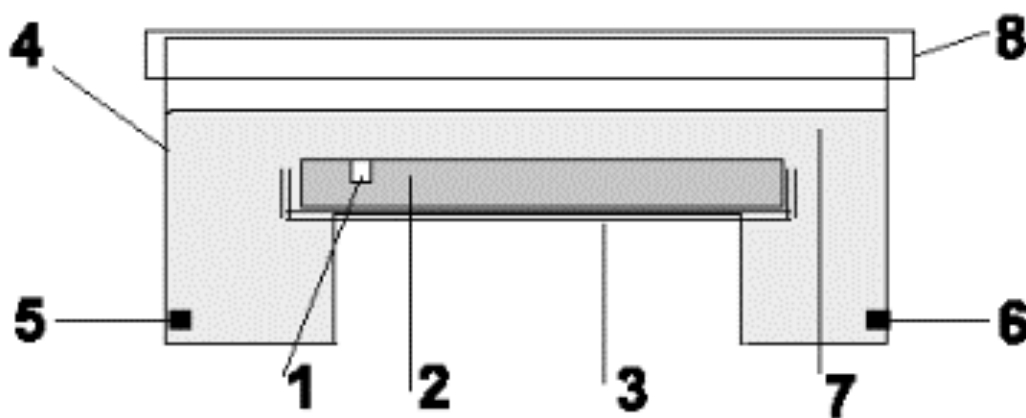
(1 mark)

c) What is the survival advantage to the eukaryotic cells that carry out this process?

 _____ (2 marks)

Question 3 (Total 10 marks)

The diagram below is of a gel electrophoresis tank as a side on 2D view. There are 8 components illustrated that each have an important role to play during gel electrophoresis.



From: http://www.ibo2002.lv/report/P_Tasks3.shtml

- a) Name the following components and state their role in the process of gel electrophoresis

Component 1: _____

Component 5: _____

Component 7: _____

_____ (3 marks)

Before gel electrophoresis is conducted, samples of DNA extracted from individuals undergoes PCR, which uses samples of; DNA, *taq* polymerase, DNA nucleotides and primers.

- b) (i) What does PCR stand for?

_____ (1 mark)

- (ii) Explain the purpose of the primers in the process of PCR

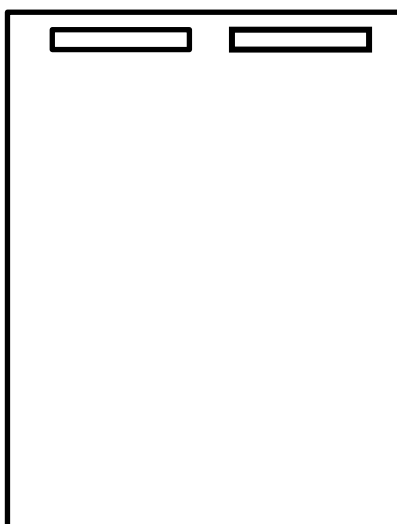
_____ (2 marks)

Question 3 (continued)

Paternity testing is one of the applications of gene technology that involves gel electrophoresis as one of the steps. STRs (short tandem repeats) are sections of DNA that show hyper variability between unrelated individuals; however, between related individuals, such as a father and a son, there is a similarity in at least 50% of their STRs. In the case study below where the father of a child is in dispute, 3 separate STRs were tested from 3 different loci (labelled loci 1, 2 or 3). The numbers next to the STRs are the total number of nucleotides at that locus. The mother, child and 2 men were tested and the outcome is illustrated below.

Locus	STR size at the 3 loci tested					
	1	1	2	2	3	3
Mother	228	302	12	48	87	180
Child	15	228	12	24	87	240
Male 1	228	340	12	84	45	120
Male 2	15	85	24	48	240	400

- c) (i) Draw in the space below the gel electrophoresis pattern for locus 1 of the mother and the child



(2 marks)

- (ii) Who is the father of the child, Male 1 or male 2. Use the data to illustrate your answer.

(2 marks)

Question 4 (Total 10 marks)

An experiment was set up testing the effect of different substrates on the rate of respiration in yeast cells. Yeast was suspended in a solution of water and different types of substrate were added to each of 4 thermos flasks A to D. A diagram of the apparatus is shown below and the results gained are illustrated on the data table beneath.

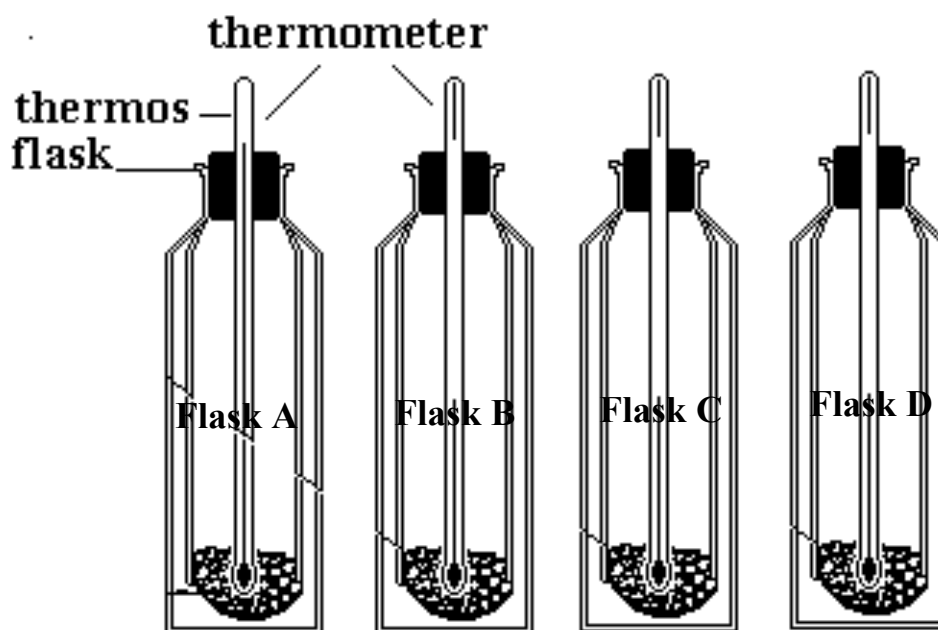


Diagram modified from: http://www.uq.edu.au/_School_Science_Lessons/UNBiology7.html

Flask contents	Initial Temperature (°C)	Maximum Temperature reached (°C)
No substrate	25	28
Glucose	25	38
Equal (a glucose substitute)	25	31
Splenda (a glucose substitute)	25	34

a) (i) What was the independent variable in the experiment?

(1 mark)

(ii) Why did the 'no substrate' results show an increase in temperature?

(1 mark)

(iii) State 2 controlled conditions that would need to be met so the results obtained could be compared to each other

(1 mark)

Question 4 (continued)

Cell respiration rates can be measured in a range of ways apart from temperature changes

- b) Describe another way of measuring respiration rate. In your answer describe a method that could be used to quantify the measurement.

(2 marks)

A criticism of the initial method was that it could not clearly be determined if the yeast was undergoing aerobic or anaerobic respiration.

- c) (i) Complete the table below showing the differences between anaerobic and aerobic respiration in eukaryotic cells

	Aerobic respiration	Anaerobic respiration
Cellular location		
ATP production		
Speed of process		

(3 marks)

- (ii) How could the initial experiment be altered to ensure the respiration was primarily anaerobic?

(2 marks)

Question 5 (Total 9 marks)

The Calvin cycle uses the enzyme *Rubisco* (RuBP carboxylase) to fix CO₂ to RuBP and make a 3C compound (GP).

- a) Name the cellular location of the Calvin cycle

_____ (1 mark)

Plants that fix carbon dioxide directly from the air are called C₃ plants (as the initial product is a 3C compound). C₃ plants include some of the most important sources of calories all over the world: cowpea, cassava, soybean, and rice. The regions where these crops are grown in are often hot and dry, meaning they could benefit from the energy-saving mechanisms of C₄ photosynthesis.

- b) Describe the difference between C₃ and C₄ plants

_____ (2 marks)

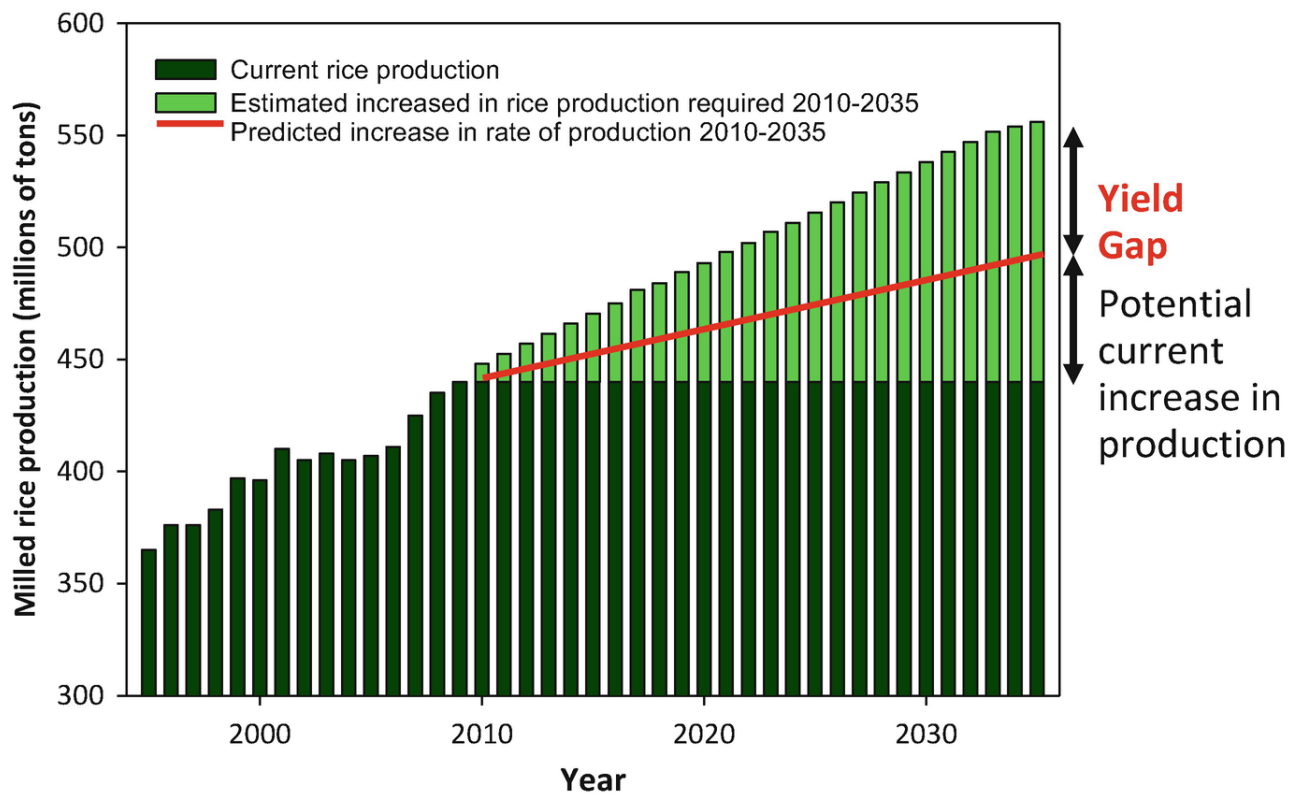
An international C₄ rice consortium was set up to generate a rice plant that is more productive without changing the direct environment the rice plants are typically grown in. A promising line of research involved the knocking out of a hexokinase gene in rice plants using CRISPR-Cas9 technology.

- c) How would CRISPR-Cas9 technology work to generate a rice plant more suited to hot dry environments.

_____ (4 marks)

Question 5 (continued)

The graph below illustrates the past current and future of world wide rice production



Link: https://link.springer.com/chapter/10.1007/978-3-319-77878-5_6

- d) Use the information provided from the graph to justify the investment of money into developing plants such as rice to be more drought resistant. The graph was constructed during 2010.

(2 marks)

Question 6 (Total 8 marks)

COVID-19 infection is accompanied by an aggressive inflammatory response with the release of a large amount of pro-inflammatory cytokines in an event known as “cytokine storm” initiated by cells such as macrophages. Several studies analyzing cytokine profiles from COVID-19 patients suggested that the cytokine storm correlated directly with lung injury and multi-organ failure.

- a) Describe how macrophages function in an inflammatory response against COVID-19 that could lead to a “cytokine storm”

(2 marks)

- b) Explain why both a cell mediated, and humoral response are needed in response against a disease such as COVID-19

(4 marks)

- c) Why has the vaccine provided against COVID-19 never been as effective as a vaccine developed against a disease such as chicken pox?

(2 marks)

Question 7 (Total 6 marks)

Leukemia is a form of cancer that leads to a high concentration of abnormal white blood cells.

- a) Why would one of the symptoms of Chronic Lymphocytic Leukemia (CLL) be swollen lymph nodes?

(1 mark)

Leukemic cells have a high level of a protein called BCL-2 embedded in the mitochondrial membrane that are vital for a cancer cells survival. Early in 2017 a drug that inhibits the action of BCL-2 called Venetoclax was approved for use in Australia to treat CLL because of its success in a series of clinical trials.

- b) Discuss how clinical trials would be conducted for testing the effectiveness of a drug such as Venetoclax

(3 marks)

A model was constructed illustrating the action of the drug which blocks the action of BCL-2. BCL-2 is localized to the outer membrane of mitochondria, where it plays an important role in promoting cellular survival.

- c) Explain how blocking BCL-2 could lead to the death of cancerous white blood cells.

(2 marks)

Question 8 (Total 6 marks)

One common misconception about evolution is that individual organisms evolve during their lifetimes. Natural selection acts on individuals but the population that the individual is a member of, evolves.

- a) (i) How do mutations contribute to genetic variation within a population?

_____ (1 mark)

- (ii) How could biologists measure that a population has evolved?

_____ (2 marks)

White clover (*Trifolium repens*), a European native plant, which has been introduced all over the world is an example of a population that shows change in phenotype with altitude. *Trifolium repens* releases cyanide when parts of the plant are eaten by grazers, such as snails and slugs. The cyanide protects the plant from further grazing because it is toxic to the grazers. However, the cyanide-releasing form of clover suffers more frost damage than clover plants that do not release cyanide and so at higher altitudes, the clover plants release less cyanide when damaged.

Several environments were artificially tested on *Trifolium repens* as illustrated in the diagrams below. All of the plants selected were cyanide releasing.

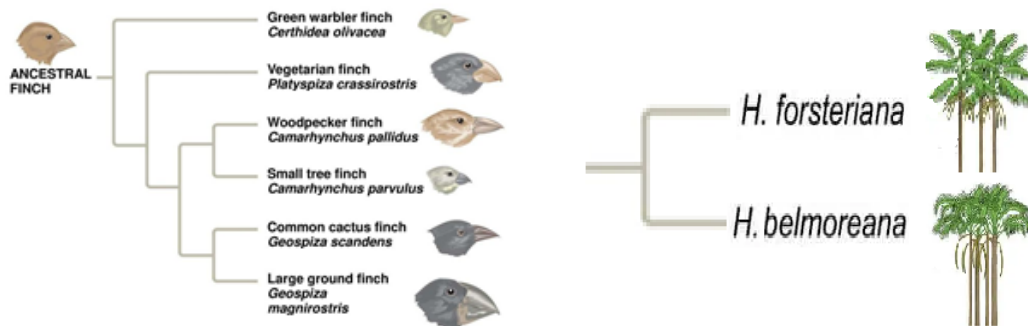
Environment	Conditions <i>Trifolium repens</i> were exposed to
1	Cold without snails and slugs
2	Cold with snails and slugs
3	Warm without snails and slugs
4	Warm with snails and slugs

- b) Rank the order of environments that would have the highest survival rate of *Trifolium repens* through to the lowest survival rate. Explain your reasoning.

_____ (3 marks)

Question 9 (Total 9 marks)

The diagrams below represent the phylogenetic trees for some of the finches that exist on different Galapagos islands as well as the Howae palms on Lord Howe Island



Link: <https://slideplayer.com/slide/13029960/>

a) (i) What defines a species?

(1 mark)

(ii) Name and describe the differences in the speciation events that led to the different species of Howae palms compared to Galapagos finches

(4 marks)

b) Describe the fossil evidence that would support these different types of speciation seen in the Howae palms compared to the Galapagos finches.

(2 marks)

Question 9 (continued)

- c) As paleontologists are formulating ideas based on fossil evidence, how useful are index fossils in the support or contradiction of these ideas?

(2 marks)

Question 10 (Total 8 marks)

Australian aboriginals are one of the most ancient civilizations outside of Africa, which is surprising considering the journey that was required to get to Australia. The oldest aboriginal bones found in Australia date to over 50,000 years old.

- a) How can bones be dated to be 50,000 years old?

(2 marks)

The map below illustrates the journey required by the humans that left Africa to eventually migrate to Australia as well as other parts of the world.



Diagram from:

<https://www.sciencenewsforstudents.org/article/globes-non-africans-all-descend-single-move-out-africa>

Mitochondrial DNA comparisons can be made to provide evidence for these journeys.

- b) (i) Why is mitochondrial DNA a useful tool to help explain human migration patterns?

(2 marks)

- (ii) What other evidence could anthropologists look for to confirm that the route illustrated in the diagram was the route that Australian aboriginals took to get to Australia?

(2 marks)

Question 10 (continued)

- c) Indigenous Australians have been here for over 50,000 whereas indigenous Americans have been in that continent for 15,000 years. Explain the differences in their mtDNA that would support this age discrepancy.

(2 marks)

End of questions for the 2017 Kilbaha VCE Biology Trial Examination Units 3 and 4

Edited for the new study design. Units 1–4: 1 January 2022 – 31 December 2026

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