

JURONG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATIONS
Higher 1

CANDIDATE
NAME

CLASS

BIOLOGY

8875/01

Paper 1 Multiple Choice

15 September 2017

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name and class on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **20** printed pages and **2** blank pages.

[Turn over

- 1 An actively growing cell is supplied with radioactive amino acids.

Which cell component would first show an increase in radioactivity?

- A Golgi body
- B mitochondrion
- C nucleus
- D rough endoplasmic reticulum

- 2 When mucus is secreted from a goblet cell in the trachea, these events take place.

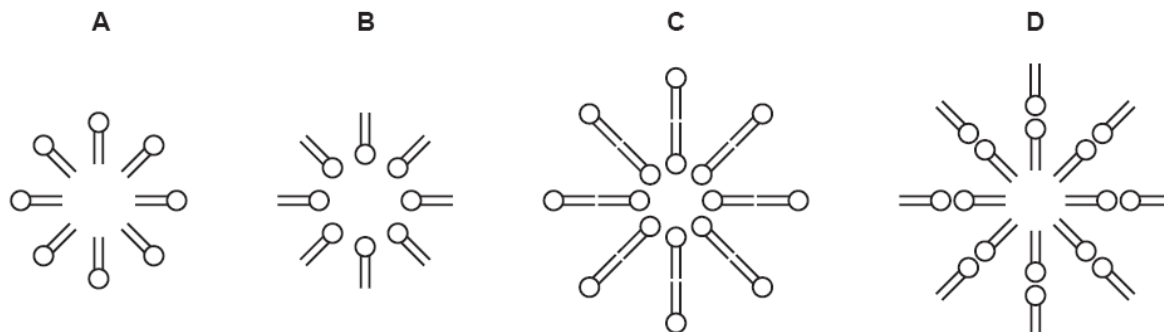
- 1 addition of carbohydrate to protein
- 2 fusion of the vesicle with the plasma membrane
- 3 secretion of a glycoprotein
- 4 separation of a vesicle from the Golgi body

What is the sequence in which these events take place?

- A 1 → 4 → 2 → 3
- B 1 → 4 → 3 → 2
- C 4 → 1 → 2 → 3
- D 4 → 1 → 3 → 2

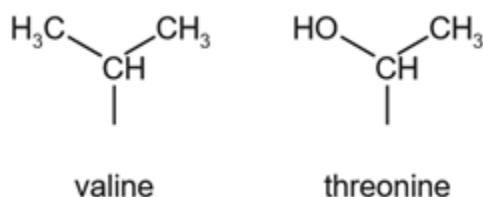
- 3 When a small quantity of phospholipid is added to a test tube of water and then shaken vigorously, an emulsion is formed by small droplets called liposomes.

Which diagram shows the arrangement of phospholipid molecules in a cross-section of a liposome? **ANSWER: C**

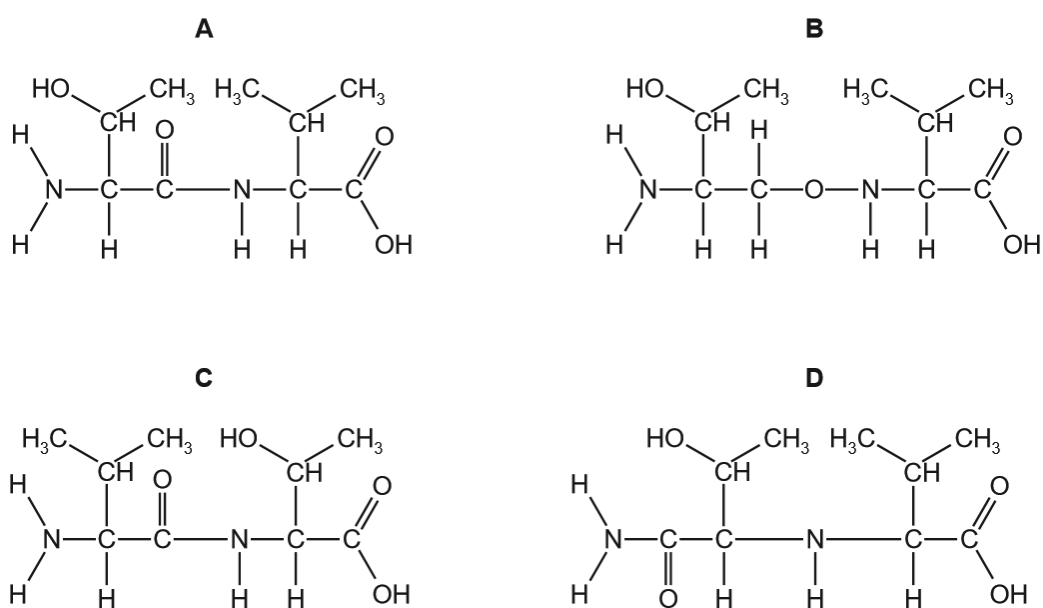


- 4 Threonylvaline is a dipeptide formed from the two amino acids, valine and threonine. A peptide bond forms between the amine group of valine and carboxyl group of threonine.

The side-chains (R groups) of the two amino acids are shown.



Which molecular structure is threonylvaline? **ANSWER: A**



5 Which set of statements correctly describes haemoglobin?

	1	2	3	4
A	four polypeptide chains, each containing a haem group	iron ions can associate with oxygen forming oxyhaemoglobin	in each chain, hydrophobic R groups of amino acids point towards the centre of the molecule	at 50% saturation, two oxygen molecules are transported by the molecule
B	polypeptide chains interact to produce a globular chain	each chain contains a haem group of amino acids surrounding an iron ion	consists of two identical alpha chains and two identical beta chains	each chain can transport an oxygen molecule
C	polypeptide chains interact to produce an almost spherical molecule	an iron ion is present within each haem group	quaternary structure has two alpha chains and two beta chains	each molecule can transport a total of four oxygen atoms
D	polypeptide chains produce a loose helical shape, which folds to form a spherical molecule	iron ions in the molecule can bind reversibly with oxygen	in each chain, hydrophobic R groups of amino acids surround the iron ion	each molecule can transport a total of eight oxygen atoms

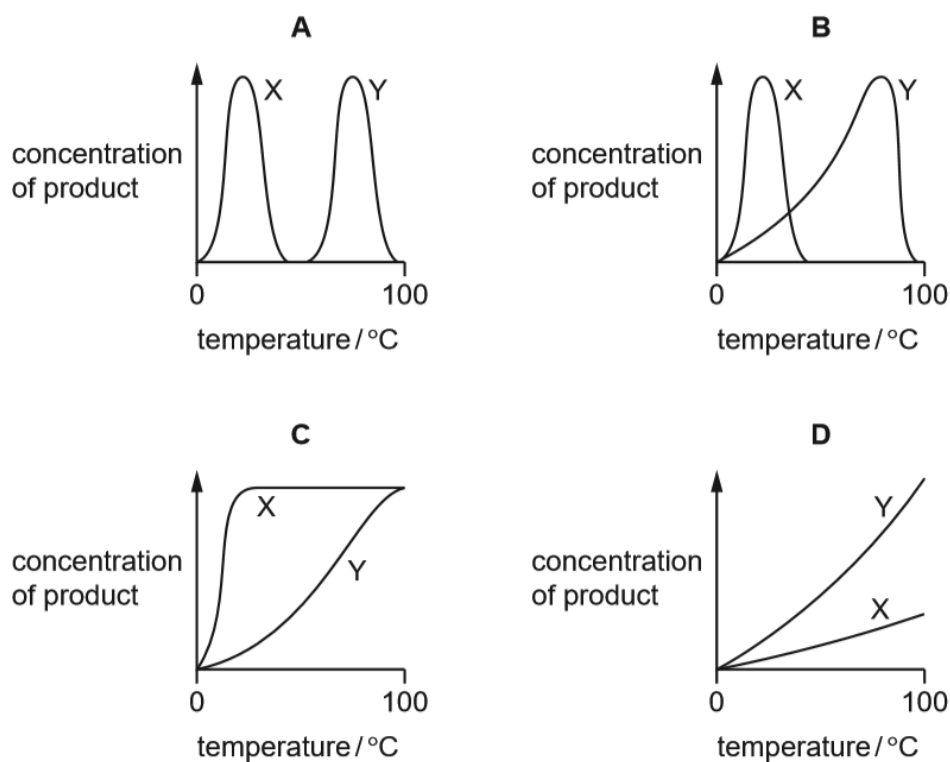
- 6 Two enzymes, X and Y, were used in an experiment.

Enzyme X was from bacteria that live in rivers and lakes at temperatures from 5°C to 20°C.

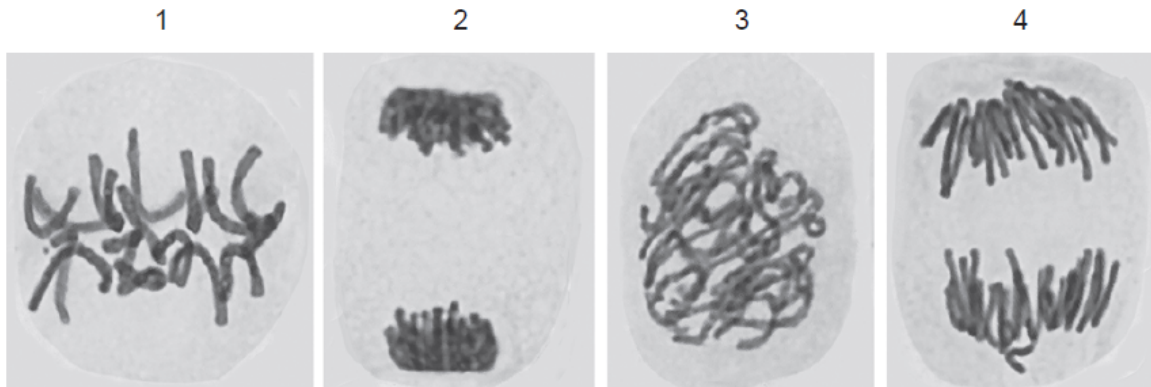
Enzyme Y was from bacteria that live in hot water springs at temperatures from 40°C to 85°C.

The experiment measured the concentration of product produced by each enzyme at temperatures between 0°C and 100°C after 5 minutes.

Which graph shows the results? **ANSWER: B**



7 The photomicrographs show cells in various stages of the cell cycle.



Which cells contain twice as many DNA molecules as a cell from the same organism after cytokinesis?

- A** 1, 2, 3 and 4
- B** 1, 2 and 4 only
- C** 1 and 3 only
- D** 2 and 4 only

8 Yeast cells without a *cdc25* gene cannot divide. This gene is active throughout the cell cycle, steadily building up the concentration of a protein, p80cdc25. This protein activates a kinase which regulates other proteins involved in cell division, but does not seem to affect other cell processes. When the p80cdc25 protein reaches a critical concentration, mitosis starts.

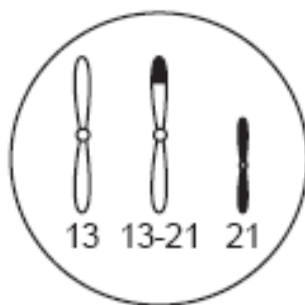
Which changes will be seen if p80cdc25 is produced at a faster rate than usual?

- 1 faster cell cycle
- 2 slower cell cycle
- 3 smaller cells
- 4 larger cells

- A** 1 and 3
- B** 1 and 4
- C** 2 and 3
- D** 2 and 4

- 9 Down's syndrome can be caused by a trisomy of chromosome 21, but can also result from the translocation of chromosome 21 into chromosome 13, forming a single chromosome 13-21.

The diagram shows chromosomes 13 and 21 in the nucleus of a diploid ($2n$) testis cell from a phenotypically normal male carrier of a 13-21 translocation. This cell has a chromosome number of 45.



Which is not a likely outcome of fertilisation of normal oocytes by sperm from this male?

	chromosomes in sperm	embryo
A	13 and 21	$2n = 46$ normal phenotype
B	13-21	$2n = 45$ normal phenotype
C	13-21 and 21	$2n = 46$ Down's syndrome
D	13-21 and 21	$2n = 47$ Down's syndrome

- 10 Which row represents the correct features of the nitrogenous base guanine?

	has a single ring structure	is a purine	joins its complementary base by three hydrogen bonds
A	x	✓	✓
B	✓	x	✓
C	✓	✓	✓
D	x	x	✓

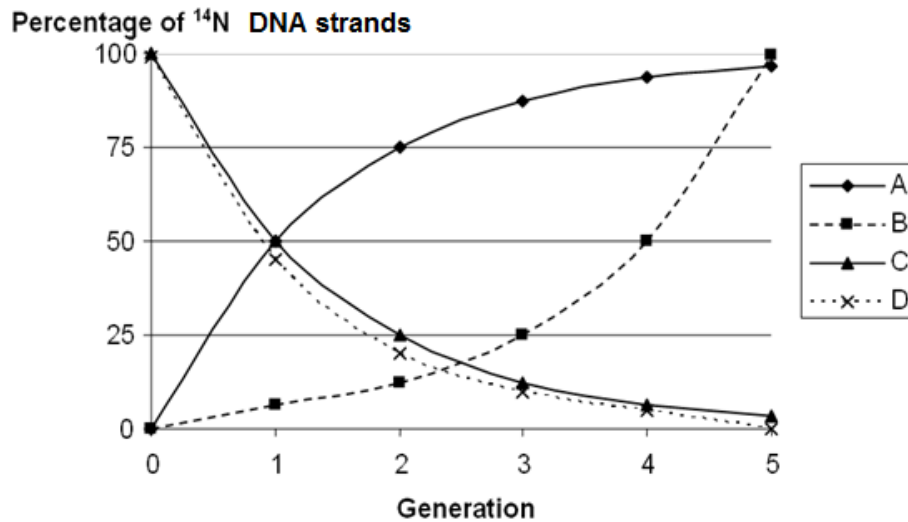
key

✓ = true

x = false

- 11 Bacteria were cultured in a medium containing heavy nitrogen (^{15}N) until all DNA was labelled. These bacteria were then grown in a medium containing only normal nitrogen (^{14}N) for 5 generations. The percentage of ^{14}N DNA strands in each generation was estimated.

Which curve provides evidence that DNA replication is semi-conservative? **ANSWER: A**



- 12 An unidentified single-stranded molecule was described as having the following features:

- complementary base pairing along some of its length
- an area that can attach to a ribosome
- a site to which a specific amino acid attaches

What is the unidentified molecule?

- A ribosomal RNA
- B messenger RNA
- C RNA polymerase
- D transfer RNA**

- 13** In order to synthesise a polypeptide, the DNA triplet code of the template (non-coding) strand of the DNA is transcribed to mRNA.

What correctly describes this process?

- A** mRNA is made from free bases complementary to those of the template strand of DNA.
- B** mRNA is made from free bases identical to those of the template strand of DNA.
- C** mRNA is made from free RNA nucleotides complementary to those of the template strand of DNA.
- D** mRNA is made from free RNA nucleotides identical to those of the template strand of DNA.

- 14** Some antibacterial drugs can affect the synthesis of proteins.

antimicrobial drug	rifampicin	streptomycin	tetracycline
mode of action	binds to RNA polymerase	genetic code misread during translation	prevents binding of tRNA to ribosome

Which is the correct set of immediate effects of these drugs?

antimicrobial drug	rifampicin	streptomycin	tetracycline
A	defective protein synthesised	mRNA does not bind to ribosome	amino acids not added to growing chain
B	mRNA not synthesised	defective protein synthesised	amino acids not added to growing chain
C	mRNA not synthesised	mRNA does not bind to ribosome	transcription prevented
D	transcription prevented	defective protein synthesised	mRNA does not bind to ribosome

- 15 The table shows the DNA triplet codes for some amino acids from the strand complementary to mRNA.

amino acid	DNA triplet codes
glycine	CCA, CCG, CCT, CCC
leucine	AAT, AAC, GAA, GAG, GAT, GAC
lysine	TTT, TTC
methionine	TAC
proline	GGA, GGG, GGT, GGC
threonine	TGA, TGG, TGT, TGC

The sequence of DNA triplets from the strand complementary to mRNA for part of a gene is shown.

... T A C T T T A A T G G C C C T G A G G G C T A C T G T ...

Which mutated DNA sequence of this part of a gene would result in the same amino acid sequence as the original gene sequence?

A ... T A C T T T A A T G G C C C T G A G G G T C C A T G T ...

B ... T A C T T C G A T G G C C C T G A G G G C T A C T G T ...

C ... T A C T T T A A T G G C C C G G A G T G A T A C T G T ...

D ... T A C T T T A A T G G C C C T G A G G G C T T C T G T ...

- 16 The feather colour of a certain breed of chicken is controlled by codominant alleles. A cross between a homozygous black-feathered chicken and a homozygous white-feathered chicken produces all speckled chickens.

What phenotypic ratios would be expected from a cross between two speckled chickens?

A all speckled

B 1 black feathers : 1 white feathers

C speckled, black feathers and white feathers in equal numbers

D 1 black feathers : 2 speckled feathers : 1 white feathers

- 17 The presence of freckles is a characteristic controlled by a dominant gene. Two parents who are heterozygous for the characteristic have three children, all of whom have freckles.

Which statement is true if they have a fourth child?

- A There is a 100% chance that their next child will have freckles.
- B There is a 75% chance that their next child will have freckles.**
- C There is a 50% chance that their next child will have freckles.
- D The next child will have no freckles as the ratio is 3 with freckles to 1 without freckles.

- 18 Isolated chloroplasts, suspended in buffer solution, are often used to study the light dependent stage of photosynthesis.

During this stage, electrons (e^-) are transferred by carriers and provide energy so that a proton (H^+) gradient can be formed. Protons diffuse through membrane proteins that are linked to synthase enzymes.

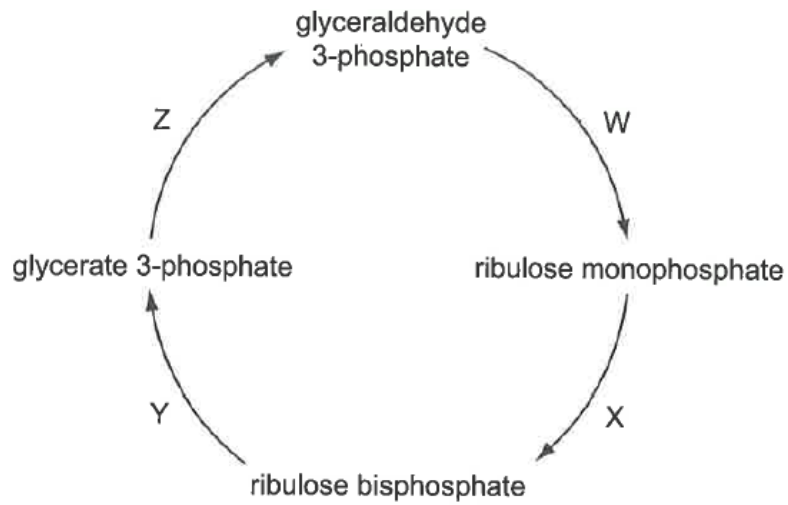
Three compounds that can be added to isolated chloroplasts are:

- 1 DCMU, which inactivates a carrier that accepts electrons from photosystem II
- 2 DCPIP, which can act as a final electron acceptor
- 3 ammonium hydroxide solution, which absorbs protons

Which compounds, when added separately to isolated chloroplasts, would allow the light dependent stage of photosynthesis to occur and which would inhibit it?

	allow	inhibit
A	1	2 and 3
B	1 and 3	2
C	2	1 and 3
D	2 and 3	1

19 The diagram shows the main stages in the Calvin cycle.

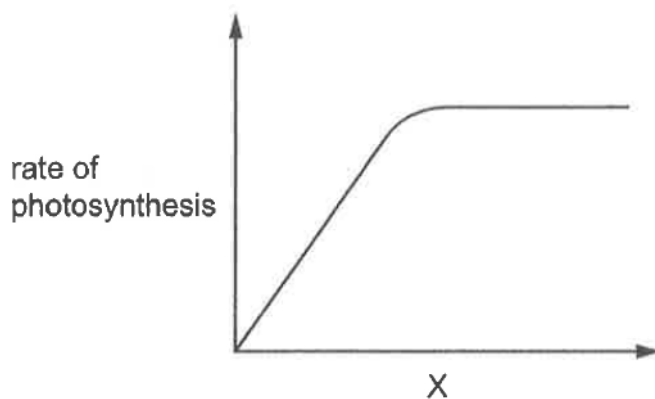


At which stages are ATP and reduced NADP used and carbon dioxide taken up?

	ATP used	reduced NADP used	carbon dioxide taken up
A	W and Z	X	Y
B	X	W and Y	Z
C	Y	X and Z	W
D	X and Z	Z	Y

- 20** The rate of photosynthesis in pondweed was measured when one variable was changed and all others were standardised.

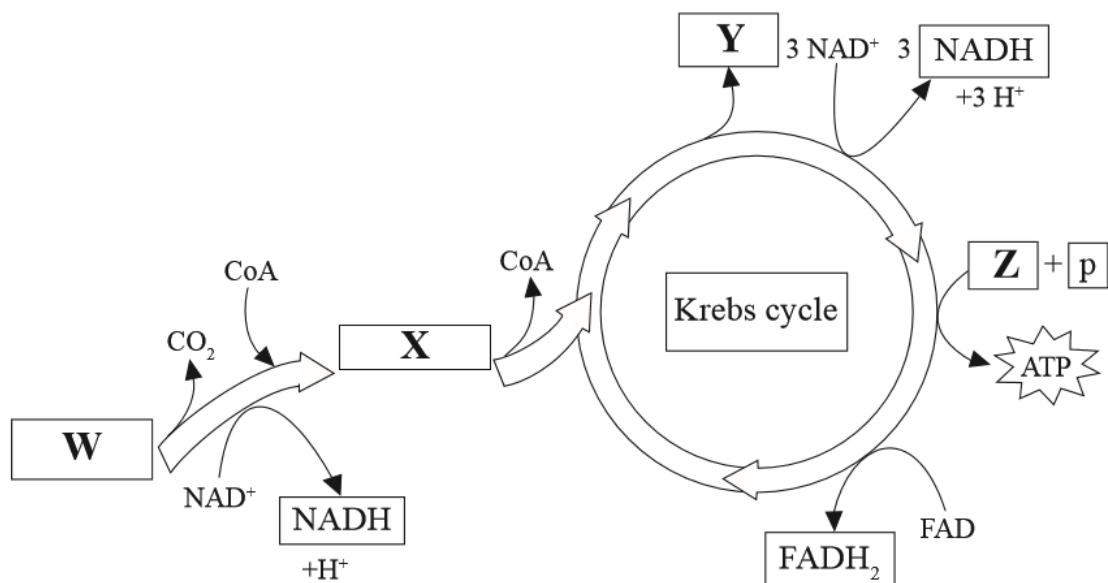
The graph shows the rate of photosynthesis at different values of a variable, X.



Which variables could be represented by X?

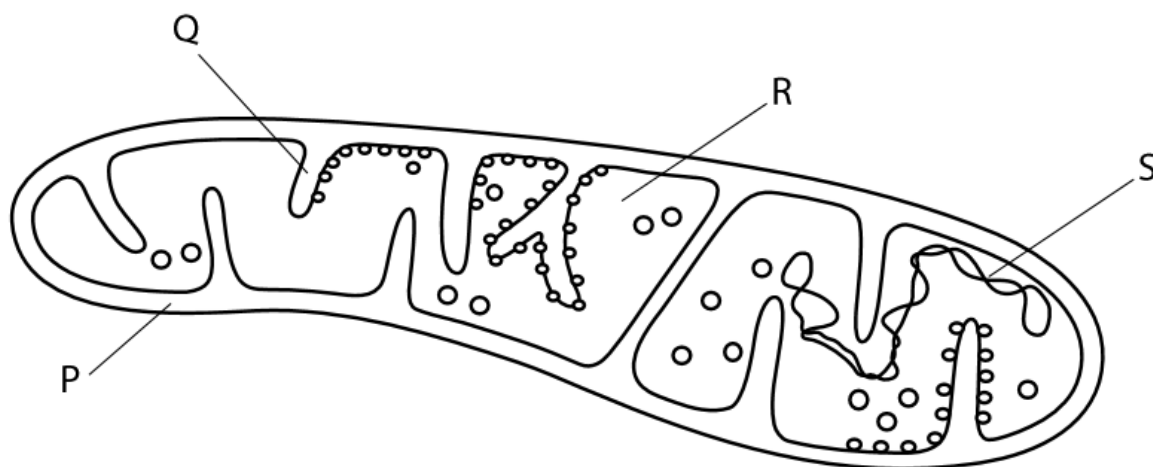
- 1 carbon dioxide availability
 - 2 light intensity
 - 3 oxygen availability
 - 4 temperature
 - 5 leaf area exposed to direct light
- A** 1, 2 and 5
- B** 1 and 2 only
- C** 2, 4 and 5
- D** 3 and 4

- 21 The diagram below shows the link reaction and stages of the Krebs cycle. Which molecules are represented by the letters W, X, Y and Z?



	W	X	Y	Z
A	acetyl CoA	carbon dioxide	ADP	pyruvate
B	pyruvate	acetyl CoA	carbon dioxide	ADP
C	ADP	carbon dioxide	acetyl CoA	pyruvate
D	acetyl CoA	pyruvate	carbon dioxide	ADP

- 22** Aerobic respiration is a series of reactions that occur in the cytoplasm and mitochondria of animal and plant cells. The diagram shows a mitochondrion.

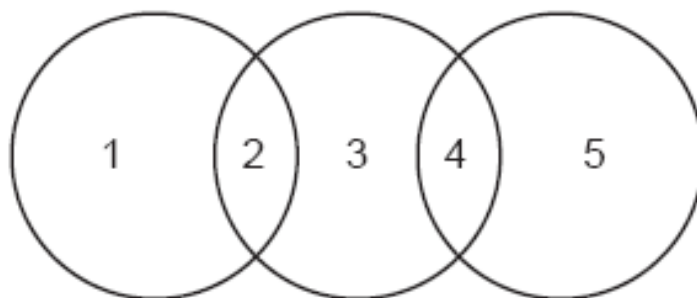


Which row shows where each process takes place in a mitochondrion?

	diffusion of hydrogen ions	production of reduced NAD
A	P	Q
B	Q	R
C	R	S
D	S	P

- 23** The diagram shows the relationship between different polysaccharides and the glycosidic bonds formed between the monomers.

Which row is correct?



	1	2	3	4	5
A	amylopectin	α -1,6	cellulose	β -1,4	glycogen
B	amylose	α -1,4	glycogen	β -1,4	amylopectin
C	cellulose	β -1,4	amylose	α -1,4	glycogen
D	glycogen	α -1,6	amylopectin	α -1,4	amylose

- 24** Which roles of the cell surface membrane are a result of the properties of the phospholipids?

- 1 to allow cytokinesis to occur in mitotic cell division
- 2 to allow entry and exit of oxygen and carbon dioxide
- 3 to allow the phagocytosis of a bacterium into a cell

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

25 Which statements are acceptable parts of Darwinian evolutionary theory?

- 1 Advantageous behaviour acquired during the lifetime of an individual is likely to be inherited.
- 2 In competition for survival, the more aggressive animals are more likely to survive.
- 3 Species perfectly adapted to a stable environment will continue to evolve.
- 4 Variation between individuals of a species is essential for evolutionary change.

A 1, 2 and 4

B 2 and 3

C 3 and 4

D 4 only

26 Myxomatosis is a viral disease of rabbits. It spreads rapidly and most rabbits die within 14 days of being infected. Myxomatosis has been deliberately used to reduce the number of rabbits in countries where they are a significant crop pest.

The initial release of the virus caused populations of rabbits to fall by 90%. Resistance to myxomatosis increased in the 70 years following initial release, so at the present time up to 50% of infected rabbits are able to survive.

Which statement could explain the increasing frequency of resistance to myxomatosis in the years following release?

A During disease outbreaks there is greater food availability for the remaining rabbits, increasing the probability that infected rabbits will survive and breed.

B In populations with high incidences of myxomatosis, mutations leading to resistance are more likely to occur.

C Rabbits with genotypes that increase resistance to the disease are more likely to survive disease outbreaks and pass on their genes to the next generation.

D Since rabbits breed very rapidly, in between outbreaks of the disease the frequency of alleles for resistance to myxomatosis quickly increases.

27 Some comparisons of mRNA with DNA from a eukaryote are listed.

- 1 A body cell has two copies of DNA coding for a particular protein but it can have thousands of copies of mRNA coding for the same protein.
- 2 Each DNA molecule in human cells codes for hundreds of proteins, but each mRNA molecule codes for the translation of only one protein.
- 3 mRNA contains the base uracil, but DNA has thymine instead.
- 4 mRNA is single-stranded but DNA is double-stranded.
- 5 Unlike DNA, mRNA has no introns.

Which are reasons why mRNA is the preferred starting point for genetically engineering bacteria to produce human proteins?

- A 1, 2 and 3
- B 1, 2 and 5**
- C 2, 3 and 4
- D 3, 4 and 5

28 Which uses of the information from the human genome project are generally considered to be unethical?

- 1 an insurance company only giving cheap rates to people with genetic predispositions to fewer diseases
- 2 genetic archaeologists identifying the earliest forms of genes to show evolutionary relationships
- 3 cytologists developing tests for only some defective genes
- 4 doctors only giving specific drugs to block the actions of faulty genes to carriers of those genes
- 5 genetic councillors giving specific lifestyle information only to people genetically predisposed to risks
- 6 parents choosing embryos for implantation only after ante-natal tests for acceptable genes

- A 1 and 3
- B 1 and 6**
- C 2 and 5
- D 3 and 4

- 29** A gene for an insecticidal toxin was introduced into crop plants via genetic engineering. The toxin causes death to only a specific type of insect.

What is not likely to be affected by this genetic engineering?

- A ratio of population size between different insect species within the region
- B growth of other crop plants within the region**
- C use of insecticides in the area of crop growth
- D the number of insects resistant to the toxin

- 30** Blood transfusion laboratories around the world are hoping to produce large numbers of red blood cells (RBCs) from unused human embryos produced during *in vitro* fertilisation procedures.

Embryonic stem cells are removed from an embryo and cultured in a growth medium that stimulates their differentiation into RBCs.

Which statement correctly describes this differentiation?

- A Multipotent stem cells differentiate into pluripotent blood stem cells and then into RBCs.
- B Pluripotent stem cells differentiate into multipotent blood stem cells and then into RBCs.**
- C Totipotent stem cells differentiate into multipotent blood stem cells and then into RBCs.
- D Totipotent stem cells differentiate into pluripotent blood stem cells and then into RBCs.

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