

MOCK EXAM
UNIT 4
A2/EDEXCEL

Name _____

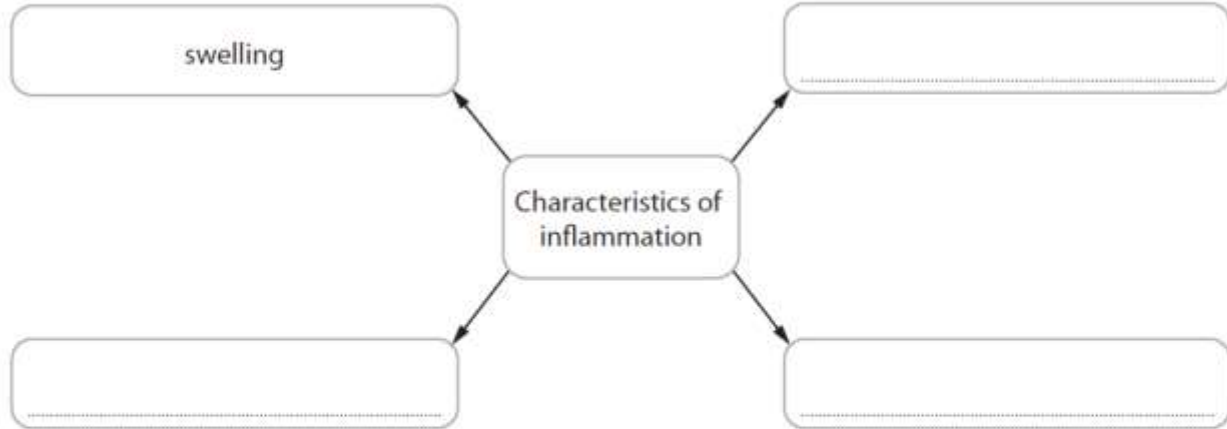
Time 1 hour 45 minutes

Total / 90

1 Inflammation is involved in the non-specific response of the body to infection and injury.

(a) (i) Complete the diagram to show the four characteristics of inflammation.

(2)



(ii) Inflammation occurs following a cut to the skin.

Describe the role of **two** of these characteristics of inflammation in response to a cut to the skin.

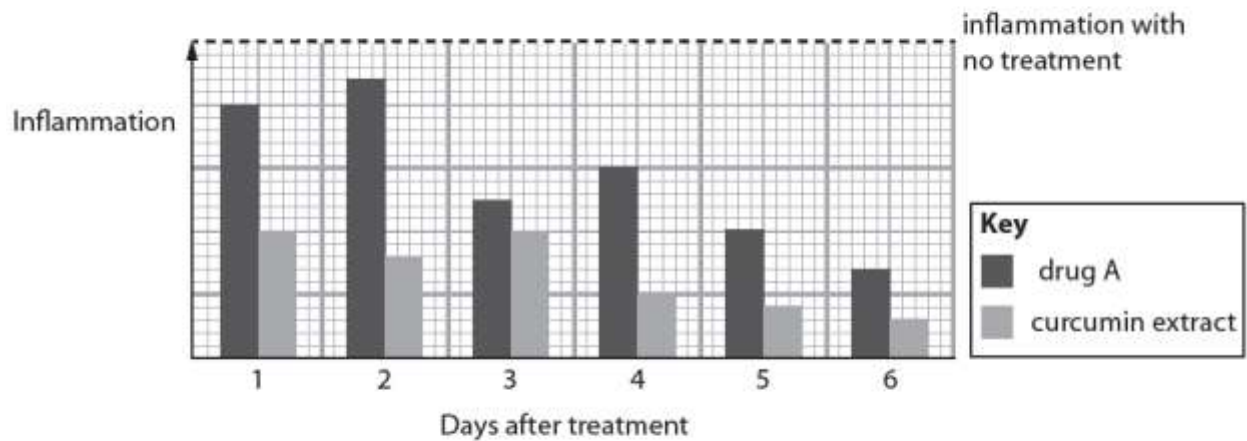
(2)

(b) Anti-inflammatory drugs reduce inflammation.

Turmeric is a spice that is added to food.

Curcumin is a chemical in turmeric that has been shown to reduce inflammation.

(i) The graph shows the effect of treating inflammation with curcumin extract and an anti-inflammatory drug, drug A.



Compare and contrast the effect of treating inflammation with curcumin extract and with drug A.

(3)

(ii) Many treatments use 1 g curcumin extract.

A sample of turmeric contains 3% curcumin.

Which is the mass of turmeric for one treatment?

(1)

- A** 0.03 g
- B** 3.33 g
- C** 33.3 g
- D** 33.4 g

(Total for Question 1 = 8 marks)

2. Chloroplasts are involved in both the light-dependent reactions and light-independent reactions of photosynthesis.

(a) Which row of the table shows where the light-dependent reactions and light-independent reactions take place?

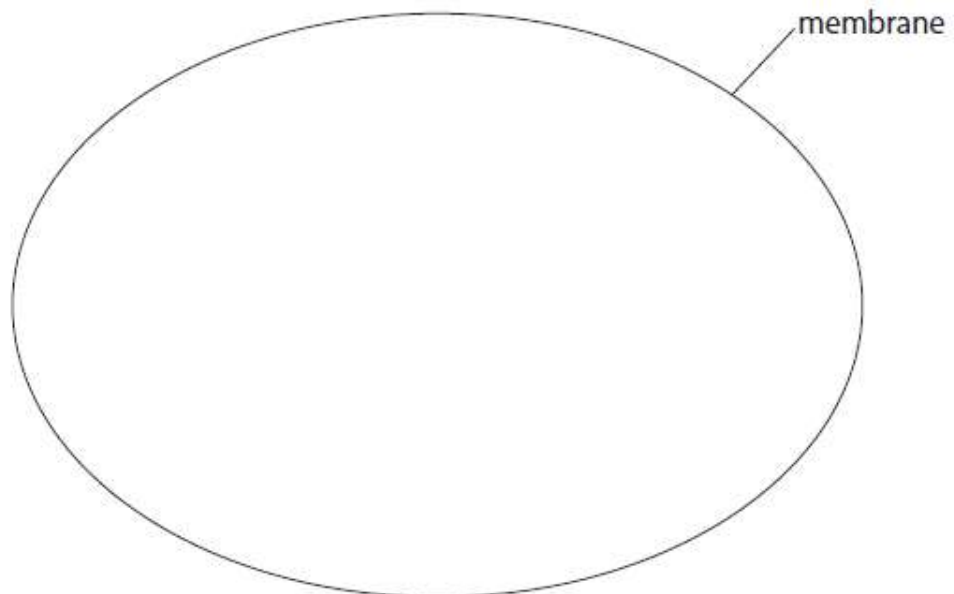
(1)

	Light-dependent reactions	Light-independent reactions
<input type="checkbox"/> A	stroma	stroma
<input type="checkbox"/> B	stroma	thylakoid membranes
<input type="checkbox"/> C	thylakoid membranes	stroma
<input type="checkbox"/> D	thylakoid membranes	thylakoid membranes

(b) The diagram shows the outline of a chloroplast.

Draw **three** labelled features on this diagram that are found in a chloroplast, other than the stroma and the thylakoid membranes.

(3)



- (c) An absorption spectrum shows how much light is absorbed by chloroplasts at different wavelengths of light.

The table shows the colour of light at four wavelengths.

Wavelength of light / nm	460	520	600	680
Colour of light	blue	green	yellow	red

Which wavelength of light is absorbed the **least** by chloroplasts?

(1)

- A** 460 nm
- B** 520 nm
- C** 600 nm
- D** 680 nm

- (d) State what is meant by the term **action spectrum**.

(1)

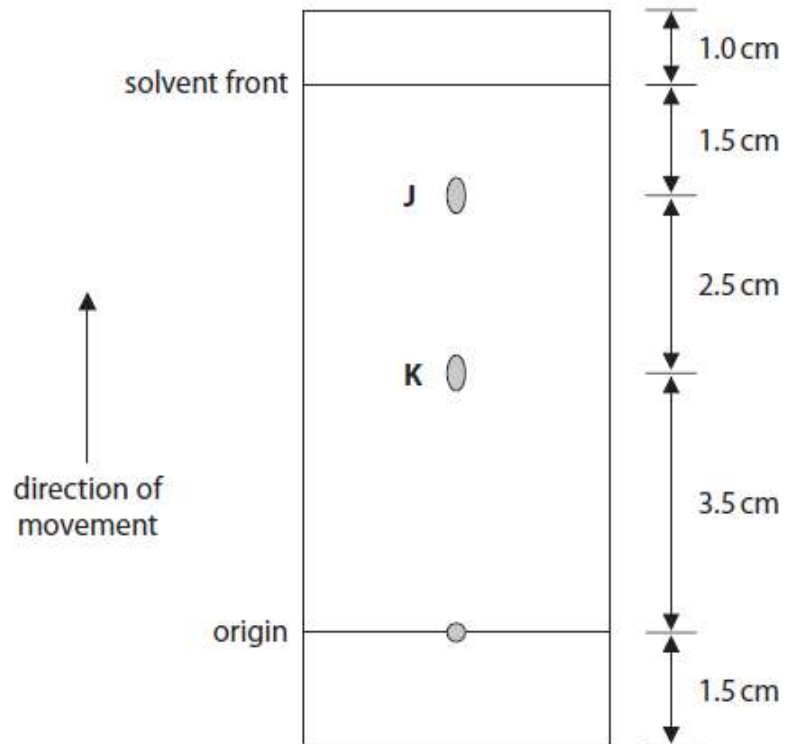
- (e) Chloroplast pigments can be separated and then identified by their R_f values.

(i) Which process can be used to separate chloroplast pigments?

(1)

- A** chromatography
- B** dendrochronology
- C** osmosis
- D** PCR

(ii) The diagram shows separated chloroplast pigments, J and K.



What is the R_f value for chloroplast pigment J?

(1)

- A 0.625
- B 0.800
- C 0.830
- D 1.714

(Total for Question 2= 8 marks)

3. Body temperature and the degree of muscle contraction can be used to determine the time since death of a person.

The table shows how body temperature and body stiffness, due to muscle contraction, change with time since death.

Time since death / hours	Body temperature	Body stiffness
< 3	warm	not stiff
3 to 8	warm	stiff
8 to 36	cold	stiff
> 36	cold	not stiff

- (a) State how the temperature of a dead body should be measured.

(1)

- (b) (i) Body temperature can be used to estimate the time since death using the following information:

- loss of 0.78°C per hour for the first 12 hours after death
- after 12 hours, loss of 0.4°C per hour.

Estimate the time since death of a person whose body temperature had fallen 11.5°C .

Give your answer to the nearest hour.

(2)

4 Greenhouse gases are involved in anthropogenic climate change.

(a) (i) Which of the following are greenhouse gases?

(1)

- A carbon dioxide and oxygen
- B methane and water vapour
- C carbon dioxide, oxygen and water vapour
- D methane, carbon dioxide and oxygen

(ii) State what is meant by **anthropogenic climate change**.

(2)

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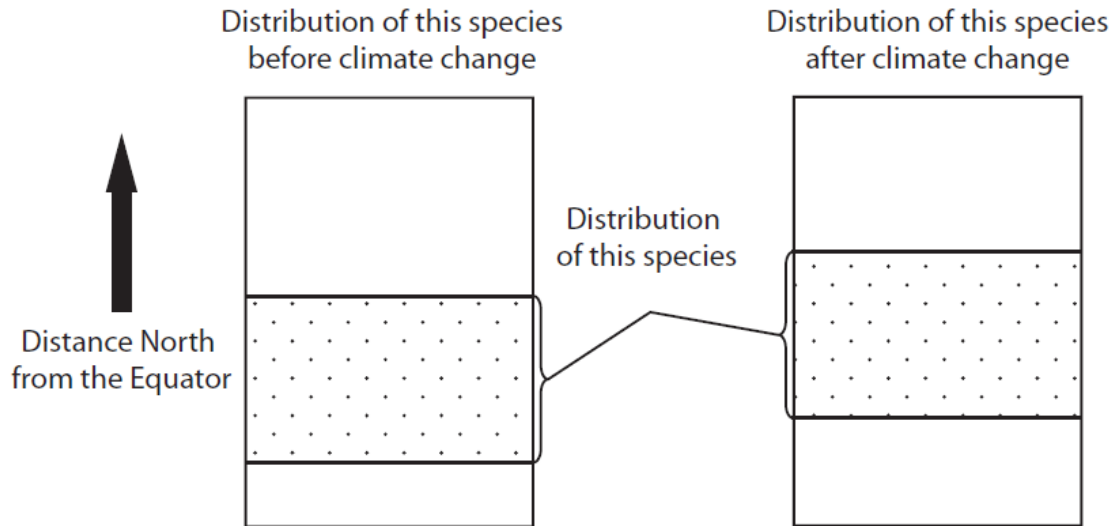
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(b) The distribution of species has been affected by climate change.

The diagrams show how the distribution of one species, in a country in the Northern Hemisphere, could change as a result of climate change.



Explain the changes in the distribution of this species in this country.

(3)

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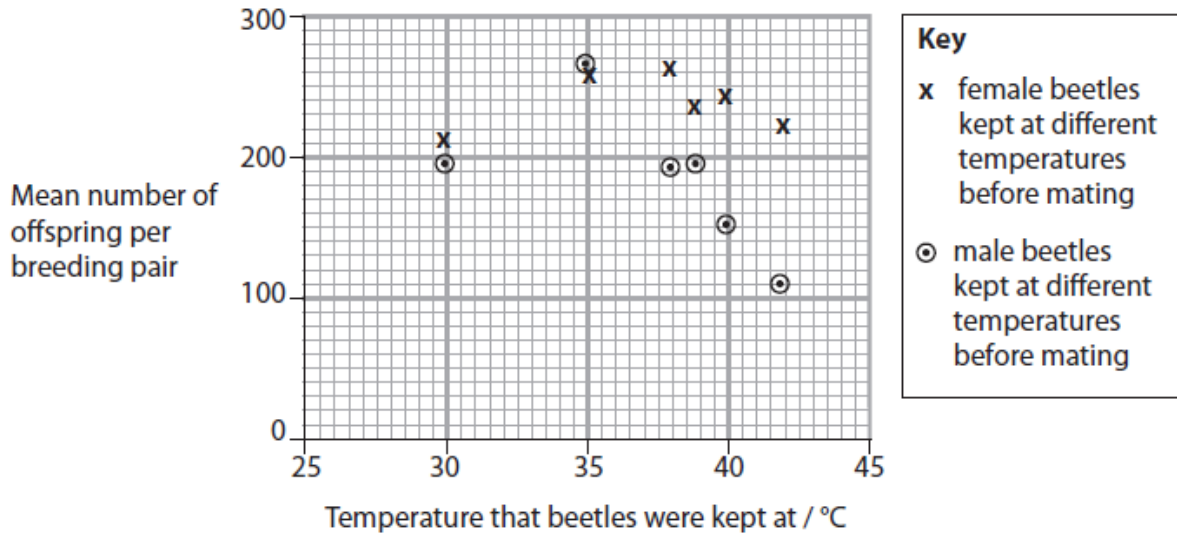
(c) The effect of temperature on reproduction in a species of beetle was studied.

Groups of male and groups of female beetles were each kept at different temperatures for five days.

The beetles were then mated with beetles, of the opposite sex, that had been kept at 30°C for five days.

The mean number of offspring per breeding pair was then determined.

The graph shows the results of this study.



(i) Identify **two** conclusions that can be drawn from this study.

(2)

5 Viruses can infect bacteria.

(a) Which virus can infect bacteria?

(1)

- A Ebola virus
- B human immunodeficiency virus (HIV)
- C lambda phage (λ phage)
- D tobacco mosaic virus (TMV)

(b) Some viruses that infect bacteria cause the production of molecules called holins.

Holins form protein channels in the cell membranes of bacteria. This allows polar molecules called lysins to reach the cell wall by facilitated diffusion.

The DNA of these viruses codes for lysins.

(i) Describe the role of channel proteins in the facilitated diffusion of lysins.

(2)

6. Gel electrophoresis is used to separate DNA fragments of different lengths.

The rate at which the DNA fragments move through the gel depends on several factors including:

- molecular size of the DNA fragment
- shape of the DNA fragment
- concentration of the gel.

(a) (i) Which enzyme is used to cut the DNA into fragments?

(1)

- A DNA polymerase
- B integrase
- C restriction enzyme
- D reverse transcriptase

(ii) Explain why the use of an enzyme to cut the DNA results in fragments, of different lengths, that can be separated by gel electrophoresis.

(3)

(b) Fragments of double-stranded DNA move through the gel at a relative rate (M_r) that is inversely proportional to the log of their molecular weight (MW).

(i) Complete the table using the equation:

$$M_r = \frac{1}{\log_{10} MW}$$

(2)

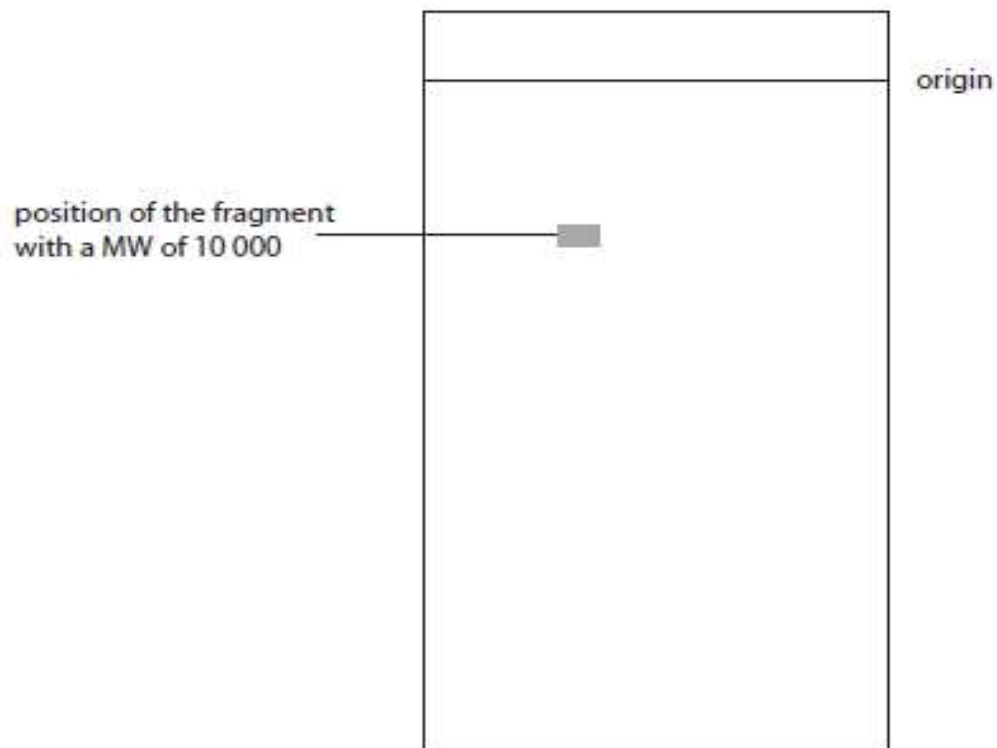
Molecular weight of DNA fragment (MW)	Relative rate of movement (M_r)
100 000	
10 000	0.25
	0.34

(ii) The diagram shows the position of a DNA fragment with a MW of 10 000, after gel electrophoresis.

Complete the diagram to show the position of a DNA fragment with a MW of 100 000.

Use the information in the question.

(1)



(c) The fragments move more slowly through a higher concentration of gel.

Suggest why the fragments move more slowly through a higher concentration of gel.

(1)

(d) Circular DNA moves at a faster rate through the gel than linear DNA.

(i) Give **two** examples of circular DNA found in cells.

(2)

(ii) Give **two** differences between the structure of circular DNA and that of linear DNA, other than their shapes.

(2)

(Total for Question 6= 12 marks)

7 Antibiotics are medicines used to treat some medical conditions.

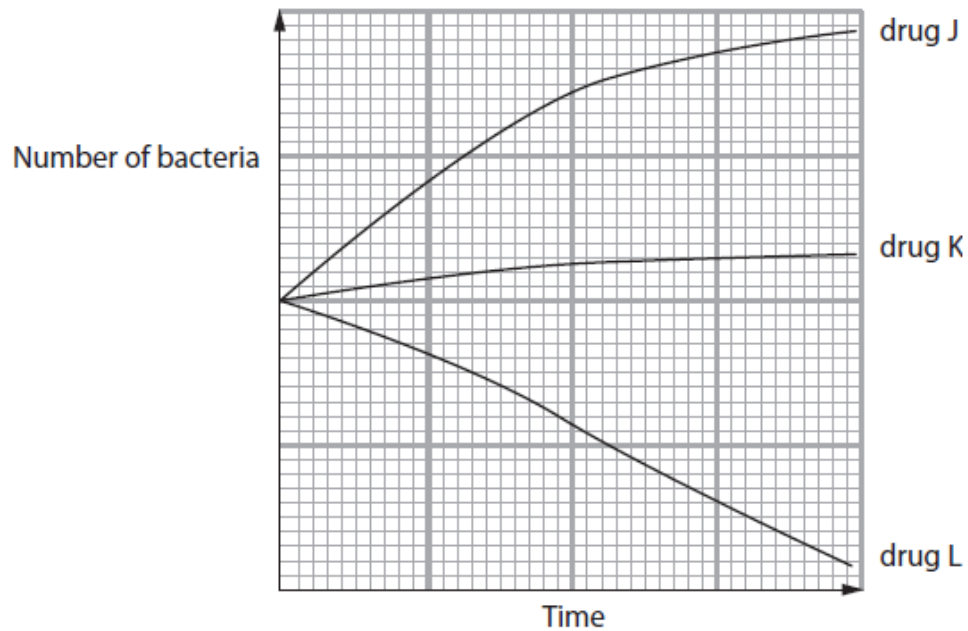
(a) The table shows some medical conditions and whether or not antibiotics are needed to treat the condition.

Medical condition	Are antibiotics needed to treat the condition?
Impetigo	yes
Whooping cough	yes
Middle ear infections	sometimes
Sinus infections	sometimes
Multiple sclerosis	no
Rheumatoid arthritis	no

Explain the use of antibiotics to treat these conditions.

(2)

(b) The graph shows the effect of three drugs, J, K and L, on the number of bacteria in a culture.



Which row of the table describes each of these three drugs?

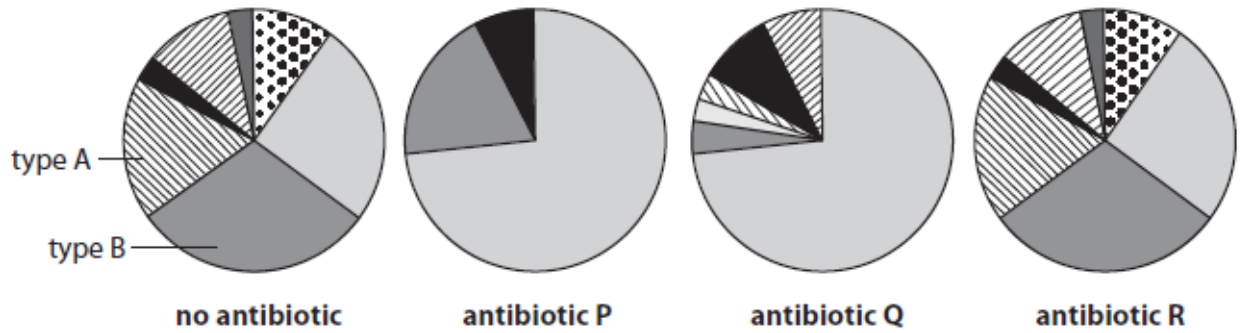
(1)

	drug J	drug K	drug L
<input checked="" type="checkbox"/> A	not an antibiotic	bactericidal antibiotic	bacteriostatic antibiotic
<input checked="" type="checkbox"/> B	not an antibiotic	bacteriostatic antibiotic	bactericidal antibiotic
<input checked="" type="checkbox"/> C	bactericidal antibiotic	not an antibiotic	bacteriostatic antibiotic
<input checked="" type="checkbox"/> D	bacteriostatic antibiotic	not an antibiotic	bactericidal antibiotic

(c) One problem of taking antibiotics is their effect on gut flora.

The diagrams show the effects of three antibiotics, P, Q and R, on the proportion of different types of gut flora.

Each section in each of the diagrams represents a different type of gut flora.



(i) Explain the role of gut flora in protecting the body from infection.

(2)

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(ii) Explain why antibiotics can affect gut flora.

(2)

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(iii) The number of type A in gut flora in the absence of antibiotics is 6 000 000.

Estimate the number of type B in gut flora in the absence of antibiotics.

Give your answer in standard form.

(1)

Answer

(iv) Deduce the effects of antibiotics P, Q and R on gut flora.

(3)

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(Total question 7 = 11marks)

8 Photosynthesis consists of the light-dependent reactions and the light-independent reactions.

(a) In the light-dependent reactions, light energy is converted into energy stored in ATP.

(i) Explain why light energy is converted into energy stored in ATP.

(2)

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(ii) An equation can summarise the production and breakdown of ATP.

Complete this equation, by writing the names of the substrates and the type of reaction on the three dotted lines provided.

(2)



(ii) Simple sugars have the formula $C_nH_{2n}O_n$.

Name the inorganic molecule from which each element in a simple sugar originated.

(2)

C

H

O

(iii) Simple sugars are used in the synthesis of new biological molecules.


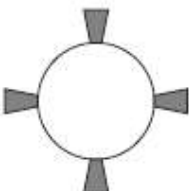


Which row of the table shows the inorganic ions that are needed to synthesise these new biological molecules?

(3)

New biological molecule	Nitrates	Phosphates	Both nitrates and phosphates	Neither nitrates nor phosphates
protein	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RNA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
triglyceride	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

(Total for question 8 = 13 marks)

- 9 Humans can have one of four different blood types: A, B, AB or O.
 Blood type is determined by antigens present on the membranes of red blood cells.
 The table shows which antigens are present in each blood type.

Blood type	Antigens on the membrane of red blood cells	Diagram of one red blood cell
A	antigen A only	
B	antigen B only	
AB	both antigens A and B	
O	neither antigen A nor B	

Blood transfusions are used in the treatment of some diseases.

A blood transfusion involves taking blood from a healthy person and putting it into the person needing the treatment.

(ii) Both the molecules on the membranes of the cells lining our intestines and the antigens on red blood cells have sugars attached to protein molecules.

Bacteria living in our intestines secrete an enzyme that separates the sugars from the protein molecules.

Suggest why bacteria living in our intestines secrete this enzyme.

(2)

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(iii) Explain why this enzyme may be useful in blood transfusions.

(2)

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(Total for question 9 = 11 marks)