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1791825526

BIOLOGY **0610/43**

Paper 4 Theory (Extended) **May/June 2020**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Blank pages are indicated.

[Turn over

1 **(a)** State **three** uses of energy in the human body.

1 Protein synthesis

2 Cell division

3 Active transport

[3]

(b) Fig. 1.1 shows part of the digestive system of a human.

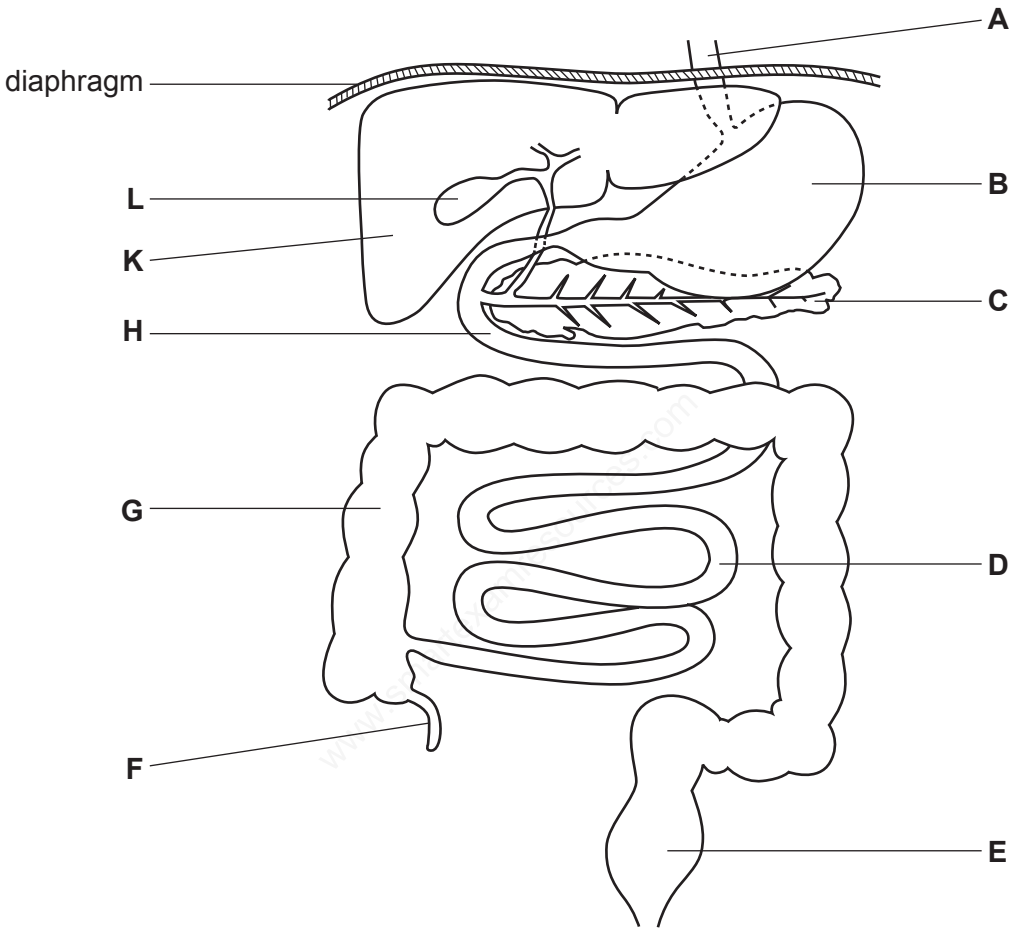

Fig. 1.1

Complete Table 1.1. One row has been done for you.

Table 1.1

function	name of structure	letter from Fig. 1.1
pushes food to the stomach	oesophagus	**A**
assimilation of amino acids to produce plasma proteins	Liver	K
storage of bile	Gall bladder	L
secretion of insulin	Pancreas	C
absorption of fatty acids and glycerol	Small intestine	H/D
secretion of pepsin	Stomach	B
digestion of starch	Small intestine	H/D

[6]

(c) Describe the role of the liver in the recovery from oxygen debt after strenuous exercise.

Lactic acid is produced in the muscles by anaerobic respiration. Liver absorbs the lactic acid from the blood and changes it into carbon dioxide and water.

[2]

(d) Alcohol is a drug.

Define the term drug.

A drug is any substance taken into the body that modifies or affects the chemical reactions in the body. [2]

(e) **(i)** State **two** immediate effects of excessive alcohol on the body.

1 It acts as a depressant .....

2 It lengthens the reaction time [OR] .....
It reduces self control [2]

(ii) State **two** long-term effects of excessive alcohol on the body.

1 Addiction .....

2 Liver damage .....
[2]

(f) Pregnant women are advised not to drink alcohol as it may have harmful effects on the fetus.

(i) Outline these harmful effects.

[Only 2 needed from] 5. Fetal alcohol syndrome .....
1. Miscarriage (FAS) .....
2. Premature birth .....
3. Low birth weight .....
4. Addiction / Dependence ..... [2]

(ii) State **two** harmful substances **other than alcohol** that can cross the placenta.

1 Nicotine [Only 2 needed from] .....

2 Pathogens / Virus example HIV / Rubella .....
[2]

3. Heavy metals example: Lead / Mercury.
4 Pesticides
5. Medicinal drugs
6. Illegal drugs example heroin

[Total: 21]

2 **(a)** Fig. 2.1 shows the human population of a country between 1910 and 2020.

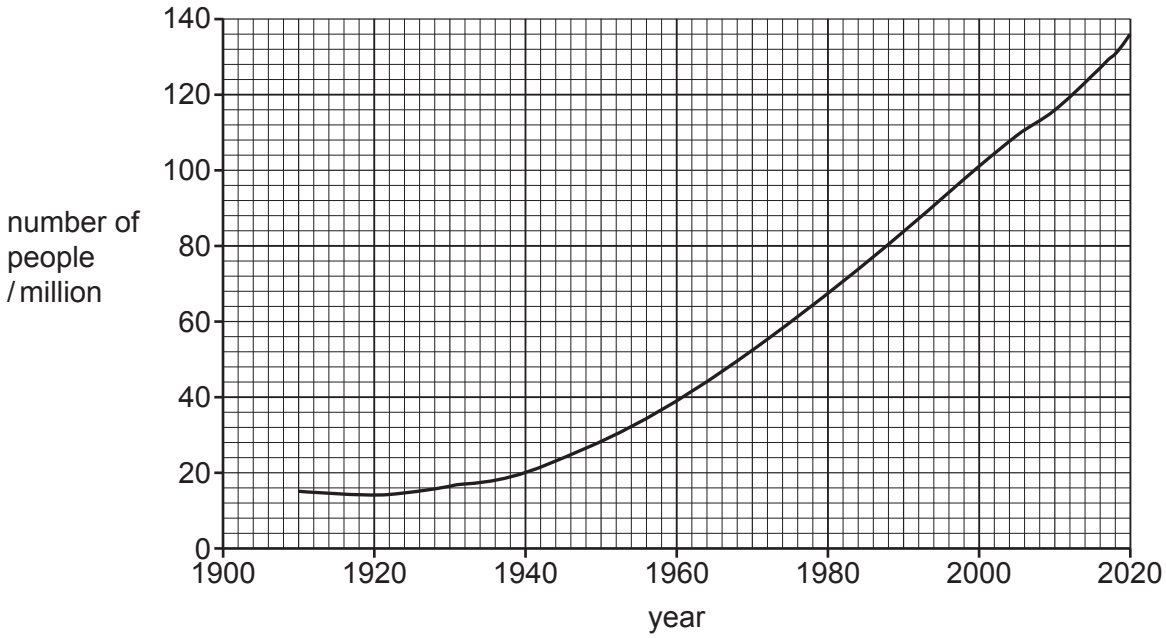

Fig. 2.1

(i) Calculate the percentage increase in the population of the country between 1940 and 2020.

Space for working.

Population in 1940 = 20 million
Population in 2020 = 136 million
% increase = $\frac{136-20}{20} \times 100 = 580\%$

580 .....%
[3]

(ii) Describe the factors that could cause the change in the population size between 1940 and 2020, shown in Fig. 2.1.

1 Increase in the birth rate [OR] Decrease in the death rate [Any 3 needed from:]
2. Immigration
3. Increased food supply
4. Reduced poverty
5. Better housing | sanitation | health care | vaccination

..... [3]

(b) Some countries have invested in biofuels such as ethanol, biomass and biodiesel.

(i) Describe how ethanol can be made by microorganisms.

Ethanol can be manufactured from yeast via anaerobic respiration

[2]

(ii) Some countries use large areas of land to grow maize plants. This crop plant can be used to produce biofuels.

Discuss the negative impact on the **environment** of growing large-scale monocultures of crop plants such as maize.

[Any 4 from:]

1. Deforestation
2. Loss in variety of habitat
3. Soil erosion
4. Disrupted nutrient cycling
5. Pollution by use of fossil fuels in machinery
6. Overuse of pesticides/insecticides
7. Desertification
8. Over-use of herbicides
9. Pollution of the atmosphere by NO_x from fertilisers
10. Soil erosion/flooding

[4]

[Total: 12]

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3 The American writer Ernest Hemingway lived on the island of Key West in Florida, USA in the 1930s. During this time he was given a male cat by a sea captain.

The cat had more toes than usual. This inherited condition is called polydactyly. The allele for polydactyly is dominant.

(a) Define the term inheritance.

Inheritance is the transmission of genetic information from generation to generation

..... [1]

(b) Fig. 3.1 is part of a pedigree diagram for Hemingway's cats.

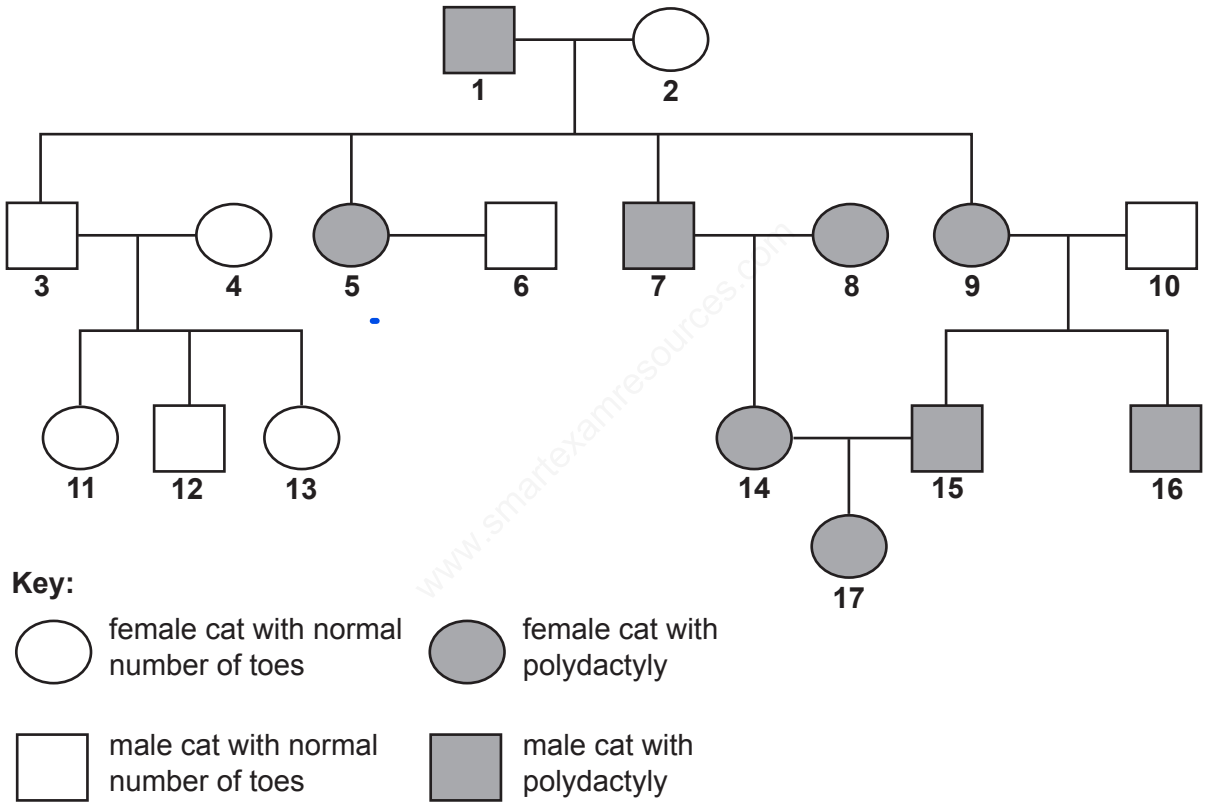

Fig. 3.1

(i) State the genotypes of cats **5**, **6** and **14** in the pedigree diagram in Fig. 3.1.

Use the letters **T** and **t**.

cat **5** Tt

cat **6** tt

cat **14** TT | Tt

[3]

(ii) Explain why none of the offspring of cats **3** and **4** have inherited polydactyly.

Use the information in Fig. 3.1 in your answer.

Cats 3 and 4 are homozygous recessive [OR]
Cats 3 and 4 do not have the allele for polydactyly.

[1]

(c) Scientists published the results of an investigation into the DNA of cats with and without polydactyly. They compared the base sequence from a particular region of DNA that controls the development of the limbs.

Table 3.1 shows the base sequences.

Table 3.1

cats without polydactyly	AGA CAC AGA AAT GAG
Hemingway's cats with polydactyly	AGA CAC GGA AAT GAG
cats with polydactyly from Oregon and Missouri in the USA	AGA CAC GGA AAT GAG
cats with polydactyly from the UK	AGA CAC AGT AAT GAG

(i) Describe how the base sequences of the cats with polydactyly differ from the base sequence of cats without polydactyly.

[Any 2 from:]
→ Cats from normal number of toes have AGA for bases 7, 8 and 9
→ Cats with polydactyly have GGA OR AGT
→ Bases 7 and 9 are different [2]

(ii) State the name of the process by which base sequences in DNA are changed.

Mutation [1]

(iii) The base sequences in Table 3.1 provide evidence that indicates which country the male cat given to Hemingway in the 1930s came from.

Suggest which country this cat came from **and** give a reason for your choice.

Origin of the cat was USA because the base sequence is the same as the other cats from USA OR because they have the same mutation / base sequence as the Oregon and Missouri cats [2]

(d) Fig. 3.2 shows part of a DNA molecule from a chromosome of a cat.

Complete Fig. 3.2 by writing the letters for the base sequence of the other strand of the DNA molecule.

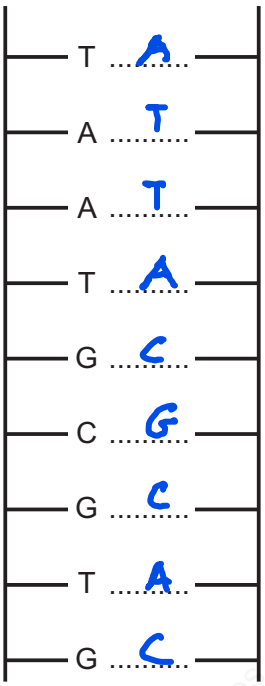

Fig. 3.2

[1]

(e) Explain why polydactyly is an example of discontinuous variation.

Because the phenotypes are distinct with no intermediates. OR because phenotypes are not on a continuous scale.

[2]

[Total: 13]

4 Xerophytes grow in habitats with low rainfall and soils that often have high concentrations of salts.

Fig. 4.1 shows the xerophyte *Yucca treculeana* growing on salt flats.

Fig. 4.1

(a) (i) Explain how xerophytes, such as *Y. treculeana*, are adapted to absorb sufficient water in the conditions in which they live.

[Any 4 from]

1. They have deep roots to absorb water from the water table

2 The roots are long and spread out below the surface to absorb water when it rains.

3. Root cells have lower water potential to absorb water by osmosis from very salty soils.

4. Roots branch many times to give a very large surface area for absorption of water.

[4]

(ii) Explain how xerophytes are adapted to reduce water loss to the atmosphere.

[Any 3 from]

1. They have low stomal density
2. They have sunken stomata
3. Stomata close during the day and open during the night
4. Leaves are rolled 5. Thick epidermis
6. Hairs on leaves 7. Low transpiration rate

[3]

(iii) Xerophytes often have many defence mechanisms that reduce or prevent herbivores eating them.

Suggest how xerophytes protect themselves against herbivores.

[Any 2 from]

1. They make toxins
2. They make | store foul-tasting substances
3. They have spines 4 They have thick inedible leaves 5. They make resins that trap insects

[2]

(b) Forest ecosystems can be affected by acid rain.

Describe how the production of acid rain **and** its effects on forest ecosystems can be reduced.

[Any 3 from]

1. Reduce air pollution
2. Reduce emissions of sulfur dioxide
3. Use filters | scrubbers on chimneys
4. Use catalytic convertors
5. Use low-sulfur fossil fuels
6. Use alternative sources of power
7. Add lime to soils
8. Reduce mobilisation of aluminium in soils.
9. To raise pH of soils

[4]

[Total: 13]

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5 Bacteria are classified in the Prokaryote kingdom.

(a) State **two** features of animal **and** plant cells that are **not** found in prokaryotes.

1 Nucleus | nuclear membrane | nuclear envelope

2 linear chromosomes

[2]

3. Mitochondrion

4. Endoplasmic reticulum

5. Vacuoles | Vesicles

(b) Methicillin-resistant *Staphylococcus aureus* (MRSA) is a type of bacterium that is resistant to some antibiotics.

Fig. 5.1 shows how a population of bacteria may develop antibiotic resistance and how the antibiotic resistance can be passed from one strain of bacterium to another.

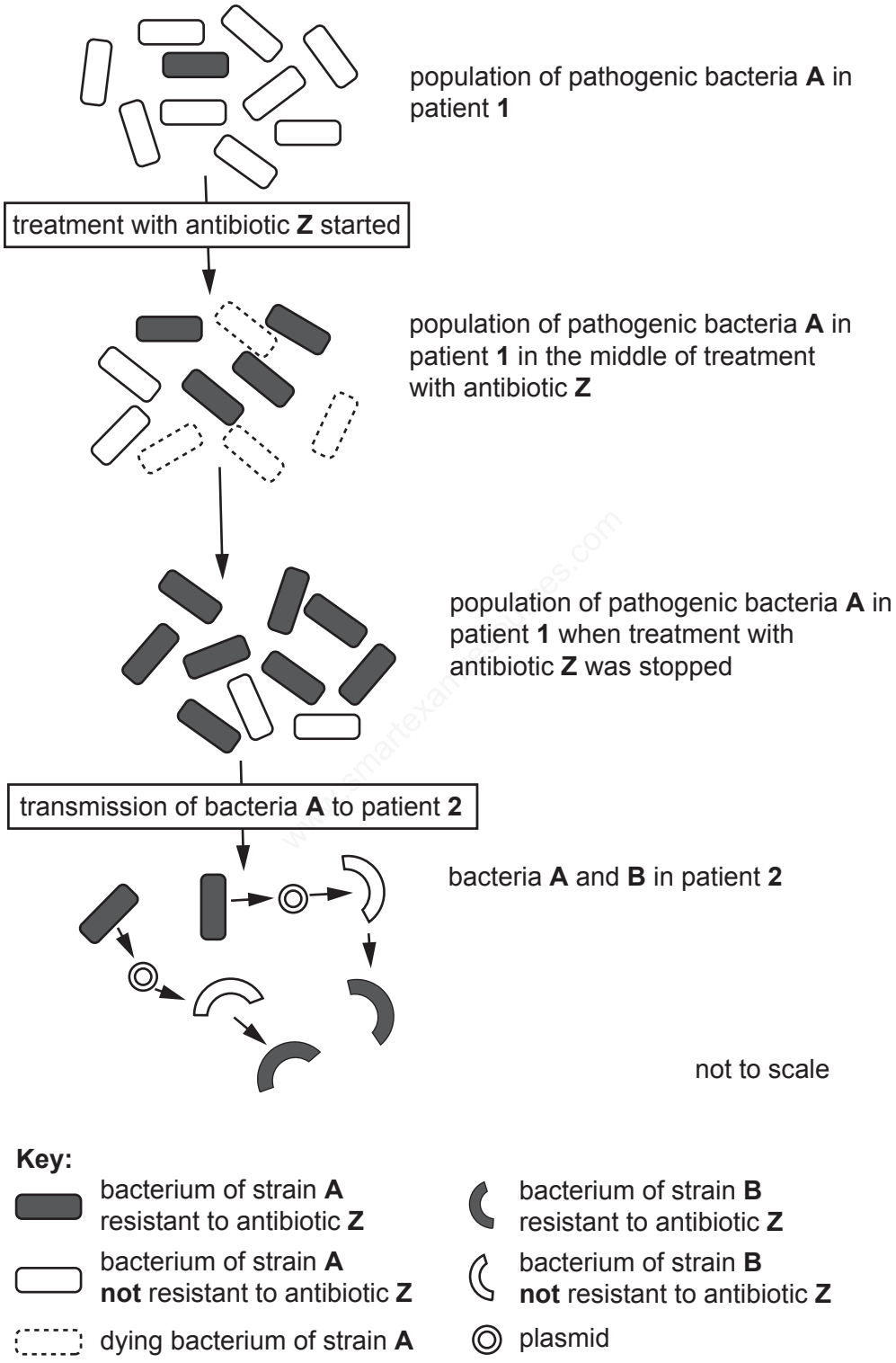

Fig. 5.1

Explain how resistance to an antibiotic develops in a population of bacteria and spreads in the human population.

Resistance arises in a small number of bacteria due to a random event: The antibiotic kills the bacteria that do not have the mutation. Resistant bacteria have no competition. They reproduce and pass on the genes for resistance via natural selection

Through the human population, it spreads via the method of transmission such as skin contact, transfer of body fluids etc.

The gene can also be transfered to other bacteria of a different type in a plasmid

[6]

(c) Explain how the development of resistant bacteria, such as MRSA, can be minimised.

[Any 3 from]

1 Prescribe / use antibiotics less often
2 Do not use antibiotics for viral / fungal infections
3. Develop new antibiotics
4. Make sure people complete the course of antibiotics
5. Use combination of antibiotics
6. Do not use the same antibiotic for too long
7. Use of antibiotics in farming.

[3]

[Total: 11]

[Turn over

6 In many parts of the world dairy cattle are kept in large barns and reared intensively, as shown in Fig. 6.1.

Fig. 6.1

(a) Food for cattle that are reared intensively includes cereals, such as maize and barley.

Ecologists have calculated that it is more energy efficient to grow crops for human consumption than for food for livestock.

Explain why intensive rearing of livestock is **not** an efficient use of crops.

[Any 3 from]
There will be fewer trophic levels in the food chain if crops are used as food. 90% of the energy is lost at each trophic level. And since energy will also be lost from cattle. Therefore less energy will be available to humans.

..... [3]

(b) The urine and faeces from cattle kept in barns is removed and treated in the same way as human sewage to avoid polluting the aquatic environment.

Outline the effects of **untreated waste** from cattle on the aquatic environment.

[Any 4 from:]

1. Smell / visual pollution
2. Increased risk of water-borne diseases
3. Increased organic content of rivers / lakes.
4. Increased growth of bacteria / decomposers.
5. Bacteria / decomposers use up all the dissolved oxygen. 6 Death of organisms that rely on oxygen. 7. Eutrophication results.
8. Ammonia is added 9. Plant growth increases

[4]

(c) Intensive livestock production could be one way of preventing famine.

Describe the causes of famine.

[Any 3 from:]

1. Lack of food supply / Uneven distribution of food.
2. Wars / Sudden migration with inadequate resources for the population.
3 Drought / floods destroy live-stocks / crops
4. Poverty

[3]

[Total: 10]

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