Questions are for both separate science and combined science students unless indicated in the question

Q1.

This question is about pathogens.

A scientist investigated antibiotic resistance in bacteria.

(a) Name **one** antibiotic.

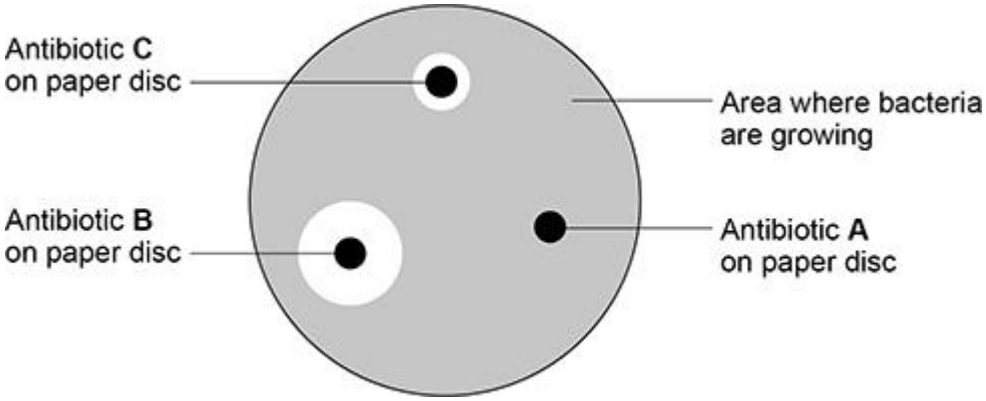
_____

(1)

The scientist grew one type of bacterium on agar in a Petri dish.

The scientist placed paper discs each containing a different antibiotic on the agar.

The figure below shows the appearance of the Petri dish after 2 days.



(b) A student said:

'The bacterium is resistant to antibiotic **C**.'

Explain how the results in above figure show that the student is **not** correct. **(biology only)**

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_____

_____

_____

(2)

(c) Suggest why doctors are concerned about antibiotic resistance.

_____

_____

_____

_____

(2)

Diseases caused by viruses **cannot** be treated using antibiotics.

(d) Suggest why viruses **cannot** be grown on agar.

_____

_____

(1)

(e) Why is it difficult for scientists to develop drugs to destroy viruses?

_____

_____

(1)

(f) Which disease is caused by a virus that damages white blood cells?

Tick (✓) **one** box.

AIDS ☐

Gonorrhoea ☐

Measles ☐

Salmonella ☐

(1)

(Total 8 marks)

Q2.

Salmonella bacteria cause outbreaks of food poisoning in humans.

To prevent food poisoning in humans, farmers vaccinate their animals against *Salmonella* bacteria.

(a) How do *Salmonella* bacteria in food cause the symptoms of vomiting and diarrhoea?

_____

_____

(1)

During a food poisoning outbreak, scientists identified the farm where the food came from.

The farmer had **not** vaccinated the farm animals against *Salmonella* bacteria.

(b) The food poisoning outbreak could have been prevented if the farm animals had been vaccinated.

Explain how:

- the immune systems of animals respond to a vaccination
- the immune response in farm animals prevents an outbreak of food poisoning in humans.

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(4)

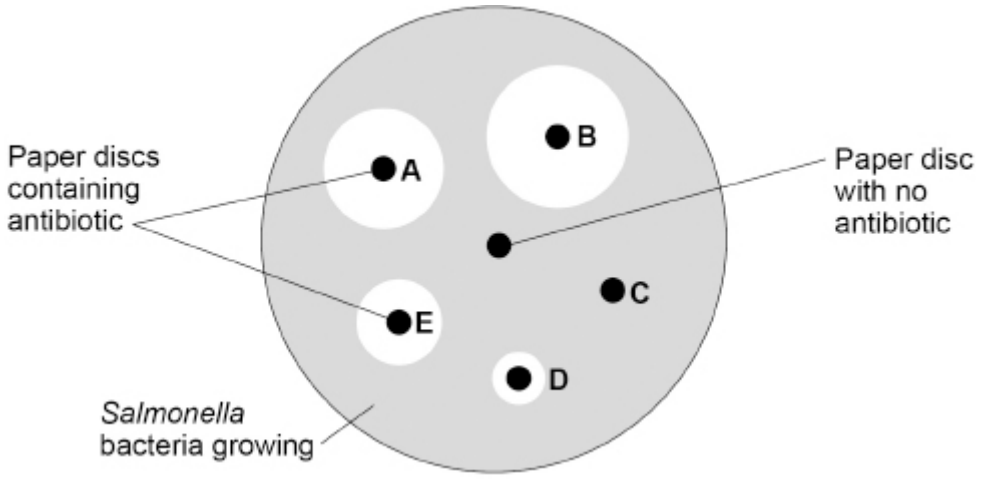
Most cases of food poisoning do **not** need to be treated with antibiotics.

However, some patients may need to take antibiotics to recover.

Scientists investigated the effectiveness of five different antibiotics on the *Salmonella* bacteria in the outbreak.

Antibiotics **A**, **B**, **C**, **D** and **E** were used in the investigation.

The figure below shows the results.



(c) Describe **two** aseptic techniques the scientists should have used in the investigation. **(biology only)**

1 _____

_____

2 _____

_____

(2)

(d) The scientists incubated the bacteria at 37 °C.
Students in school laboratories incubate bacteria at 25 °C.

Explain why scientists use 37 °C but students must use 25 °C to incubate bacteria.

(biology only)

(3)

(e) What is the purpose of the paper disc with no antibiotic in the figure above? **(biology only)**

(1)

(f) The scientists concluded that either antibiotic **A** or antibiotic **B** should be prescribed to patients with food poisoning.

Why should antibiotic **A** or antibiotic **B** be prescribed? **(biology only)**

(1)

(g) The scientists wanted to be more certain about which antibiotic should be prescribed.

Describe how the results in the figure above could be used to obtain a **quantitative** comparison of antibiotics **A** and **B**. **(biology only)**

(1)

(h) One year later, there was another outbreak at the farm involving *Salmonella* bacteria.

Antibiotic **B** did **not** have an effect.

Suggest why antibiotic **B** no longer had an effect.

_____

_____

(1)

(i) Antibiotics treat food poisoning because they kill *Salmonella* bacteria inside the human body.

Some antibiotics work because they damage the bacterial cell wall.

The bacteria die because the cells burst.

Explain why the cells burst.

_____

_____

_____

_____

_____

_____

(3)

(Total 17 marks)

Q3.

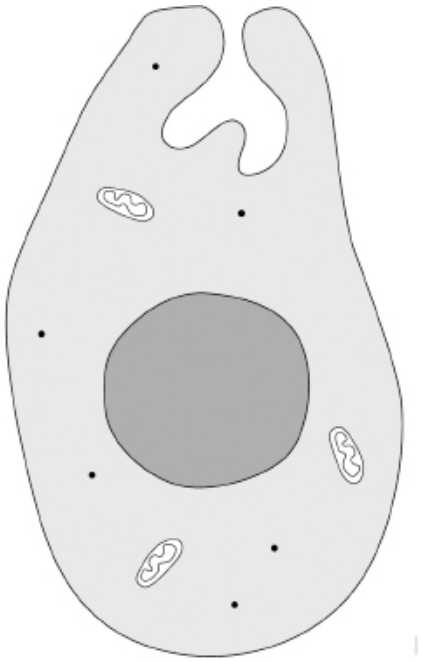
The protist that causes malaria is passed from one person to another person by mosquitos.

(a) What term describes an organism that passes a pathogen from one person to another person?

_____

(1)

(b) The figure below shows the malarial protist.



The malarial protist is a eukaryotic cell.

Describe **three** ways the structure of the malarial protist is different from the structure of a prokaryotic cell.

Do **not** refer to size in your answer.

1 _____

_____

2 _____

_____

3 _____

_____

(3)

(c) During one stage of malaria infection, the malarial protists enter red blood cells and cause them to burst.

Explain why the bursting of red blood cells causes tiredness.

_____

_____

_____

_____

(2)

(d) The malarial protist reproduces sexually and asexually during a life cycle.

Complete **Table 1** to give **three** differences between sexual reproduction and asexual reproduction.

One difference has been completed for you.

Table 1

	Sexual reproduction	**Asexual reproduction**
	Involves two parents	Involves one parent
1		
2		
3		

(3)

(e) One drug for treating malaria prevents mitosis occurring in the malarial protist.

The drug stops the synthesis of new DNA bases in the cell.

Suggest how the drug prevents mitosis occurring. **(biology only)**

_____

_____

(1)

(f) Describe the process of cell division by mitosis.

(3)

(g) Different types of disease may interact.

Scientists studied the incidence of malaria infections in children:

- with disorder **S**
- without disorder **S**.

The incidence of malaria in children with disorder **S** was calculated as a percentage of the incidence in children without disorder **S**.

Table 2 shows the results.

Table 2

Age in years	**Calculated percentage (%) incidence of malaria in children with disorder S**
2 to < 4	69
4 to < 6	63
6 to < 8	50
8 to 10	45
> 10	73

Describe what the results in **Table 2** show about the interaction between disorder **S** and malaria.

(2)

(Total 15 marks)

Q4.

Human immunodeficiency virus (HIV) is a pathogen.

(a) Give **one** way HIV can spread from one person to another person.

_____

_____

(1)

The table below shows information about new cases of HIV diagnosed in the UK.

Year	Number of new HIV cases in women	Number of new HIV cases in men
2010	376	2266
2012	361	2310
2014	397	2370
2016	298	1886
2018	242	1288

(b) Describe the trends shown in the table above between 2010 and 2018.

_____

_____

_____

_____

(2)

(c) Suggest **one** reason for the change in the number of new HIV cases between 2014 and 2018.

_____

_____

(1)

(d) Calculate the ratio of new cases of HIV in women to new cases of HIV in men in 2018.

Give your answer to 3 significant figures.

Ratio (3 significant figures) = _____**:** 1

(3)

(e) In the UK population the total number of women is greater than the total number of men.

The data in the table in part (a) is used to compare the proportions of new cases of HIV in the population for men and women.

Suggest how the data could be presented differently so that a more valid comparison can be made.

(1)

Scientists have been working to produce a vaccine for HIV for many years.

(f) Explain how a vaccine for HIV could work to prevent a person developing HIV infection.

(4)

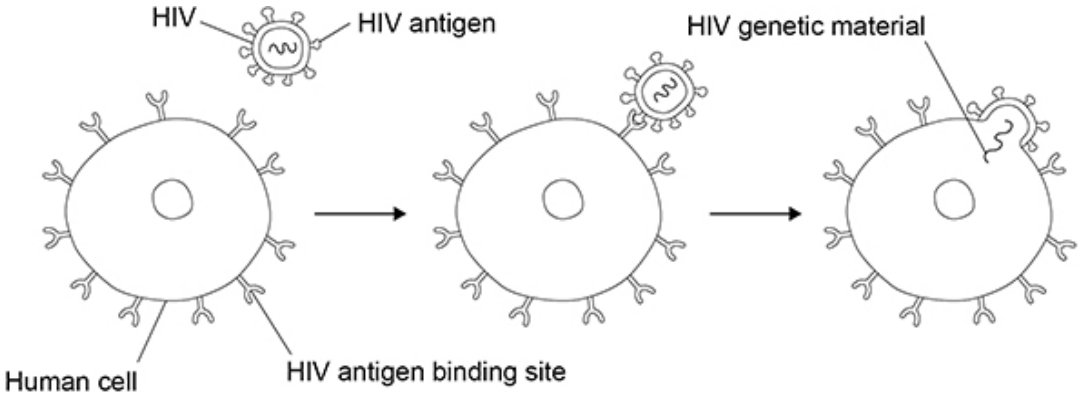
A person with late stage HIV infection has AIDS.

Scientists have produced monoclonal antibodies for HIV.
The monoclonal antibodies can prevent a person infected with HIV developing AIDS.

(g) Describe how the monoclonal antibody for HIV can be produced. **(biology only) (HT only)**

(4)

(h) The figure below shows how HIV enters a human cell.



Suggest how the monoclonal antibody for HIV helps to prevent a person infected with HIV developing AIDS.

Use information from the figure above. **(biology only) (HT only)**

(3)

(Total 19 marks)