Fig. 2.1 is a transmission electron micrograph showing the bacterial pathogen that causes tuberculosis (TB).

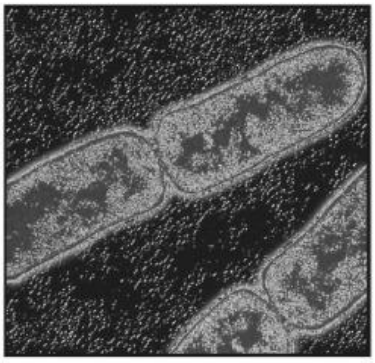

Fig. 2.1

(a) (i) Name the pathogen shown in Fig. 2.1 that causes TB.

..... [1]

The World Health Organization (WHO) introduced a strategy in 2015 to end the global TB epidemic.

An important part of the strategy is to:
- identify people at risk of becoming infected with TB
- use methods to prevent transmission of TB.

The BCG vaccination is one method of prevention recommended for use in countries where TB is common. The BCG vaccine contains a non-pathogenic, living form of the microorganism that causes TB.

(ii) Complete Table 2.1 by using a tick (✓) to identify the type of immunity that develops in a person who has been given the BCG vaccination.

Table 2.1

artificial active immunity	
artificial passive immunity	
natural active immunity	
natural passive immunity	

[1]

(b) Rifampicin is one of the antibiotics used to treat TB.

Rifampicin inhibits RNA polymerase in bacterial cells by binding to a site other than the active site. This prevents polypeptide synthesis.

(i) Suggest **and** explain how rifampicin prevents polypeptide synthesis in bacterial cells.

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..... [3]

Some bacteria have developed resistance to rifampicin. However, they are still susceptible to the other antibiotics that can be used to treat TB.

Multi-drug resistant bacteria have developed resistance to at least two drugs, including rifampicin.

WHO collects data from all countries on the number of cases of TB caused by rifampicin-resistant bacteria (RR-TB) and multi-drug resistant bacteria (MDR-TB).

Fig. 2.2 shows the reported number of cases of TB between 2009 and 2013.

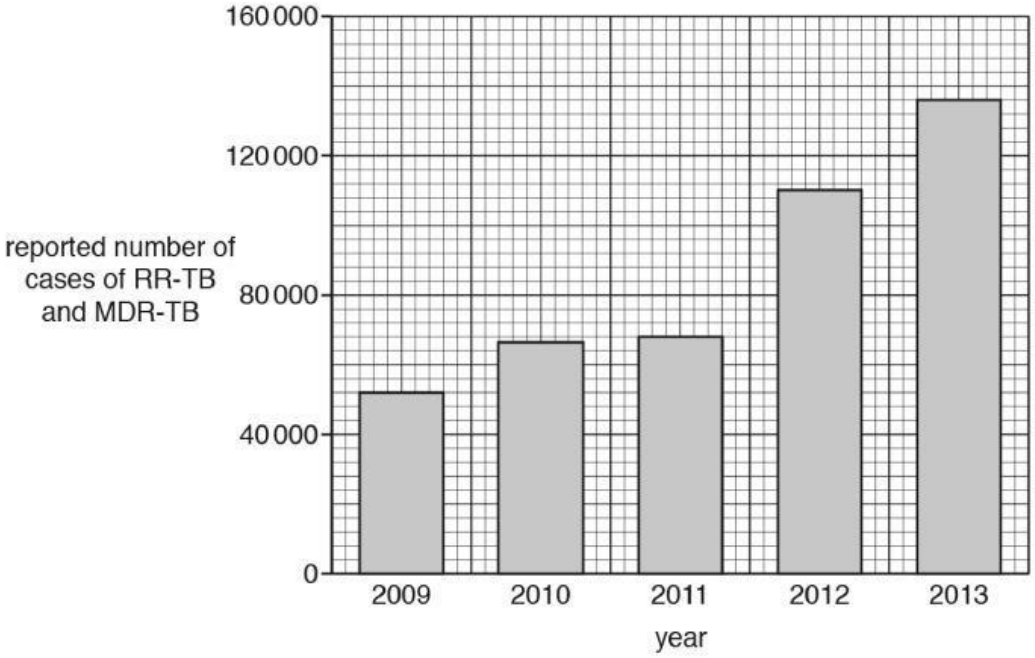

Fig. 2.2

(ii) Describe the trend shown by the data in Fig. 2.2.

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..... [2]

(iii) Explain how resistance to drugs such as rifampicin develops.

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..... [4]

[Total: 11]

Fig. 3.1 is a diagram that shows the structure of an antibody molecule.

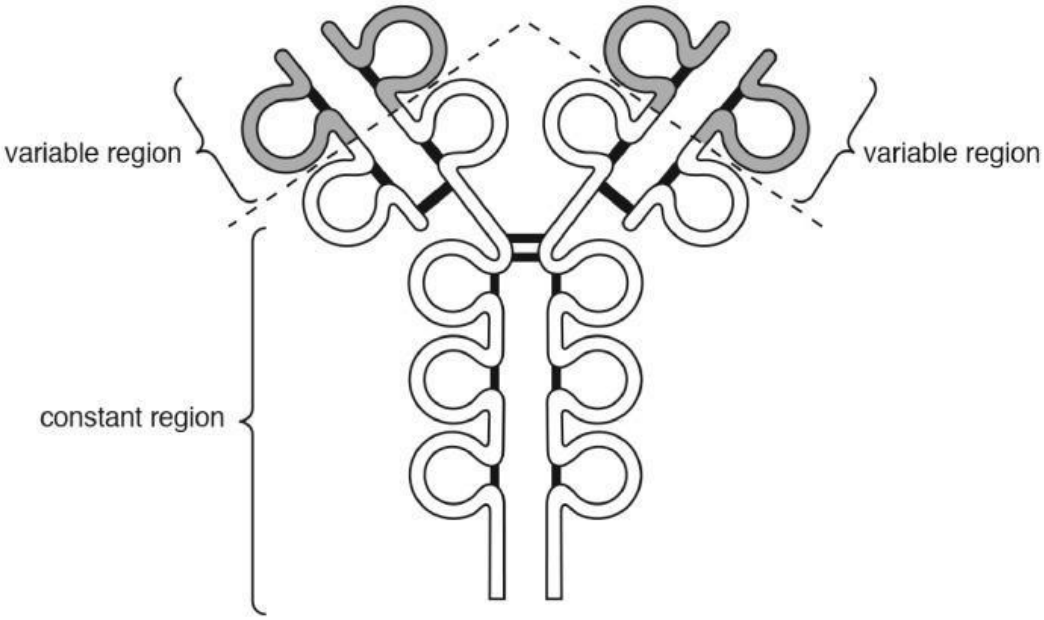

Fig. 3.1

(a) State why the antibody molecule shown in Fig. 3.1 has quaternary structure.

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.....[1]

(b) **(i)** Use Fig. 3.1 to explain how the structure of the variable region of an antibody molecule is related to its function.

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.....[3]

(ii) State the role of the constant region of an antibody.

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.....[1]

(c) Monoclonal antibodies are used both in diagnosis and in treatment of disease.

(i) Outline how monoclonal antibodies are produced.

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.....[4]

(ii) Suggest the advantages of using monoclonal antibodies in diagnosis of disease.

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.....[2]

[Total: 11]