**1** Tuberculosis (TB) kills approximately three million people every year.
Droplets containing the organisms that cause TB are released into the air when a person suffering from TB coughs. Transmission of TB occurs if these droplets are inhaled into the alveoli of the lungs.

In the lungs, the organisms are taken up by macrophages and carried to lymph nodes.

(a) (i) State **one** characteristic symptom of TB other than coughing.

**(1)**

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(ii) Place a cross ☒ in the box next to the name of the organism that causes TB.

**(1)**

☒ **A** *Macrobacterium tuberculosis*

☒ **B** *Microbacterium tuberculosis*

☒ **C** *Monobacterium tuberculosis*

☒ **D** *Mycobacterium tuberculosis*

(iii) Describe how the organisms that cause TB are taken up by macrophages.

**(3)**

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(iv) Ingesting food containing these organisms is unlikely to lead to the development of TB. Give an explanation for this.

**(2)**

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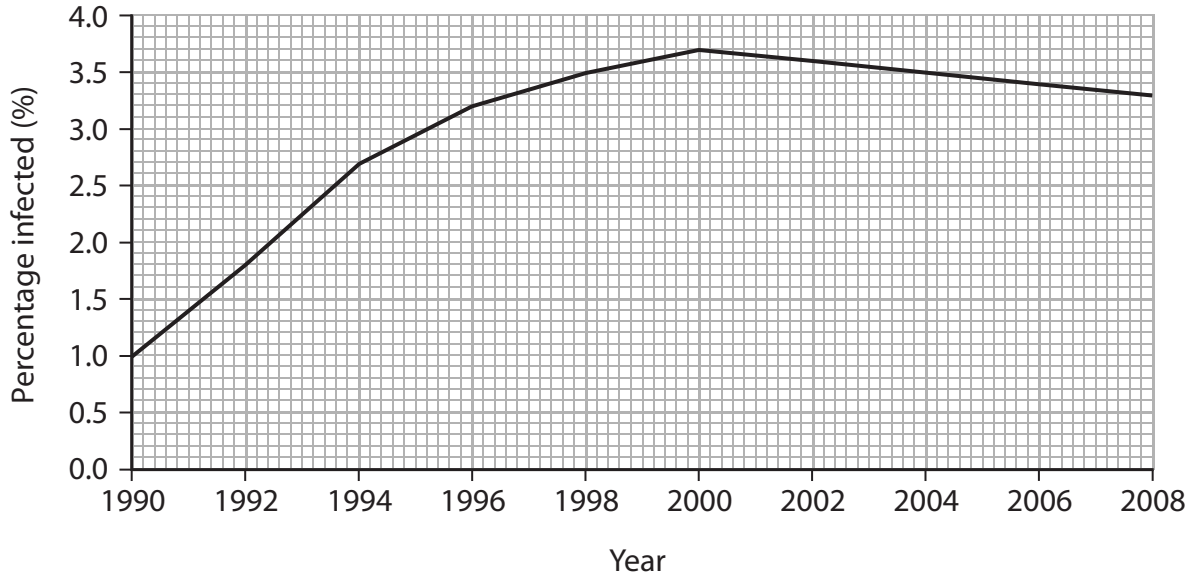
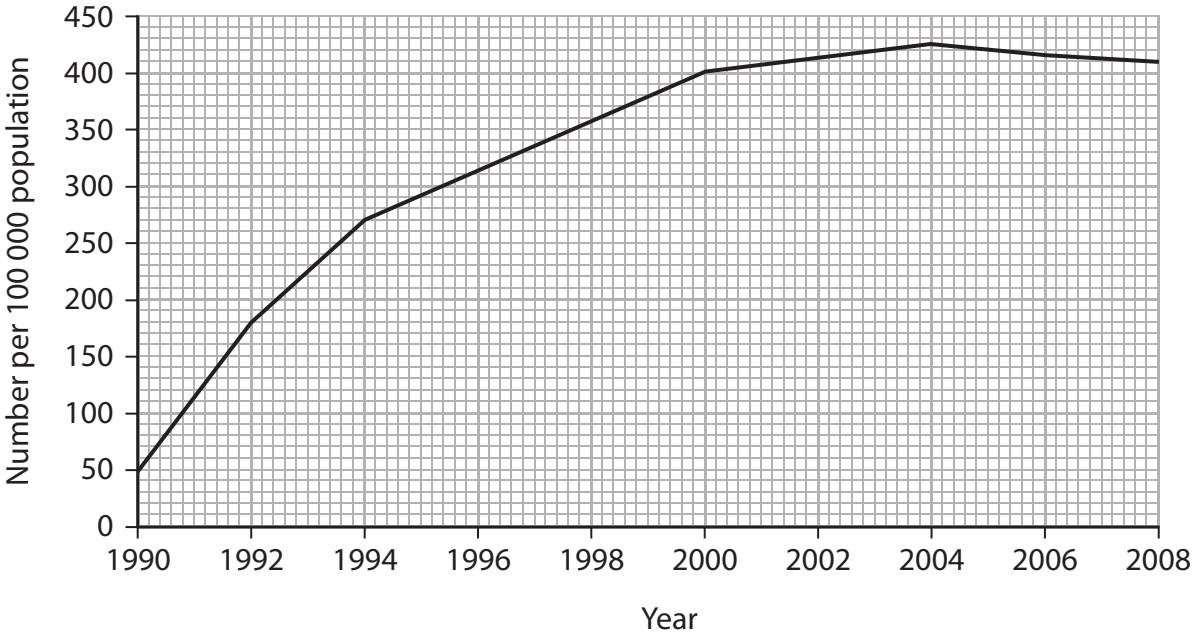
*(b) The graphs below show data related to TB and HIV infections in the population of central Africa from 1990 to 2008.

**Graph 1 –** The percentage of the population infected by TB




**Graph 2 –** The number of cases of HIV infection per 100 000 population



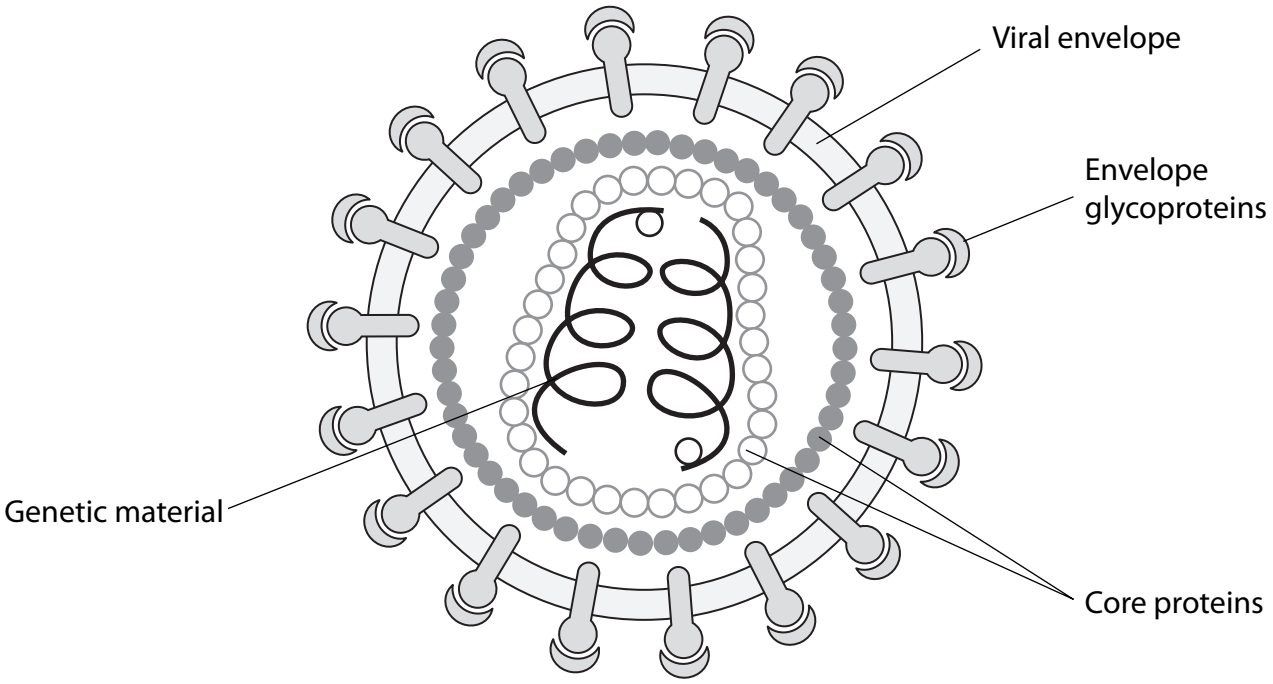
Discuss how far the data in the graphs support the following hypothesis.

The increase in HIV infection in central Africa has led to an increase in TB infection.

**(4)**

**(Total for Question 1 = 11 marks)**

**2** The diagram below shows the structure of Human Immunodeficiency Virus (HIV).




(a) State how the genetic material in HIV differs from the genetic material in the bacterium *Mycobacterium tuberculosis* that causes TB.

**(2)**

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(b) One of the ways in which HIV may enter the blood is through the use of infected needles. Explain why unbroken skin is an effective barrier against HIV infection.

**(2)**

(c) The table below shows the changes in the number of CD4 T-lymphocytes in the blood of a person infected with HIV, during the first 10 weeks after infection.

| Time after infection / weeks | CD4 T-lymphocyte count / cells per $mm^3$ of blood |
|---|---|
| 0 | 1050 |
| 1 | 980 |
| 2 | 810 |
| 3 | 600 |
| 4 | 520 |
| 5 | 490 |
| 6 | 480 |
| 7 | 500 |
| 8 | 530 |
| 9 | 580 |
| 10 | 600 |

(i) Describe the change in numbers of CD4 T-lymphocytes during the first 6 weeks after infection with HIV.

**(2)**

*(ii) Explain the change in numbers of CD4 T-lymphocytes during the first 6 weeks after infection with HIV.

**(5)**

(iii) Suggest **one** effect that this change would have on one other component of the infected person's blood.

**(1)**

**(Total for Question 2 = 12 marks)**