

**A Level Biology B**

**H422/01** Fundamentals of biology

**Question Set 15**

1. (a) (i) The human immunodeficiency virus (HIV) is spread through direct contact with body fluids.

Untreated HIV infection causes progressive destruction of the immune system. This leads to acquired immunodeficiency syndrome (AIDS).

The graph in Fig. 31.1 summarises yearly epidemiological data relating to HIV infection and AIDS in the USA between 1981 and 2008.

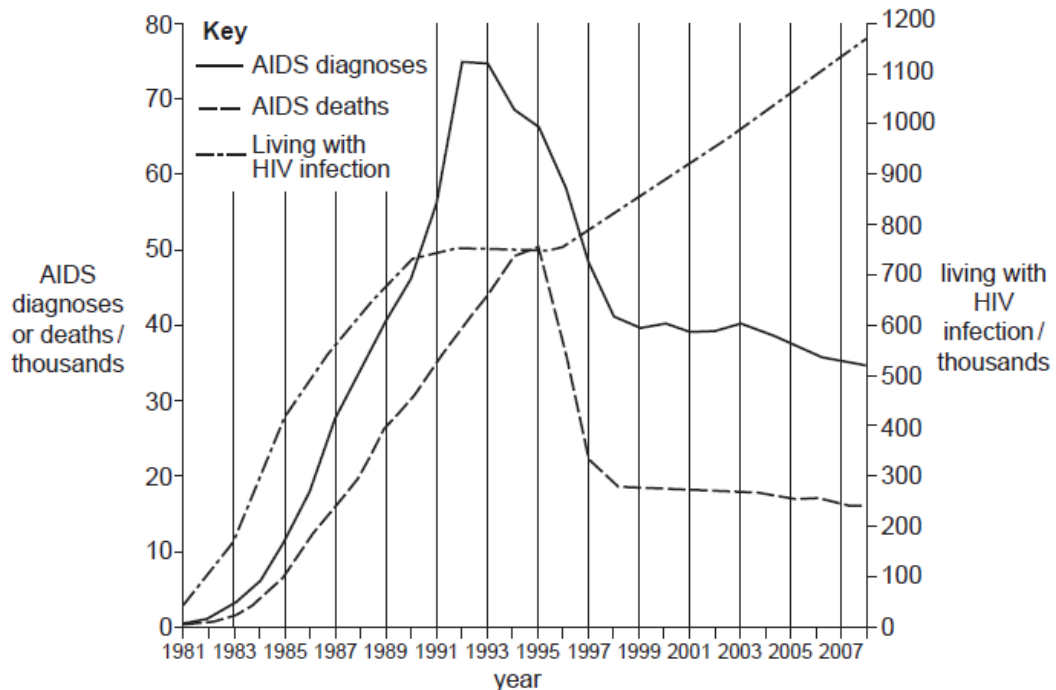


Fig. 31.1

The population of the USA in 1993 was 260 million.

Estimate the mortality rate of AIDS as number of deaths per 100 000 in the USA in 1993.

[2]

- (a) (ii) Patients with HIV/AIDS are managed with highly active antiretroviral therapy (HAART), which was introduced in 1996.

Discuss the effectiveness of HAART as a treatment for patients with HIV/AIDS. Use the data in Fig. 31.1 to support your answer.

[4]

- (b) HIV testing can prevent the spread of infection. In the UK, HIV testing must be carried out with consent from the patient. The results must be treated in a confidential manner.

Suggest **two** other ethical or social concerns associated with receiving an HIV positive test result.

[2]

- (c) Vaccines against HIV are currently being developed:
- to protect individuals from contracting HIV
  - to boost the immune response in HIV-positive individuals.

Explain why it is difficult to produce an effective vaccine for HIV.

[3]

- (d) (i) HIV destroys the immune system by infecting and killing a type of T helper cell known as a CD4 cell. Therefore, blood levels of CD4 cells can indicate strength of the immune system in patients with HIV.

A clinical trial was conducted to evaluate the safety and effectiveness of a new HIV vaccine in patients with HIV receiving HAART.

The vaccine contains a purified viral protein known as Tat, which is required for transcription of the HIV genome.

State **one** advantage of using purified Tat protein instead of a live, attenuated (weakened) virus.

[1]

- (ii) Fig. 31.2 shows CD4 cell levels over time in patients immunised with 7.5  $\mu\text{g}$  or 30  $\mu\text{g}$  Tat protein.

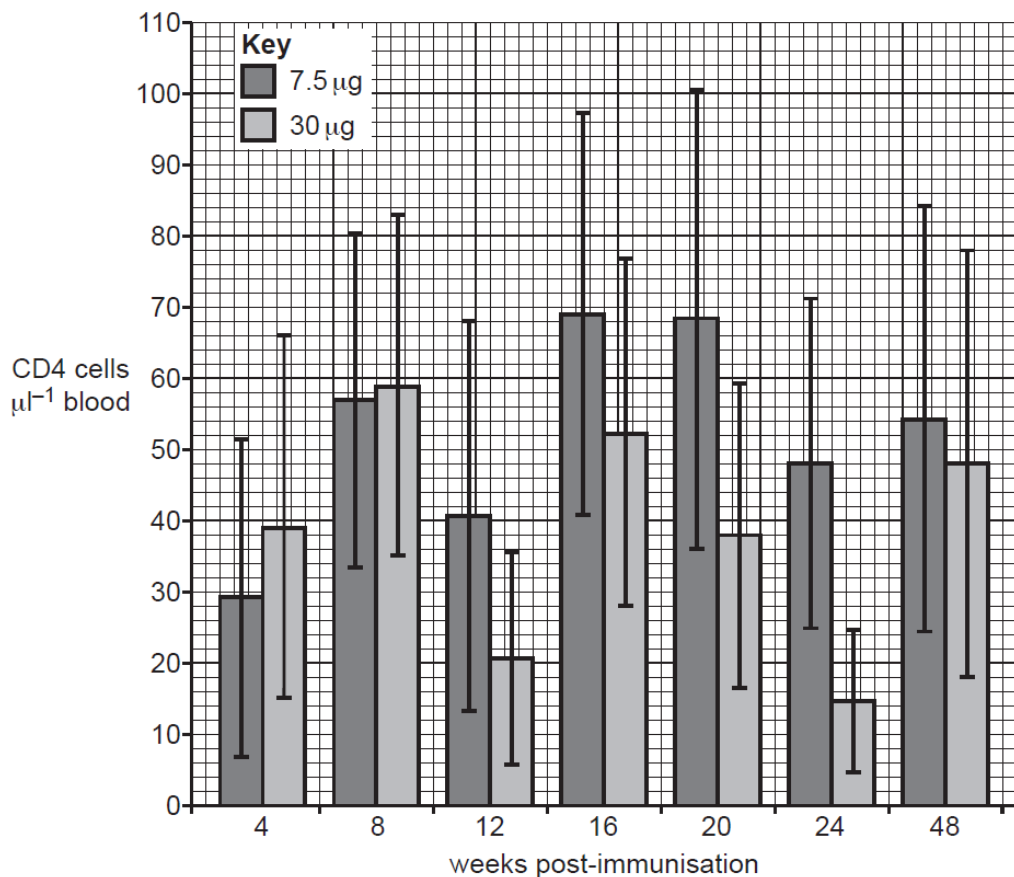


Fig. 31.2

Suggest **two** reasons why the effectiveness of the vaccine can **not** be determined from the data in Fig. 31.2.

[2]

- (e) (i) AIDS is an advanced stage of HIV infection that is defined by the occurrence of opportunistic infections, such as tuberculosis (TB) and hepatitis B and C. TB is the most common opportunistic infection in patients with HIV.

In the UK, TB is a notifiable disease.

State **two** possible consequences of the reporting of a notifiable disease.

[2]

- (e) (ii) Active TB infection is treated with a combination of antibiotics.

The cell wall of the TB pathogen *Mycobacterium tuberculosis* is strengthened by complex lipid molecules.

What term is given to describe antibiotics that inhibit cell wall synthesis?

[1]

- (e) (iii) Multi-drug resistance is a major challenge in the treatment of patients with TB.

Outline how a population of *M. tuberculosis* may become resistant to antibiotics.

[3]

**Total Marks for Question Set 15: 20**

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