

## **A-Level Biology**

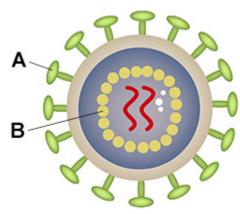
## HIV

**Question Paper** 

Time available: 66 minutes Marks available: 51 marks

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1. The diagram below shows the structure of the human immunodeficiency virus (HIV).



(a)	Name structures <b>A</b> and <b>B</b> .	
	A	
	В	
		(2)
(b)	Describe how HIV is replicated.	
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		-
		(4)

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(Total 6 marks)

Describe how the human immunodeficiency virus (HIV) is replicated <b>once inside</b> help cells ( $T_H$ cells).	er T
- <u></u>	

HIV-1 is the most common type of HIV. HIV-1 binds to a receptor on T<sub>H</sub> cells called CCR5.

Current treatment for HIV-1 involves the use of daily antiretroviral therapy (ART) to stop the virus being replicated. Only 59% of HIV-positive individuals have access to ART.

Scientists have found that two HIV-1-positive patients (**P** and **Q**) have gone into remission (have no detectable HIV-1). This happened after a blood stem cell transplant (BSCT).

Patient P was given two BSCTs, and patient Q was given one BSCT.

2.

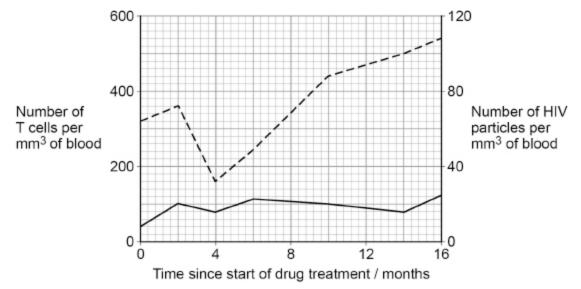
- All BSCTs came from a donor with T<sub>H</sub> cells without the CCR5 receptor.
- In addition, patient **P** had radiotherapy, and patient **Q** had chemotherapy. Both of these treatments are toxic.
- Both patients (P and Q) stopped receiving ART 16 months after BSCT.

18 months after stopping ART, **both** patients had **no** HIV-1 RNA in their plasma, **no** HIV-1 DNA in their  $T_H$  cells and **no** CCR5 on their  $T_H$  cells.

(4)

(a)		 (Total 9 m
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(b) A scientist measured the effect of a drug on the number of T cells and the number of HIV particles in blood taken from a person with AIDS. The results are shown on the graph below.



Key
--- T cells
--- HIV particles

Symptoms of AIDS occur when the number of T cells is below 200 cells mm <sup>-3</sup>
Use all of this information to evaluate the effectiveness of the drug in treating AIDS.

(5)

(Total 8 marks)

Describe the structure of the human immunodeficiency virus (HIV).

(4)

Some people infected with HIV do not develop AIDS. These people are called HIV controllers.

Scientists measured the number of HIV particles (the viral load) and the number of one type of T helper cell (CD4 cells) in the blood of a group of HIV controllers and also in a group of HIV positive patients who had symptoms of AIDS.

The median values and the range of their results are shown in the table.

HIV status of people	Median viral load / virus particles per cm <sup>3</sup> of blood (range)	Median number of CD4 cells per mm <sup>3</sup> of blood (range)
HIV controllers	212 (<50 to 609)	693 (529 to 887)
HIV positive people with AIDS symptoms	66 274 (30 206 to 306 163)	248 (107 to 365)

(b) A test sample of 500 mm<sup>3</sup> of blood is taken from an HIV controller to determine the viral load.

Tick ( $\checkmark$ ) **one** box that shows the number of virus particles that would be present in a test sample of blood taken from an HIV controller with the median viral load.

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10 600	
1060	
106	

(1)

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**5.** Read the following passage.

Azidothymidine (AZT) is a drug used to treat people infected with human immunodeficiency virus (HIV). It inhibits the enzyme that synthesises DNA from HIV RNA. This does not destroy HIV in the body but stops or slows the development of AIDS.

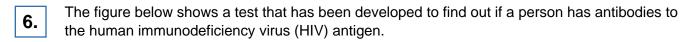
- In the past, some people who took AZT on its own eventually developed AIDS. Some of the HIV in their bodies had become resistant to AZT. To prevent this from happening, people infected with HIV are now treated with highly active antiretroviral therapy (HAART). This involves taking AZT with other anti-HIV drugs at the same time.
- 10 AZT is taken in low doses. This is because people who took high doses over long periods of time suffered muscle wastage. It was found that high doses of AZT inhibit replication of mitochondria.

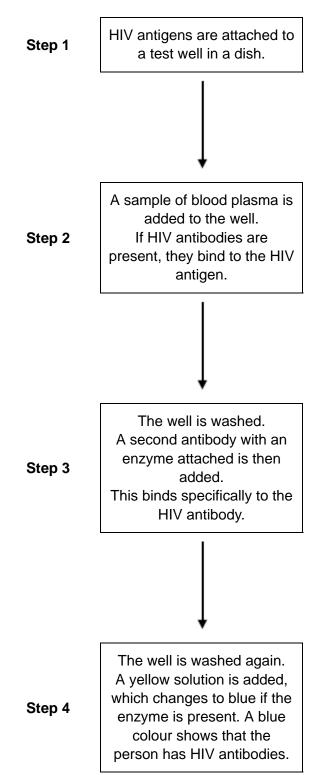
Use information from the passage and your own knowledge to answer the questions.

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Suggest and expla	in <b>two</b> advantage	oc of ucina ∐∧	APT (lines 7	. 0)	
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Advantage 1	_				
Advantage 1			·		
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(c)	Suggest why high doses of AZT lead to muscle wastage (lines 10–11).	
		(2) (Total 10 marks)





1	
2	
The solution will remain yellow if a person is <b>not</b> infected with HIV. Explain why.	
A mother who was infected with HIV gave birth to a baby. The baby tested positive us this test. This does not prove the baby is infected with HIV. Explain why.	on ig
A control well is set up every time this test is used. This is treated in exactly the same as the test wells, except that blood plasma is replaced by a salt solution.	e way
Use information from the figure above to suggest <b>two</b> purposes of the control well.	
1	
2	