Cambridge International AS & A Level

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

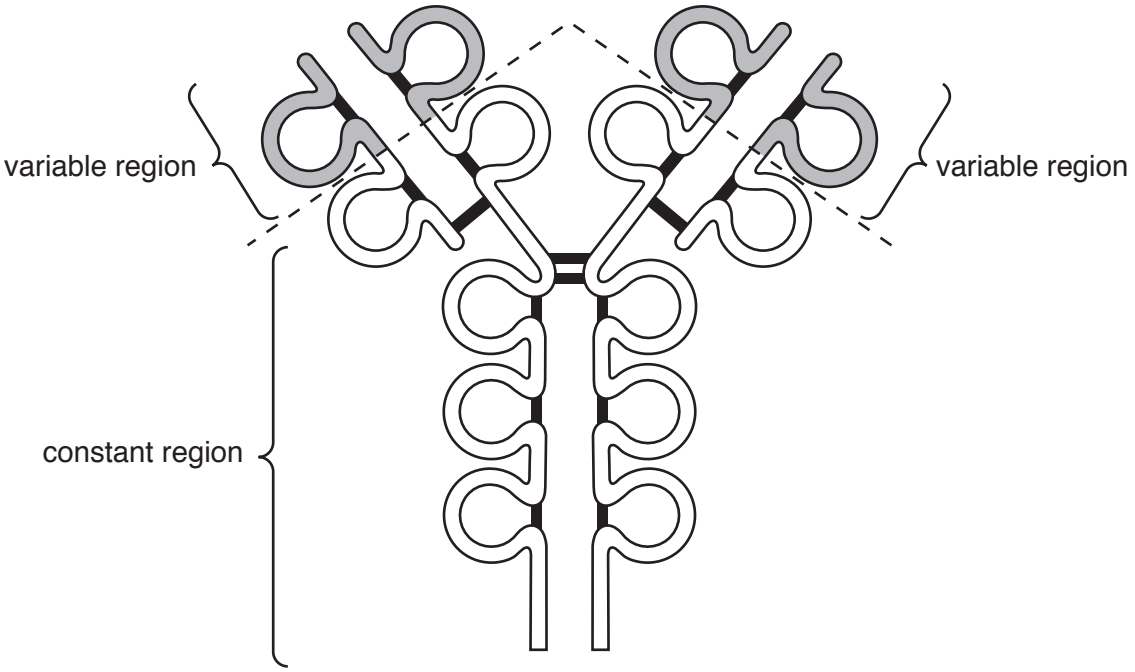

Fig. 3.1

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

.....

.....[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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.....

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.....

.....

.....[3]

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

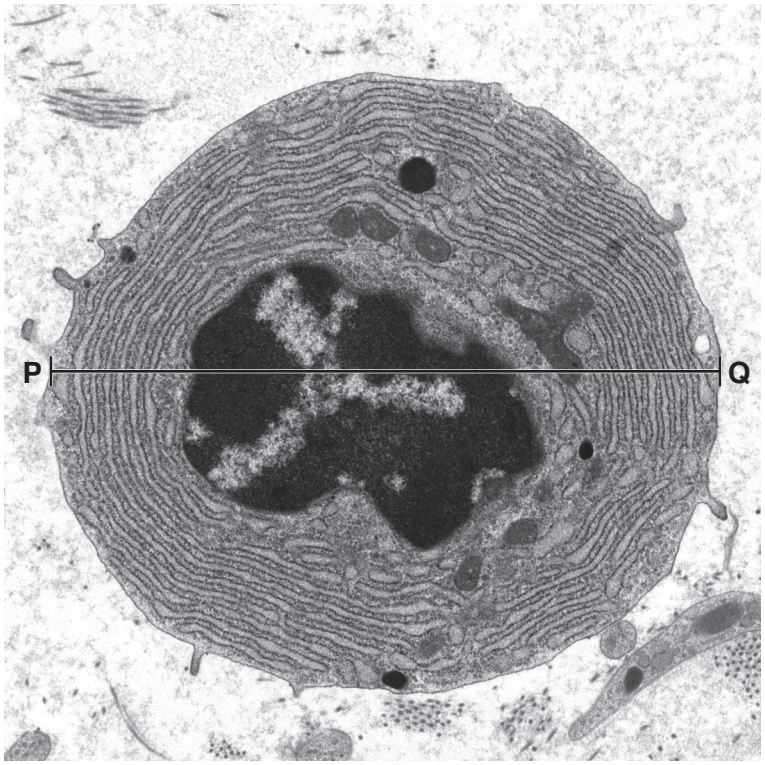
.....

.....

.....[1]

(b) Plasma cells synthesise and secrete antibodies.

Fig. 1.3 is a transmission electron micrograph showing a plasma cell.



magnification ×6000

Fig. 1.3

(i) Use a label line and the label **T** on Fig. 1.3 to identify where the genes coding for the polypeptide chains of the antibodies are located. [1]

(ii) Calculate the actual diameter of the plasma cell shown by the line **P**–**Q**.

Write down the formula used to make your calculation.

Show your working and give your answer to the nearest micrometre (μm).

formula

actual diameter = ...μm [2]

(c) The maturing red blood cell synthesises haemoglobin and other proteins.

(i) Complete Table 3.1 to:

- name **three** organelles (cell structures) that are involved in the synthesis of a fully functioning protein
- state **one** way in which the named organelle is involved in protein synthesis.

Table 3.1

organelle	how the organelle is involved in protein synthesis

[3]

Question	Answers	Marks
3(a)	(antibody has) more than <u>one polypeptide</u> **;** **A** <u>four polypeptides</u> **R** two / two or more / two types of / many / AW, polypeptides	**1**
3(b)(i)	**1** (two) antigen-binding, site(s) / region(s) **;** **A** binds to / AW, antigens **R** active site **2** (shape / structure is) <u>complementary</u> to antigen **;** ***3*** *idea of* specificity / AW **;** **4** *ref. to*, primary structure / sequence of amino acids **;** **5** *ref. to* R-groups / (amino acid) side chains, and interactions with antigen / giving specific shape **;**	**max 3**
3(b)(ii)	binds to (receptors on), phagocytes / macrophages / neutrophils **;** **A** other correct named cell of the immune system AVP **;** e.g. gives class of antibody (e.g. IgM, IgG, IgA, IgE)	**max 1**

Question	Answer	Marks
1(b)(i)	label line to any area of the nucleus ;	**1**
1(b)(ii)	correct formula ; e.g. actual diameter = image length / magnification 15 (µm) ;	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(c)(i)</td><td>
3 structures correct and involvement, incorrect / not stated, allow 1 mark
three correct rows
I extra rows added with additional structures
<table>
<tr><td>nucleus / chromosome</td><td>(has) gene / DNA, coding for protein
or (for) transcription / mRNA synthesis ;
A produces ribosomes if stated as made in nucleolus</td></tr>
<tr><td>nucleolus</td><td>produces, rRNA / ribosomes / ribosomal subunits ;</td></tr>
<tr><td>ribosome
A ribosomal subunit</td><td>(site of) polypeptide / protein, synthesis
A described I makes amino acids
A to synthesise enzymes

or (for) translation

or binding of, mRNA / tRNA ;</td></tr>
<tr><td><u>rough</u> endoplasmic reticulum
A rough ER / RER
R wrong word for ‘rough’ if RER also stated</td><td>site of, polypeptide / protein, synthesis
A described
A to synthesise enzymes

or (for) translation

or (for) attachment of ribosomes

or protein / post-translational, modification
A examples

or protein transport ;
I packaging proteins</td></tr>
<tr><td>transport vesicle</td><td>to move protein from RER to Golgi (body / apparatus / complex) ;</td></tr>
<tr><td>Golgi (body / apparatus / complex)</td><td>for, protein / post-translational, modification / AW ;
A examples
I packaging proteins</td></tr>
<tr><td>mitochondrion</td><td>provides / produces, ATP for, tRNA aminoacylation / charging amino acids before attachment to tRNA ;</td></tr>
</table>
</td><td>3</td></tr>
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