Solutions

Each answer shows the steps, then the **result**.

2.1

- an antigen is a molecule (usually a protein) on a cell surface that the immune system recognises; a self antigen is the body's own (ignored), a non-self antigen is foreign and triggers a response

2.2

(a)

- plasma cells

(b)

- memory cells

2.3

- a **phagocyte** (neutrophil or macrophage)

2.4

- the B or T lymphocyte with receptors complementary to the antigen is selected and divides by mitosis

3.1 B

- A macrophage displays the antigen to alert other immune cells

3.2 B

- Memory cells are already present, giving a quicker, larger response

3.3

- a macrophage engulfs the pathogen and displays its antigen; a T-helper cell with a matching receptor is activated; it activates the matching B-lymphocyte, which divides; into plasma cells that secrete antibodies

3.4

- memory cells made in the first infection remain in the body; they respond rapidly and strongly if the same pathogen returns, destroying it before illness

3.5

- after the first exposure, memory cells specific to the antigen remain in the blood
- on second exposure the memory cells recognise the antigen at once, so there is no delay while the right lymphocytes are selected
- they divide rapidly into many plasma cells, so antibodies are made faster and in larger amounts

3.6

- the new strain has different antigens on its surface (antigenic variation)
- the memory cells and antibodies from the vaccine are not complementary to the new antigens, so they do not recognise it