Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

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

2.1

the skin is a tough physical barrier of dead cells; mucus traps pathogens in the airways, and cilia move it away

2.2

platelets gather at the cut and release clotting factors; a cascade activates thrombin, which converts fibrinogen into fibrin; fibrin threads form a mesh that traps blood cells, sealing the cut

2.3

antibiotics block processes found in bacteria, e.g. cell wall formation or protein synthesis; viruses have no metabolism of their own / use the host cell; so there is nothing for antibiotics to act on, and they would harm the host if they blocked host processes

2.4

a random mutation gives some bacteria resistance; the antibiotic kills the non-resistant ones, so resistant bacteria survive and reproduce: natural selection

2.5

an infectious disease that passes from animals to humans; e.g. COVID-19 / rabies / bird flu / Ebola

3.1

(a) second response is faster; and produces much more antibody

(b) the first dose produced memory cells; on the second exposure, memory cells recognize the antigen quickly; they divide rapidly into plasma cells that secrete more antibodies

(c) antigens / weakened or killed pathogens / mRNA coding for an antigen

(d) when most people are immune, the pathogen cannot pass from person to person; so it is unlikely to reach those who are not immune

3.2

(a) falls over the ten years; from about 1000 to below 200 per mm^3

(b) helper T-cells are needed to activate B-cells; so few plasma cells / antibodies are made; the body cannot fight other pathogens, so opportunistic infections develop (AIDS)

(c) any two: sexual intercourse; sharing needles / blood; from mother to baby at birth or in breast milk

(d) innate is non-specific and present from birth; adaptive is specific to an antigen and has memory

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