Solutions

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

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

2.1

A: **antibody** (B cells; X-linked agammaglobulinaemia)

B: **T cells** (severe combined immunodeficiency)

C: **phagocyte killing** (chronic granulomatous disease)

2.2

IgG from his mother crossed the placenta and protects him

it is broken down and mostly gone by about 6 months

2.3

A (minutes): **hyperacute**

B (2 weeks): **acute**

C (5 years): **chronic**

2.4

the spleen clears bacteria with capsules from the blood

vaccinate against pneumococcus (or Hib, meningococcus)

3.1

(a) **severe combined immunodeficiency (SCID)**

(b) there are no working T cells, and B cells need T cell help to make good antibody

(c) they are live vaccines, which can multiply and cause disease without T cells

(d) a **bone marrow (stem cell) transplant**

(e) to kill donor T cells, which would otherwise attack his tissues (graft-versus-host disease)

3.2

(a) she already has anti-A or anti-B antibodies; they would bind the graft's blood vessels at once, causing hyperacute rejection

(b) **acute (cellular) rejection**

(c) it blocks calcineurin, so T cells do not make IL-2 and are not switched on

3.3

(a) each parent passes one of two haplotypes: $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

(b) $1 - \left(\frac{3}{4}\right)^3 = \frac{37}{64} \approx \mathbf{58\%}$

(c) donor T cells in the graft attack the patient's tissues, such as the skin, gut and liver

(d) a kidney carries very few donor T cells

(e) the drugs that stop rejection also weaken T cell defence against infection

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