

Model Answers: Hard

1

The correct answer is **B** because:

- TB invades the lungs initially; some people develop an infection quite quickly with infection spreading to the lymph nodes, bones and gut, whilst in others the bacteria remains inactive (dormant) for many years
- Malaria is caused by four species of *Plasmodium* protoctists which have a complex lifecycle involving stages in both female *Anopheles* mosquitoes and humans
- Sickle cell anaemia is a **genetic condition**
- The bacterium that causes cholera infects the cells of the gut; if the bacterium reaches the gut it secretes cholera toxin. This is a toxin that disrupts the function of the epithelial cells resulting in loss of salts and water which can make an immune response difficult

2

The correct answer is **C** because:

- Only statement 3 explains why TB vaccination is via injection; in that the TB **antigen** would be destroyed by stomach acid
- An injection into the bloodstream is needed so that the immune system can be activated to give **long-term immunity**

A & B are incorrect as these options both contain statement 1. This statement would be an incorrect reason as there are B-lymphocytes and T-lymphocytes in the tissues of the stomach

D is incorrect as macrophages do carry out **antigen presentation**, but this is not relevant to why TB vaccines must be given by injection.

3

The correct answer is **D** because:

- **Monoclonal antibodies** (Mabs) can be used to treat **rheumatoid arthritis**, an **auto-immune** disease
- **Infliximab** is used to bind to a protein produced by T-cells that cause damage to the cartilage in joints, blocking its action

A is incorrect as **monoclonal antibodies** are clones and only specific to one antigen; therefore they could not protect against a wide variety of pathogens

B is incorrect as taking serum from a patient would give many different types of antibody, not one specific type.

C is incorrect as Mabs have very narrow specificity to just one antigen.

4

The correct answer is **B** because:

- Pathway 1 refers to the **passive responses** – there is no activation of the immune system
- Pathway 2 refers to the **active responses** – the immune system is activated to produce antibodies to the antigens present
- No. 3 describes **artificial passive immunity** when a patient is given antibodies by injection
- No. 4 describes **natural passive immunity** when a fetus receives antibodies from its mother
- No. 5 describes the activation of the immune system through vaccination, an **artificial activation** of the immune system
- No. 6 describes the **natural activation** from infection of the immune system

5

The correct answer is **A** because:

- Cancer cells are cells growing out of control that will divide continuously
- Plasma cells will not keep dividing (their role is to produce antibodies), this is why they need to be combined with the cancer cells into a **hybridoma** to make **monoclonal antibodies**
- The cancer cells and the plasma cells, when combined into a hybridoma, will retain the **ability to divide continuously**

6

The correct answer is **B** because:

- Records in developing countries are still incomplete of all the vaccinations that have been given
- Issue around giving the vaccination such as transport and instability due to civil war prevents individuals from certain areas from receiving vaccination

7

The correct answer is **A** because **monoclonal antibodies** cannot bind to chromosomes to identify any abnormalities.

B is incorrect as **monoclonal antibodies** can be used for **tissue typing** as there are many copies of the same specific antibody to bind to the antigens present.

C is incorrect as **monoclonal antibodies** are used in pregnancy tests to bind to the **hCG hormone present** in pregnant urine which is produced by the placenta when pregnancy occurs.

D is incorrect as **monoclonal antibodies** can be used to target B and T cells that would be involved in the **rejection of an organ**.

8

The correct answer is **D** because:

- **Antibodies** are too big to go through the cell membrane, so they can't get to the **viruses** inside the cells
- **Antibodies** that would cause **agglutination** would have multiple binding sites to allow the **clumping of the bacteria**

9

The correct answer is **B** because:

- **Monoclonal antibodies** are made by first injecting a mouse with the **antigen**
- They are then recognised by the mouse immune system which result in the formation of plasma cells
- The plasma cells are then fused with a cancer cell to form a **hybridoma** that will divide continuously
- The hybridoma cells are cultured and the one that is producing the correct **antibody isolated and cloned**

10

The correct answer is **C** because:

- **Live attenuated** vaccines contain live strains of the pathogen that has been **weakened**
- An **inactive vaccine** is a pathogen that has been **killed with heat or chemicals**
- **Subunit vaccines** contain **fragments** of the pathogen containing the antigen which allow the immune response to be activated but without the patient receiving the full pathogen