4.7 Pathogens, infection routes and TB/HIV

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS capsid • plasmid • lysozyme • vector

Objective

Practise statements 6.5-6.7: the structures of bacteria and viruses, the major routes pathogens take into the body, the barriers that meet them, and how tuberculosis and HIV attack.

1 Key knowledge and worked examples

Two designs of parasite

Bacterium: cell wall, plasma membrane, single circular DNA, plasmids, 70S ribosomes, sometimes capsule and flagellum – a living cell. Virus: nucleic acid (DNA or RNA) in a protein **capsid** , sometimes a lipid envelope with glycoproteins – no organelles, no independent metabolism.

Routes and barriers

Routes: respiratory (inhaled droplets), digestive (contaminated food/water), sexual contact, through wounds, via vectors (insects). Barriers: intact skin; mucus trapping pathogens with cilia sweeping them; stomach acid; lysozyme in tears and saliva; blood clotting sealing breaks. Fever and inflammation follow if they fail.

The pair the exam returns to

Mycobacterium tuberculosis is inhaled in droplets, taken up by macrophages, and survives inside them – the immune system walls them off (tubercles), but they persist and reactivate when immunity drops. **HIV** infects T helper cells via the CD4 receptor, replicates, and gradually destroys them; untreated infection can severely weaken immune coordination and progress to AIDS. This increases the risk of active TB, including reactivation of a latent infection; reactivation is not inevitable.

■ Worked example: why HIV makes TB worse

T helper cells activate macrophages and drive antibody production; loss of their function weakens the immune response that helps contain TB bacteria. TB infection can remain latent; HIV-associated immune damage increases the risk of progression to active disease.

2 Practice

2.1 Give two structures a bacterial cell has that a virus does not. [2]

2.2 Name two barriers to infection in the respiratory tract. [2]

2.3 State which cell type HIV destroys and one consequence. [2]

3 Exam-style questions

3.1 Compare the structure of a bacterium and a virus under the headings: genetic material, external covering, and organelles. [5]

3.2 Cholera bacteria enter through contaminated water. Name the route, describe two barriers that such bacteria must survive before reaching the gut, and explain how the acidic stomach usually destroys them. [4]

3.3 Explain why a patient with advanced HIV infection may develop several opportunistic infections at once, naming the immune cell affected and two of its normal roles. [5]