

This is the **Higher Separate** version — includes all Higher Tier content (marked ★) and all Separate Science content.

The body has multiple layers of defence against pathogens — both non-specific (work against any pathogen) and specific (targeted to a particular pathogen).

- Non-specific defences: skin (physical barrier), mucus in airways (traps pathogens), cilia (sweep mucus away from lungs), stomach acid (pH 2 — kills most ingested pathogens).
- If pathogens enter the body, white blood cells respond.
- Phagocytes: engulf and digest pathogens by phagocytosis — a non-specific response (works against any pathogen).
- Lymphocytes: produce antibodies — Y-shaped proteins that are complementary to specific antigens on the pathogen.
- Antibody action: bind to antigens → mark pathogen for destruction; clump pathogens together; neutralise toxins.
- Memory lymphocytes: formed during an immune response. Remain in the body long-term. On re-exposure to the same pathogen → much faster, larger antibody response → person rarely notices symptoms (immune).
- ★ **HT Natural killer cells (NK cells):** destroy host cells that are infected by viruses or have become cancerous.

### Key Terms

<b>Antigen</b>	A protein on the surface of a pathogen that triggers an immune response
<b>Antibody</b>	A specific Y-shaped protein produced by lymphocytes that binds to one type of antigen
<b>Phagocytosis</b>	Process by which phagocytes engulf and digest pathogens or debris
<b>Memory cell</b>	Long-lived lymphocyte that enables a rapid immune response on second exposure to a pathogen

■ **Exam Tip:** The specific immune response: 1) Pathogen has antigens → 2) Lymphocytes produce complementary antibodies → 3) Antibodies bind to antigens → 4) Memory cells remain for future protection. Learn this sequence exactly.