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

Efficient gas exchange surfaces share key adaptations: large surface area, thin walls, good blood supply, moist surface.

- Alveoli in lungs: millions of tiny sacs → large total SA, one cell thick, dense capillary network, moist lining

★ **HT** Fish gills: large SA (lamellae), thin walls, counter-current flow — blood flows opposite to water for maximum O■ uptake

- Leaves: stomata in lower epidermis, air spaces in spongy mesophyll — CO■ diffuses to photosynthesising cells

★ **HT** Surface area : volume ratio: smaller organisms/cells have larger ratio → diffusion sufficient without specialised organs

Key Terms

Alveolus	Tiny air sac in lung — site of gas exchange
Lamella	Thin plate in fish gill increasing surface area for gas exchange

■ **Exam Tip:** For any gas exchange surface: always state LARGE surface area AND thin walls (short diffusion distance) AND good blood supply. All three together give maximum marks.