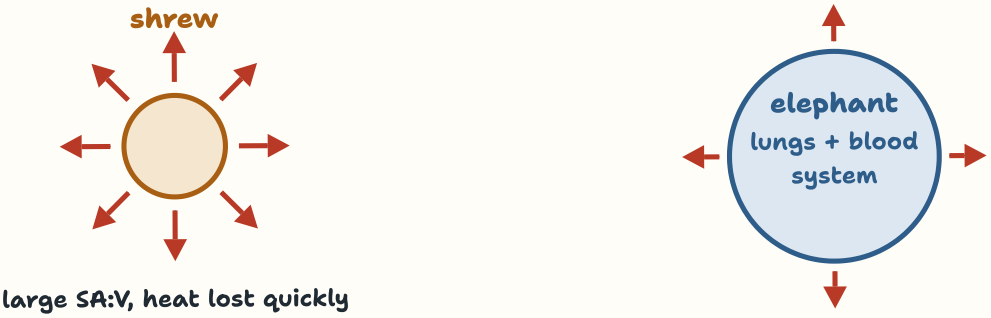
SA:V Ratio, Body Size and Metabolic Rate

A high surface area to volume ratio means fast heat loss and a high metabolic rate; a low ratio means larger organisms need exchange organs and mass transport.

Small body: heat lost fast, high metabolic rate. Large body: needs exchange organs



large SA:V, heat lost quickly
high metabolic rate

small SA:V, long diffusion distance

Key terms

metabolic rate	the rate of energy use (respiration) of an organism.
heat loss	heat is lost across the body surface, so small animals with a large SA:V ratio lose it fast.
surface area to volume ratio	surface area divided by volume; it falls as body size increases.
exchange organ	a specialised organ, e.g. lungs, with a large surface area for gas exchange.
mass transport system	e.g. the circulatory system, which carries substances between exchange surfaces and cells.
body shape	a compact shape lowers SA:V and reduces heat loss; extremities and flat shapes raise it.

I can...

- [ ] Changes to body shape and development of systems in larger organisms as adaptations facilitating exchange as the ratio reduces
- [ ] Relationship between SA:V and metabolic rate

EXAM TRAP

Always link surface area to volume. "The shrew has a large surface area" earns nothing. Say it has a large surface area to volume ratio, so it loses heat quickly and needs a high metabolic rate to replace it.

4 marks: what earns them

1. The shrew has a large surface area to volume ratio, so it loses heat quickly (to its surroundings)
   Not: shrew has a large surface area with no reference to volume; shrew is cold
2. So it needs a high metabolic rate / respires faster to release heat and maintain body temperature
   Not: shrews are more active; high metabolic rate with no link to heat loss
3. The elephant has a small surface area to volume ratio, so diffusion alone is too slow / the diffusion distance is too long to supply all its cells
   Not: elephant has a small surface area with no reference to volume; elephant is too big to diffuse, with no reasoning
4. So it needs a specialised exchange organ (e.g. lungs) with a large surface area AND a mass transport system (e.g. circulatory system); both are needed for the mark, though an answer saying a blood system carries oxygen from an exchange surface to cells earns it
   Not: elephant has organs; heart or lungs named with no function

Remember

Small body, big ratio, heat lost fast.
So respire faster to stay warm.
Large body: lungs and blood take over.

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