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

Plants produce hormones that control growth, development and responses to environmental stimuli. These responses are called tropisms.

★ **HT** Auxins (e.g. IAA): produced in shoot tips. Promote cell elongation in shoots. Move away from light.

★ **HT** Phototropism: shoot bends TOWARDS light. Auxin moves to shaded side → shaded cells elongate MORE → shoot curves towards light.

★ **HT** Gravitropism (geotropism): in roots, high auxin INHIBITS growth (opposite effect to shoots). Auxin accumulates on lower side → lower cells grow less → root grows downward.

★ **HT** Gibberellins: promote seed germination (break dormancy) and stem elongation. Used commercially to produce larger fruit and seedless grapes.

★ **HT** Ethene: a gaseous hormone. Promotes fruit ripening. Used commercially to ripen bananas during transport.

★ **HT** Commercial uses of auxins: rooting powder (stimulates root growth on cuttings); selective weedkillers (broadleaf weeds absorb more auxin → overstimulated growth → die; narrow-leaf crops unaffected).

★ **HT + Sep** Abscisic acid (ABA): promotes stomatal closure in drought conditions and seed dormancy.

Key Terms

Auxin (IAA)	Plant hormone produced in shoot tips — promotes cell elongation in shoots
Phototropism	Growth response of a plant to light — positive phototropism = growth towards light
Gravitropism	Growth response to gravity — roots are positively gravitropic, shoots are negatively gravitropic
Gibberellin	Plant hormone promoting stem elongation and seed germination
Ethene	Gaseous plant hormone promoting fruit ripening

■ **Exam Tip:** Auxin promotes growth in SHOOTS but INHIBITS growth in ROOTS. This is why in gravitropism: auxin accumulates on the lower side of the root → lower side grows less → root grows downward. Confusing this is a very common mistake.