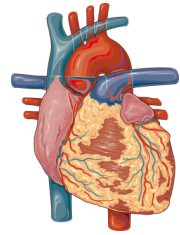


The heart and blood vessels

GCSE Biology — revision notes



How to use these notes: cover the right-hand column. Read each question and answer it from memory, out loud or on paper, then uncover and check. Mark the ones you missed and come back to them.

1. Why we need a transport system

Questions	Key points
Why don't single-celled organisms need a circulatory system?	• diffusion straight across surface membrane • high SA:V ratio → surface supplies enough • e.g. <i>Amoeba</i>, <i>Euglena</i>
Why do large multicellular animals need one?	• low SA:V ratio • volume (demand) grows faster than surface area (supply) • → need circulatory system to actively transport substances
What does the circulatory system transport?	• O₂, glucose, CO₂, urea, hormones, heat

Summary small = high SA:V, diffusion enough. Large = low SA:V, needs transport system.

2. Open vs closed, single vs double circulation

Questions	Key points
Closed vs open circulatory system?	• closed: blood stays in vessels (fish, mammals) • open: pumped into body cavity, flows around organs, not in vessels (insects)
What is single circulation?	• fish • through heart once per circuit • heart → gills → body → heart
What is double circulation? Name its two parts.	• mammals incl. humans; through heart twice per circuit • pulmonary: heart → lungs → heart (picks up O₂, drops off CO₂) • systemic: heart → body → heart (delivers O₂, collects CO₂)

Why is double circulation better for active animals?

- pressure boosted again after lungs → reaches tissues faster, higher pressure
- $\uparrow$ flow rate = $\uparrow$ O₂ for aerobic respiration, waste removed faster
- septum keeps oxygenated / deoxygenated separate → tissues get fully oxygenated blood

Summary fish = single loop (heart once). Mammals = double loop (heart twice): pulmonary + systemic → higher pressure, more O₂ delivered.

3. The heart's structure

Questions	Key points
Name the four chambers and what each does.	• right atrium — receives deoxygenated blood from body (vena cava) • right ventricle — pumps deoxygenated blood to lungs (pulmonary artery) • left atrium — receives oxygenated blood from lungs (pulmonary vein) • left ventricle — pumps oxygenated blood to whole body (aorta)
Trace blood through the heart, starting from the body.	• body → vena cava → RA → tricuspid valve → RV → semilunar valve → pulmonary artery → lungs • lungs → pulmonary vein → LA → bicuspid valve → LV → semilunar valve → aorta → body
Why are atria thin-walled but ventricles thick-walled?	• atria: push blood short distance (into ventricles below) • ventricles: thick, muscular — push blood much further
Why is the left ventricle wall thicker than the right?	• LV: high pressure to pump round whole body • RV: only pumps to nearby lungs
What does the septum do?	• wall of muscle between left + right sides • stops oxygenated / deoxygenated blood mixing
Where are the valves, and what do they do?	• atrioventricular (tricuspid R, bicuspid/mitral L): between atria + ventricles • semilunar: base of aorta + pulmonary artery • prevent backflow → blood moves one way only
What is special about cardiac muscle?	• highly resistant to fatigue • contracts continuously without tiring (unlike skeletal muscle)
What is the pacemaker?	• group of cells in wall of right atrium • electrical impulses → trigger contraction • sets heart rate (~70 bpm at rest)

What do the coronary arteries do?

- branch off aorta
- supply heart muscle itself with oxygenated blood (heart muscle respire too)

Summary 4 chambers (atria receive, ventricles pump). Thick LV for body. Septum separates, valves stop backflow, pacemaker sets rate, coronary arteries feed heart muscle.

4. The cardiac cycle

Questions	Key points
Stage 1 — what happens as the atria fill?	• deoxygenated blood: body → vena cava → right atrium • oxygenated blood: lungs → pulmonary veins → left atrium
Stage 2 — what happens when the atria contract?	• blood pushed through open tricuspid (R) + bicuspid (L) valves • deoxygenated → RV; oxygenated → LV
Stage 3 — what happens as the ventricles fill and start to contract?	• atria empty, ventricles full • tricuspid + bicuspid valves close → no backflow into atria
Stage 4 — what happens when the ventricles contract?	• semilunar valves open • RV → pulmonary artery → lungs (deoxygenated) • LV → aorta → body (oxygenated) • cycle repeats

Summary atria fill → atria contract (AV valves open) → ventricles fill (AV valves close) → ventricles contract (semilunar open) → out to lungs + body.

5. Blood vessels

Questions	Key points
Arteries — direction, pressure, wall, lumen, valves, O₂?	• away from heart; high pressure, pulsing • thick, muscular, elastic wall; small / narrow lumen • no valves; oxygenated (except pulmonary artery)
Why are arteries adapted this way?	• thick elastic / muscular walls stretch + recoil • withstand + smooth out high-pressure surges from ventricles
Veins — direction, pressure, wall, lumen, valves, O₂?	• back to heart; low pressure, smooth flow • thinner wall, less muscle / elastic tissue; large lumen • valves; deoxygenated (except pulmonary vein)
Why are veins adapted this way?	• blood lost most pressure → thin walls fine • valves stop backflow, esp. against gravity from lower body • large lumen = ↓ resistance, blood moves despite low pressure

Capillaries — direction, pressure, wall, lumen, valves, O₂?	- link arteries → veins through tissues; pressure falls, pulse disappears - wall one cell thick; very narrow lumen (RBCs single file) - no valves; lose O₂ along length
Why are capillaries adapted this way?	- one-cell wall → shortest diffusion distance (O₂, glucose, CO₂, waste) - billions → huge surface area for exchange
What is exchanged at the capillaries?	- O₂ + glucose: out of capillaries → cells - CO₂ from cells → capillaries → towards vein
What do arterioles do?	- smaller branches of arteries - act as control valves → regulate blood flow + pressure
Name the four main vessels and where each goes.	aorta — main artery, LV → body (highest pressure) vena cava — main vein, body → RA pulmonary artery — RV → lungs (only artery with deoxygenated blood) pulmonary vein — lungs → LA (only vein with oxygenated blood)

Summary arteries = thick, elastic, high pressure, away. Veins = thin, wide, valves, back. Capillaries = one cell thick, exchange.