Answers to end-of-chapter questions Chapter 9: Transport in animals

1 a hepatic portal vein, liver, hepatic vein, vena cava, right atrium, right ventricle, pulmonary artery, lungs, pulmonary vein, left atrium, left ventricle, aorta, iliac artery

b iliac vein, vena cava, right atrium, right ventricle, pulmonary artery, lungs

2 a Arteries take blood away from the heart; veins take blood towards the heart. Arteries have thick, elastic walls; veins have thinner walls.
Arteries have a narrow lumen; veins have a wider lumen.
Arteries do not have valves; veins have valves.

b Oxygenated blood contains a lot of oxygen (combined with haemoglobin inside the red blood cells) and is bright red. Deoxygenated blood contains less oxygen, and is a duller purplish-red.

C An atrium is one of the upper chambers of the heart, which receives blood and which has thin walls. A ventricle is one of the lower chambers of the heart, which has thick walls that pump blood out of the heart.

d A red blood cell is a small cell with no nucleus, indented, and containing a large amount of haemoglobin. Its function is to transport oxygen. There are several types of white blood cells, but most are larger than red blood cells and they all have a nucleus. They do not contain haemoglobin. Their function is to fight pathogens.

e Blood is made up of plasma, in which red and white blood cells and platelets are present. Lymph has a composition similar to plasma, but does not contain red blood cells or platelets. It does contain white blood cells.

f Systole is the stage of heart beat when the muscle contracts, increasing pressure inside the heart and squeezing the blood forwards. Diastole is the stage when the muscle relaxes, decreasing pressure.

g The hepatic vein transports blood from the liver to the vena cava. The hepatic portal vein transports blood from the small intestine to the liver.

3 a plasma

b white cells

c plasma

d red cells

e platelets and plasma

f plasma

4 Arteries: thick walls to withstand high-pressure blood; elastic walls to withstand pulsing blood; narrow lumen so blood moves through fast.

- Veins: valves to keep low-pressure blood moving in one direction; wide lumen to provide least resistance to blood flow.
- Capillaries: very narrow, so red blood cells have to squeeze through and are brought close to cells that require oxygen; very thin walls with gaps, so substances can easily move between blood and tissue fluid.
- Xylem vessels: dead and hollow so nothing in the way of water movement; narrow, so a tall column of water can be supported without breaking; lignin in walls to make them waterproof and to provide strength; pits in walls to allow water to move sideways.
- Phloem tubes: living but with no nucleus and only a small amount of cytoplasm, so sap can flow through; perforated end walls to allow sap to flow through.

5 a Red cell in diagram measures 23 mm;
so magnification = 23 ÷ 0.007;
= ×3285; [3]

b it has no nucleus;
it has a depression in the centre / is a biconcave disc;
it contains haemoglobin; [3]

c i transporting oxygen;

ii it contains haemoglobin;
which combines reversibly with oxygen;
it has a large surface area to volume ratio;
which speeds up the movement of oxygen into and out of the cell;
it is small;
which allows it to squeeze through very small capillaries;
it has no nucleus;
which makes more room for haemoglobin; [**max 3**]

6 a 2; [1]

b i about 0.75 s;

ii explanation of measuring time between two equivalent points; [1]

c ventricle volume decreasing;
because the muscle is contracting;
ventricular systole; [3]

d when the ventricle contracts, valve shuts;
because of the pressure of the blood pushing upwards on it;
when ventricle relaxes, valve opens; [3]

e line follows the same pattern as the first, at the same times;
but does not rise to such a high volume; [2]

7 a A left atrium;

B bicuspid valve / atrioventricular valve;

C semilunar valve;

D right ventricle. [4]

b E vena cava;

F aorta; [2]

c coronary (arteries);
plaques / cholesterol / fat deposit, in artery wall;
partly blocks artery;
less blood can flow through;
less oxygen carried to heart muscle;
increased likelihood of blood clotting; [**max 3**]

d to keep the blood moving;
to keep the blood oxygenated;
to remove carbon dioxide from the blood; [**max 2**]

e has a septum dividing the two sides of heart;
oxygenated blood on the left and deoxygenated on the right;
both sides contract at the same time;
more muscle on the left side;
so more pressure produced on the left side;
high pressure to most of body;
low pressure to lungs; [**max 4**]