

## HUMAN CIRCULATORY SYSTEM ANSWERS

1. To keep the body at a constant 37°C, to transport oxygen and glucose to and carbon dioxide and water from the body cells in the process of respiration, to transport nutrients such as amino acids vitamins and so on to the body cells where they are required, to transport hormones around the body from source to target cells, to transport white blood cells which fight infection, and platelets which aid in clotting.

2. Haemoglobin is an iron-rich compound within red blood cells which forms an attachment to oxygen or to carbon dioxide to transport them through the body.

3. Haemoglobin also can form attachments to the poisonous carbon monoxide as readily as it attaches to oxygen and carbon dioxide. Therefore a person exposed to carbon monoxide from cigarettes or car exhausts will suffer from loss of oxygen and will be less able to expel waste carbon dioxide from his/her body.

4. \*Plasma - comprises 55% of blood, transports proteins (including hormones) amino acids salts and so on.

\*Red blood cells (erythrocytes) - contain haemoglobin that transports oxygen and carbon dioxide

\*White blood cells (leukocytes) - fight invasion by foreign bacteria or particles (antigens) such as dust by surrounding and ingesting these foreign particles (phagocytosis) or by producing antibodies

\*Platelets - aid in the clotting reaction

5. Three main reactions occur when blood clots. First, when platelets are exposed to a rough damaged surface, they disintegrate to produce thromboplastin. Second, thromboplastin acts enzymatically to convert prothrombin (a plasma protein) to thrombin. Third, thrombin acts enzymatically to convert fibrinogen (a soluble plasma protein) to fibrin which is insoluble. The fibrin traps red and white blood cells to form a solid clot within minutes. Serum is the yellowish liquid that oozes out from the shrinking clot.

6. \*Arteries - take blood away from the heart, elastic and muscular walls

\*Capillaries - smallest and most numerous of blood vessels, diameter is that of one red blood cell therefore blood flow in capillaries is very slow, wall thickness is one cell thick therefore diffusion of gases nutrients and wastes between blood and body cells is efficient

\*Veins - take blood back to the heart, less muscular than arteries, contain valves to allow one-way blood flow

7. Since faulty valves in veins would mean that the blood is not going one-way back to the heart in some parts such as the legs, the person should lie with their feet raised higher than the heart or walk to allow the leg muscles to help push the blood through the veins.

8. Blood flows most slowly through the capillaries because the diameter is only the thickness of one red blood cell. This allows for efficient diffusion of gases nutrients and wastes.

9. Diffusion

10.  $2\ 000\ 000 \times 60 \times 60 \times 24 = 172\ 800\ 000\ 000$

11. Deoxygenated blood from body - Superior and inferior vena cava - Right atrium - Right ventricle - Pulmonary artery - Lungs - Oxygenated blood from lungs through Pulmonary veins - Left atrium - Left ventricle - Aorta - All body cells

12. The heart valves allow the blood to flow one-way from atria to ventricles.

13. Although the foetus receives a blood supply from its mother, the developing foetus has an increasing need for nutrients and oxygen as it grows, and so it needs a pump as soon as possible in its development.

14. The “double” heartbeat is the simultaneous contraction of the atria followed by the simultaneous contraction of the ventricles.

15. (a) The first number indicates the systolic blood pressure immediately after a heartbeat when a pulse of blood is forced into the arteries. The second number indicates the diastolic blood pressure when the heart relaxes.

15. (b) The heart is beating harder because the person is exercising or had a fright.

15. (c) The normally elastic-walled arteries are not as able to dilate and constrict with the flow of blood from the heart because the person has been eating too much salt and fat and these are being deposited on the walls of the arteries.

16. The heart has its own blood supply of nutrients and oxygen from the coronary artery. If this is occluded or blocked due to a person’s long-term salty and fatty diet, the blood will not reach the heart, and the heart muscle will be damaged.

17. The body cells need a continuous supply of glucose and oxygen to respire, giving energy to the cells. If this supply ceases, the cells that are first affected are in the nervous system, so death occurs.

18. A pulse is the wave of blood felt when an artery is compressed over a bone.

19. If a person faints after long periods of standing such as a soldier on parade, then there may be ineffective blood supply to the brain because of gravity. If the person then lies down, the blood supply to the brain is aided by gravity and consciousness returns rapidly.

20. There would be no problem as type O blood contains no foreign antigens that would cause an agglutination reaction in the AB type person.

21. Clotting is a series of enzyme-controlled chemical reactions in a normal body. Agglutination is the clumping or coagulation that occurs when an incorrect transfusion is performed e.g. AB blood donated to a type O person.

22. In the second clotting reaction, calcium ions are essential for thrombin to be formed from prothrombin. pH-neutral sodium citrate combines with calcium ions so the second and third clotting reactions do not occur.