1. **How red blood cells become sickle-shaped**
   - caused by a mutation
   - change in, DNA / base sequence
   - of gene for haemoglobin
   - (causes) a different sequence of amino acids
   - (so) abnormal haemoglobin produced

2. **How sickle-shaped red blood cells affect blood flow**
   - Not biconcave
   - rigid / inflexible
   - get stuck in / block blood vessels / capillaries
   - increased clotting

3.

(d) Fig. 2.2 and Fig. 2.3 are maps showing some of the different regions in a country. Scientists studied the distribution of the Hb^S allele in the country.

Fig. 2.2 shows the estimated frequency of the allele within the population.

Fig. 2.3 shows the estimated number of babies born with sickle cell anaemia in each region.

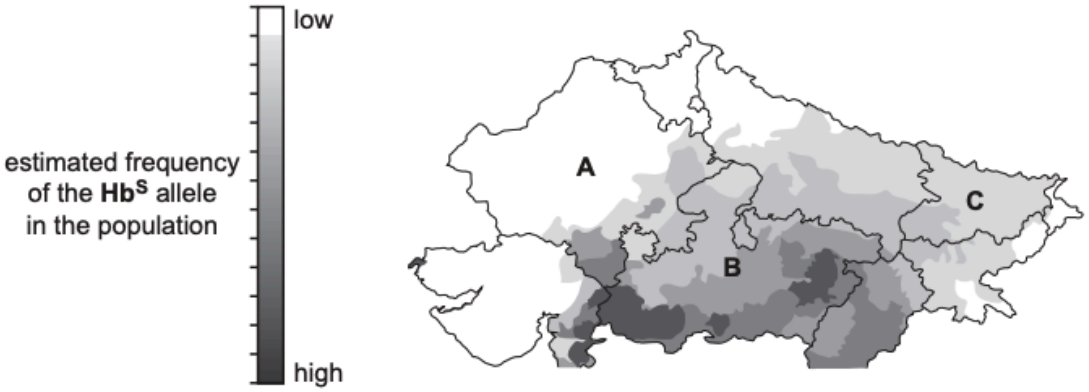


Fig. 2.2

Fig. 2.3

Scientists made a statement: '*There is a relationship between frequency of HbS allele and number of babies born with sickle cell anaemia in regions A, B and C.*' Using information in Fig. 2.2 and Fig. 2.3 discuss evidence for and against this statement for regions A, B and C.

For:

- B has highest births and highest HbS (allele) frequency
- C has lowest number of births and low HbS (allele) frequency

Against:

- A has almost no / lowest HbS (allele) frequency, but medium births
- B supports the statement but A does not support the statement; no link between births and allele frequency
- data is estimated not actual
- maps have different level of detail
- effect of population density not considered

4. **How blockages in coronary arteries can be treated**
   - stent ;
   - (small) mesh / gauze, tube inserted in artery ;
   - opens / supports, (narrow / weak) artery ;
   - (balloon) angioplasty / dilatation ;
   - (tube / catheter with) balloon inserted into artery ;
   - inflate balloon to widen artery ;
   - by-pass ;
   - (another / shunt) blood vessel, joined to / grafted to / replaces, artery ;
   - AVP ; e.g. aspirin / warfarin / ref to treatment of clots

5. **Describe structure of a vein**
   - has valves ;
   - wide, lumen / AW ;
   - thin wall ;
   - (wall) lined by single layer of cells ;
   - (wall) contains muscle (fibres) ;
   - (wall) contains elastic (fibres) ;

6. **Evidence of double circulatory system**
   - heart has, two / left and right, sides / AW ;
   - blood flows through the heart twice in one (complete) circuit / AW (of the body)
   - there are 2 separate blood circuits: pulmonary and systemic circuits / circuits from heart to lungs and from heart to rest of body ;

7. **Advantages of double circulation**
   - 1 oxygenated and deoxygenated blood, are kept separate / do not mix / separated by septum ;
   - 2 ensures efficient supply of oxygen (to, body / AW) ;
   - 3 ensures efficient supply of (named) nutrients (to, body / AW) ;
   - 4 low(er) pressure in, pulmonary, artery / circuit / AW ;
   - 5 to prevents damage to (capillaries in the) lungs ;
   - 6 allows more time for gas exchange ;
   - 7 allows high(er) pressure (in body) ;
   - 8 to ensure efficient, blood supply to (rest of) body ;
   - 9 to allow filtration in kidneys (for excretion) ;
   - 10 to allow / maintain, a high, metabolic rate / rate of respiration ;

8. **Explain why the ECG trace recorded during exercise differs from the ECG trace recorded at rest.**

   ECG during exercise:
   - 1 increased, frequency of heart beats / pulse rate ;
   - 2 exercising muscles require more energy ;
   - 3 for muscle contraction ;
   - 4 increase in respiration ;
   - 5 faster blood flow (to muscles) ;
   - 6 to supply more, oxygen / glucose ;
   - 7 to remove more carbon dioxide ;

9. **way of monitoring the activity of the heart.**
   - ECG
   - Counting/measuring pulse rate
   - listening to the valves of the heart shutting

10. **Function of septum**
    - separates the left side and the right side of the heart / separates right atria and ventricle from the left atria and ventricle ;
    - Separates / prevents mixing of oxygenated & deoxygenated blood

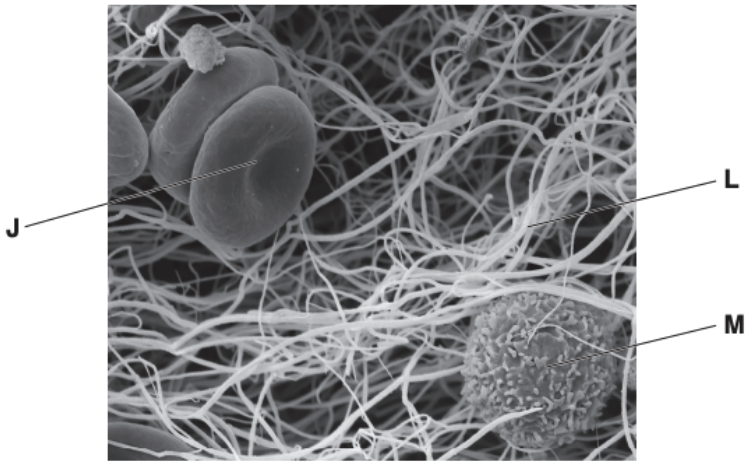
11. **Advantages of double circulation**
    - Allows blood to flow at lower pressure in pulmonary circuit
    - Prevents damage to capillaries in lungs
    - Allows more time for gas exchange
    - Allows blood to flow at higher pressure in body
    - For efficient supply of oxygen / nutrients to body

- For efficient removal of carbon dioxide / urea / wastes from body
- For efficient filtration in kidneys for excretion
- To allow / maintain a high metabolic rate / rate of respiration

12. Formation of blood clot

- Occurs with the help of platelets
- Soluble fibrinogen converted to insoluble fibrin
- Fibrin forms a mesh
- Fibrin traps (red) blood cells

13. Label the following parts:



J = red blood cell

L = fibrin

M - white blood cell

Fibrin (L) traps the blood cells (J & M)

14. Importance of blood clotting

- prevents blood loss
- prevent pathogens entering a wound

15.

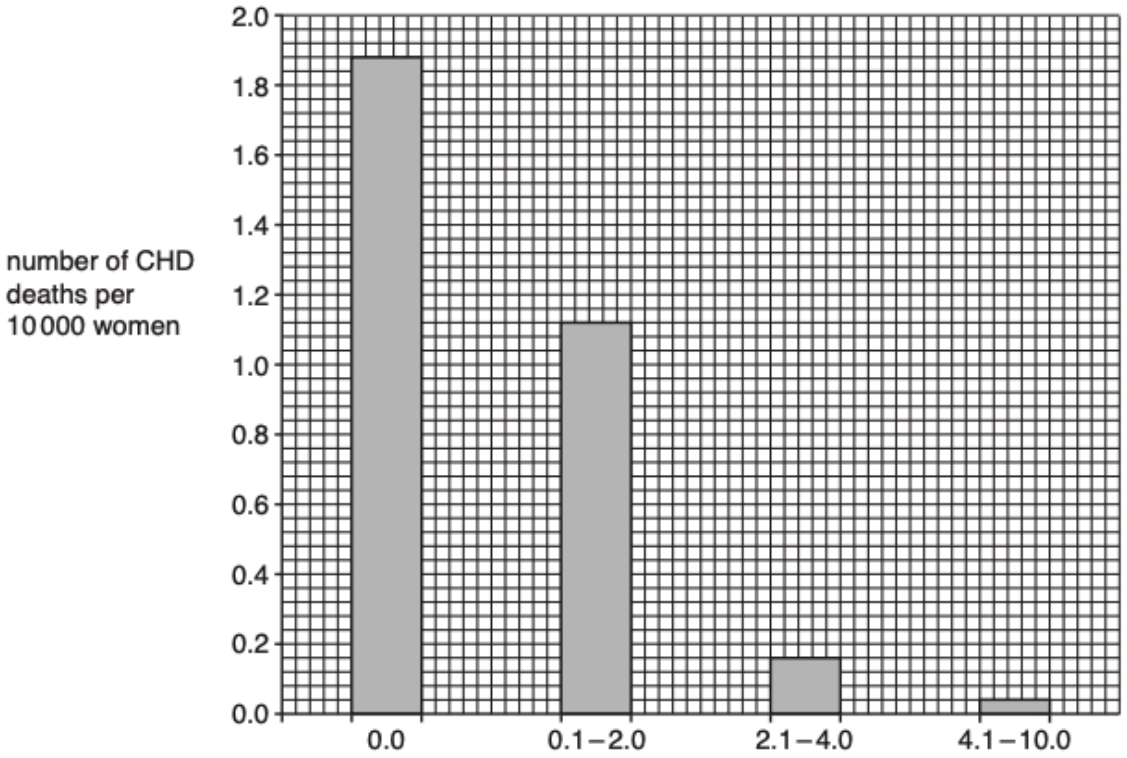
(b) Many health specialists think that the risk of coronary heart disease can be reduced by doing regular exercise.

A long-term study of a large group of women was used to test this hypothesis.
The women were between 35 and 45 years old at the start of the study.
Every two years the same group of women were asked how much they were exercising.

After 28 years the researchers analysed their data:

- They calculated the average time spent exercising per week by each woman.
- They put the women into categories determined by how much exercise they had done.
- For each category, they calculated the number of women who died from coronary heart disease (CHD).

The results are shown in Fig. 5.2.



Health professionals wanted to use results of this study to encourage whole population to exercise more. Discuss the arguments for and against health professionals using this study in this way.

Arguments for:

- as exercise increased CHD deaths decreased
- comparative data quote with units
- the same group of people were studied
- regular measurements were taken
- large benefit from doing only a small amount of exercise, therefore it is easy & efficient

- even if there are some doubts about the benefits no harm will be done

Arguments against:

- only women in the study
- none younger than 35 at the start of the study
- number of deaths per 10 000 is very small even for those that do not exercise
- other risk factors not considered
- e.g. diet / smoking / alcohol / genetics
- other variables not considered ; e.g. pre-existing conditions / medication / type of exercise / length of exercise
- some may have forgotten / not answered correctly about how much exercise they did
- some may have been successfully treated for CHD / not died from the condition

16. Why exercise causes increase in heart rate

- more blood flow to muscles
- to deliver more oxygen / glucose
- for aerobic respiration
- more energy required / to provide more energy
- for muscle contraction
- To remove excess CO_2 produces
- To transport/ remove lactic acid to liver/ muscle
- refer to effect of adrenaline
- To remove heat from muscles / ref to maintain constant internal body temperature ;

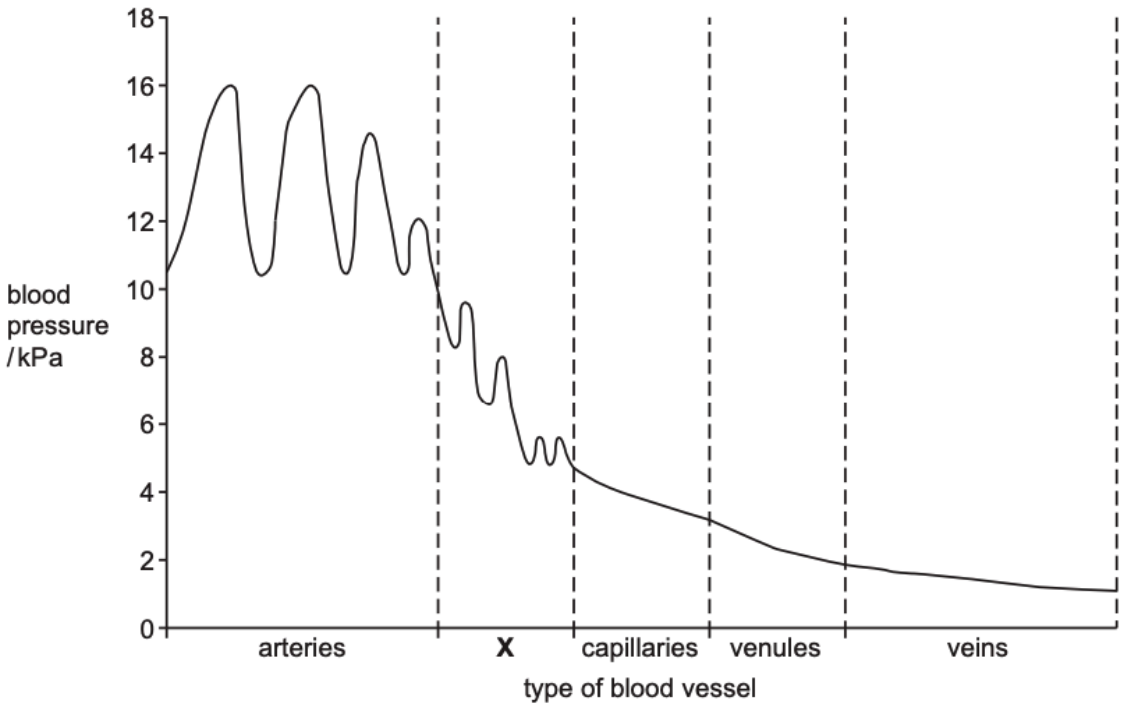
17. State the products of the action of protease on the protein fibrin.

Amino acids

18. Why blood through arteries flows at high pressure

- Narrow lumen
- Thick elastic wall

19.



Explain reasons for the changes in pressure seen in the arteries

- (change in pressure) caused by contraction of muscles (of the heart / ventricle) ;
- pressure increases when the, heart / ventricles, contract / pumps ;
- pressure decreases when the, heart / ventricles, relax ;
- pressure decreases as you move further from the heart

Using the information in the figure, explain the structural adaptations of arteries and veins

<u>arteries:</u>

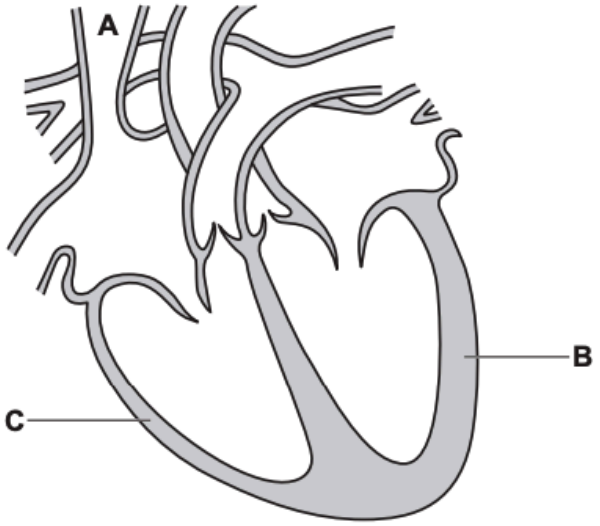
- thick / muscular, wall to withstand the high blood pressure ;
- wall contains elastic tissue to stretch and recoil ;
- (relatively) narrow / small, lumen maintains (high) blood pressure ;

<u>veins:</u>

- (relatively) large / wide, lumen to provide less resistance for blood flow / AW (at low pressure) ;
- large lumen to carry larger volume of blood ;
- valves to prevent backflow (caused by low pressure) ;

20.

Fig. 3.1 is a diagram of a section through a human heart.



Explain the reason for the difference between the thickness of the walls at B and at C

- left ventricle / thicker wall / B, contains more muscular tissue ;
- left ventricle / thicker wall / B, can contract with more force ;
- left ventricle / thicker wall / B , pumps blood at high(er) pressure ;
- left ventricle / thicker wall / B, pumps blood a long(er) distance ;

A red blood cell enters the vena cava at A in Fig. 3.1. Explain how the red blood cell is moved from the vena cava to the aorta.

- carried in the (flowing) blood ;
- from the vena cava / A, into the right atrium ;
- from the right atrium to the right ventricle as the right atrium, contracts / pumps ;
- out of the right ventricle into the pulmonary artery as the right ventricle contracts ;
- through the lungs / pulmonary circulation / into the pulmonary veins ;
- from pulmonary vein to the left atrium ;
- from the left atrium to the left ventricle as the left atrium contracts ;
- out of the left ventricle into the aorta as the left ventricle contracts ;
- (correct atria to correct ventricle) through the atrioventricular valve / atrioventricular valves close to prevent backflow ;
- (correct ventricle to (correct) artery) through the semilunar valve / semilunar valves close to prevent backflow ;