

(b) State, with reasons, whether a picornavirus can be seen using the light microscope.

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.....
..... [3]

(c) With reference to Fig. 1.1, describe how the picornavirus enters the host cell.

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..... [3]

[Total: 8]

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(c) Fig. 2.1 shows blood pressure changes that occur in the left ventricle, left atrium and aorta during one cardiac cycle.

E, F, G and **H** are the points at which a valve opens or closes as a result of blood pressure changes.

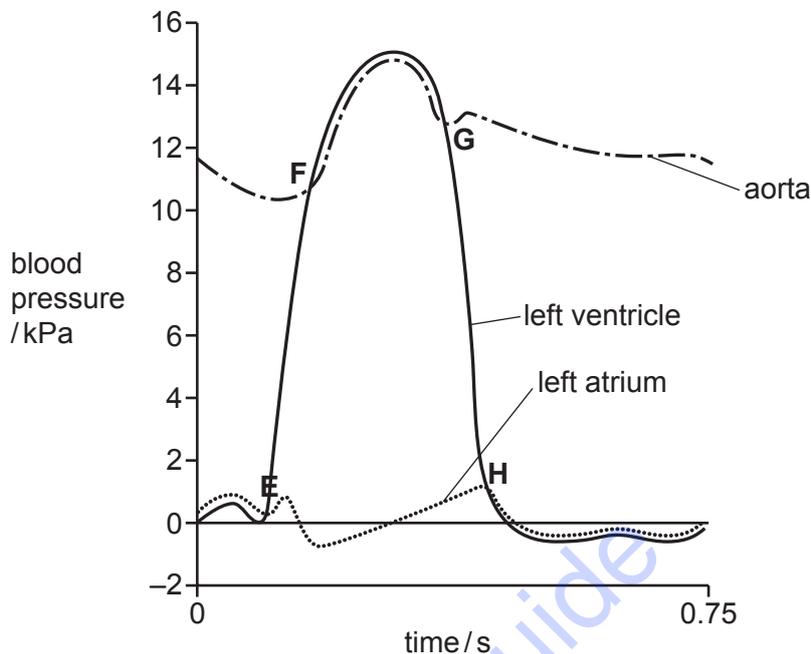


Fig. 2.1

(i) For each of the points **E, F, G** and **H** on Fig. 2.1, name the valve concerned **and** state whether the valve opens or closes.

E

F

G

H

[3]

(ii) Explain how Fig. 2.1 provides evidence that the wall of the left atrium has a different thickness to the wall of the left ventricle.

.....

[2]

[Total: 9]

3 The Bacillus Calmette-Guérin (BCG) vaccine is the only vaccine used to provide protection against the infectious bacterial disease tuberculosis (TB). Most countries of the world have a BCG vaccination programme.

(a) TB is most commonly transmitted from person to person by aerosol infection. The causative organism is present in airborne droplets.

Name the species of causative organism of TB commonly passed from person to person by aerosol infection.

..... [1]

(b) In general, the countries that do not have a BCG vaccination programme are high-income countries that have a low number of cases of TB. In most of these countries, the vaccine is given only to babies and children at high risk of developing TB.

Suggest **one** reason why a child in a country with a low number of cases of the disease could be at a high risk of developing TB.

.....

 [1]

(c) Countries are classified by the World Bank into one of four income groups.

Table 3.1 shows the estimated incidence of TB for 2012 to 2016 for these income groups.

The incidence represents the number of new cases of TB occurring per 100 000 people in one year. The new cases include the number of cases that have occurred again after a period of recovery (relapse TB).

Table 3.1

| | | incidence per 100 000 people | | | | |
|--------------|--|------------------------------|------|------|------|------|
| year | | 2012 | 2013 | 2014 | 2015 | 2016 |
| income group | | | | | | |
| low | | 253 | 244 | 238 | 231 | 224 |
| lower middle | | 244 | 240 | 236 | 232 | 227 |
| upper middle | | 84 | 81 | 78 | 76 | 74 |
| high | | 14 | 13 | 13 | 12 | 12 |

4 Collagen is a major component of the cartilage found in some of the structures of the human gas exchange system. Cells that synthesise and secrete the components of cartilage are known as chondrocytes.

(a) Fig. 4.1 is a transmission electron micrograph of a chondrocyte.

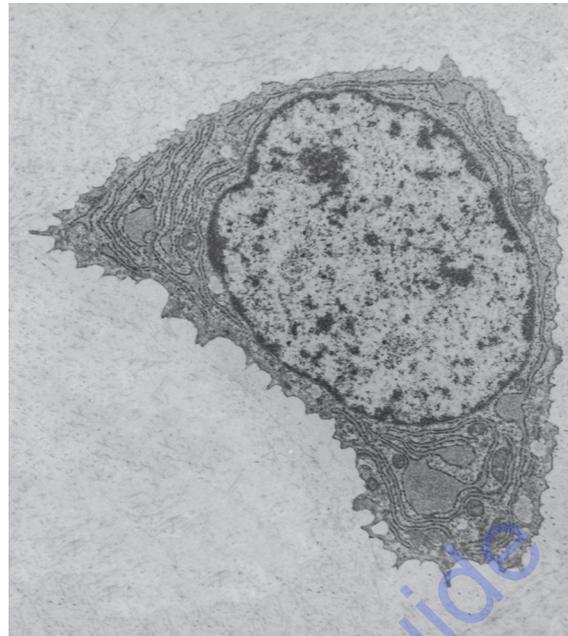


Fig. 4.1

With reference to Fig. 4.1, explain **two** features of the chondrocyte that show how the cell is adapted to its function.

.....

.....

.....

.....

..... [2]

(b) (i) Describe the distribution of cartilage in the human gas exchange system.

.....

.....

.....

.....

..... [2]

(ii) Outline the function of cartilage in the human gas exchange system.

.....

.....

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.....

..... [2]

(c) Fig. 4.2 shows part of the primary structure of a collagen polypeptide.

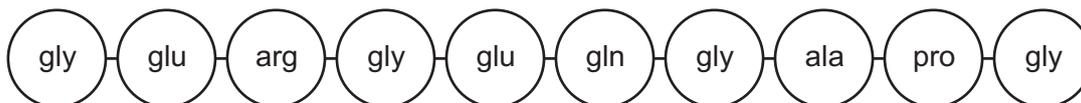


Fig. 4.2

(i) Name the type of covalent bond formed between the amino acids shown in Fig. 4.2.

..... [1]

(ii) Fig. 4.3 shows the molecular structure of the amino acid glycine (gly).

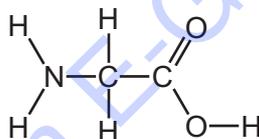


Fig. 4.3

With reference to Fig. 4.2 and Fig. 4.3 and the function of collagen, explain how the structure of a collagen polypeptide makes it suitable to form a collagen molecule.

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..... [3]

[Total: 10]

- (c) UDPG is used in some algae (photosynthetic protists) to synthesise a storage compound known as floridean starch.

The molecular structure of floridean starch has been described as an intermediate between amylopectin and glycogen, with little or no amylose.

Describe the molecular structure of floridean starch by completing the passage.

Floridean starch is a polysaccharide composed of monomers.

The monomers are joined by and linkages,

to give a branching structure that is less highly branched than

..... .

[4]

[Total: 15]

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6 The mitotic cell cycle in dividing cells is very carefully controlled.

(a) Complete Table 6.1 to show the correct order of stages in the mitotic cell cycle.

Some of the stages have been completed for you.

Table 6.1

| stage of cell cycle | | |
|---------------------|----------------------|---|
| ↓ | G ₁ phase | } |
| | | |
| | | |
| | | } |
| | | |
| | | |
| | | |
| | telophase | } |
| | cytokinesis | |

[3]

At various points during the mitotic cell cycle, checks are made. A cell goes through cell death (apoptosis) if errors occur that cannot be repaired. This makes sure that the daughter cells produced are genetically identical to each other and to the original cell.

Drugs have been developed that can inhibit the mitotic cell cycle and cause the cell to carry out apoptosis. These drugs are used in the treatment of cancer.

(b) Vincristine and 5-fluorouracil are chemical compounds that act as cell cycle inhibitors and can lead to apoptosis.

- Vincristine binds to spindle microtubules and prevents the spindle from carrying out its function.
- 5-fluorouracil prevents the synthesis of thymine nucleotides.

Complete Table 6.2 to show which event in the cell cycle will occur when Vincristine or 5-fluorouracil are added to healthy dividing cells at the start of the interphase stage of the cell cycle.

Place a tick (✓) if the event will occur or a cross (✗) if the event will **not** occur.

All boxes in the table should be completed.

Table 6.2

| event in cell cycle compound | S-phase completes | cell enters prophase of mitosis | chromosomes line up at spindle equator | sister chromatids move towards opposite poles |
|---|--------------------------|--|---|--|
| Vincristine | | | | |
| 5-fluorouracil | | | | |

[2]

(c) Vincristine has been used in the treatment of certain types of leukaemia.

Fig. 6.1 is a photomicrograph of a blood smear of a person with one form of leukaemia, which affects lymphocytes.

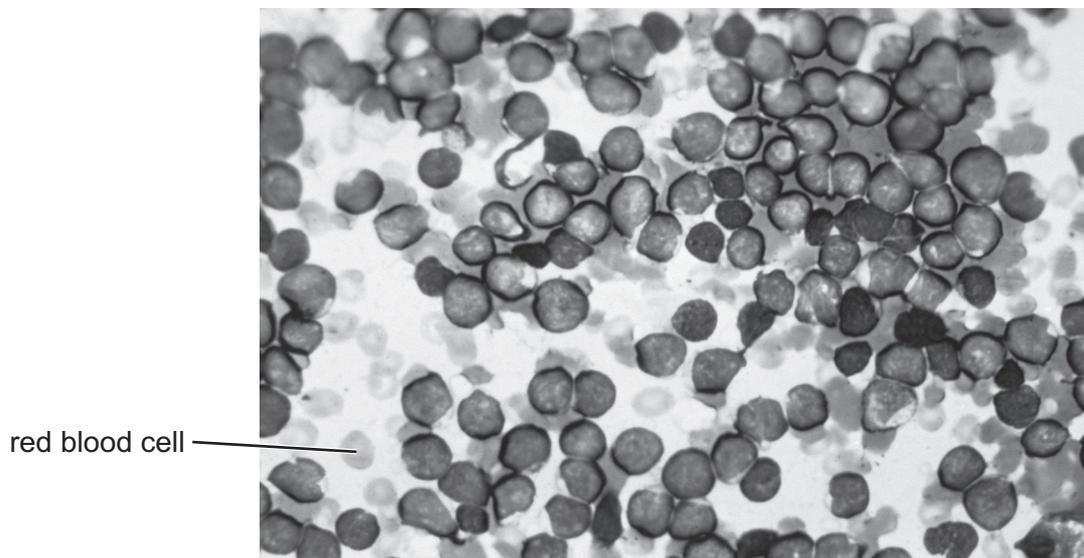


Fig. 6.1

Describe how:

- the blood smear shown in Fig. 6.1 differs from a blood smear of a healthy person
- the lymphocytes in a person with leukaemia, such as those shown in Fig. 6.1, differ from those of a healthy person.

blood smear differences

.....

.....

.....

.....

lymphocyte differences

.....

.....

.....

.....

..... [3]

[Total: 8]

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