

SAMPLE TEXTBOOK ANSWERS

Chapter 14 New body cells

The following are sample answers only. Other answers to the same questions may also be correct.

Science inquiry

Activity 14.2 Observing mitosis

- 1 Draw a cell that is in each of the four phases.

Answer: See Figure 14.3 on page 183 for illustrations of the four phases.

- 2 Notice that you cannot see the spindle in any of the cells. Suggest why it cannot be seen.

Answer: The spindle is made up of very narrow fibres that are too small to be seen with a school microscope.

- 3 Estimate the number of chromosomes in the cells you are observing. How does your estimate compare with that of others in your class?

Answer: Answers will depend on the species observed. Onions have a chromosome number of 8.

- 4 If you observed onion cells, what major difference did you see between those cells and the animal cells we have discussed in this chapter?

Answer: The main difference is that plant cells have a cell wall and the animal cells do not. Cytokinesis is also different in plant and animal cells. In animal cells a deepening furrow forms between the two daughter cells and eventually divides the cytoplasm into two. In plant cells a cell plate forms – a disc of cellulose between two dividing cells. The cell plate gradually increases in diameter until it divides the cytoplasm into two.

Activity 14.3 The incidence of cancer in Australia

Use references to find out:

which cancers are the most common in Australia

Answer:

- The most common cancers in Australia are:
 - prostate cancer, which accounts for 17.9% of all cancers diagnosed
 - bowel cancer, 13.1%
 - breast, 11.7%
 - melanoma, 9.5%
 - lung cancer, 9%

Data is from the Cancer Council of NSW.

whether there is any relationship between the type of cancer and where people live

Answer:

- The only demonstrated relationship between the type of cancer and where people live in Australia is between skin cancers and sun exposure. Queensland has the highest incidence of skin cancers in Australia because of its high level of solar radiation.

the age groups at which particular cancers are more common in Australia

Answer:

- The most common childhood cancers in Australia are leukaemia (cancer of bone marrow and blood), brain tumours, lymphoma (cancer of lymphoid tissues) and neuroblastoma (cancer that starts in nerve cells of an embryo or foetus).

Age group	Common cancer sites
15–39	Malignant melanoma, breast (women), testis (males), lymphoma and thyroid
40–64	Breast (women), prostate (men), melanoma, colorectal (bowel) and lung
65 plus	Prostate (men), breast (women), bowel, lung, and melanoma

Data is from the Cancer Council WA.

whether there is any upward or downward trends in the incidence of particular cancers in Australia.

Answer:

- Diagnosis of all cancers in Australia is trending upwards because of:
 - population growth
 - ageing of the population
 - improved methods for early diagnosis.

Review questions

1 a What is the cell cycle?

Answer: The cell cycle refers to the sequence of events that take place in a cell during the interphase period and cell division.

b Describe what happens in the four phases of the cell cycle.

Answer:

- G₁ phase: The cell grows (producing new proteins).
- S phase: DNA molecules replicate.
- G₂ phase: There is a short period of additional growth.
- M phase: The events of mitosis occur and the cell divides.

2 What is the function of the DNA in the nucleus of a cell?

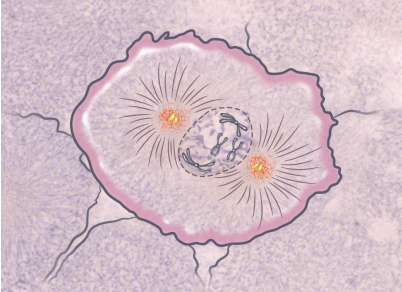
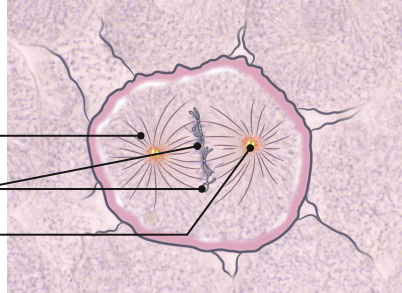
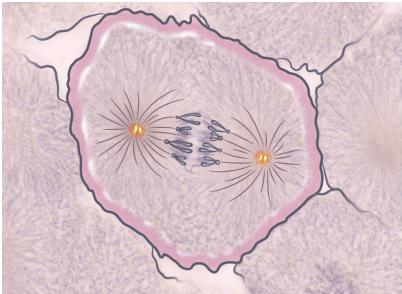

Answer: DNA determines the types of protein that the cell can make.

3 Explain the difference between a chromatid and a chromosome.

Answer: A chromosome is a tightly coiled thread of DNA. When the chromosomes become visible during cell division, they are already duplicated. Each duplicate is called a chromatid because they share a centromere. The pair of chromatids with their centromere is a chromosome. When the centromeres divide during cell division each chromatid becomes a chromosome with its own centromere.

4 Draw up a table (similar to Table 14.2) to summarise, in your own words, the events of mitosis. In your table include a column with a drawing showing the changes taking place at each stage.

Answer:

Stage	Events occurring	Diagram of stage
Interphase	DNA replicates in preparation for mitosis.	
Prophase	Nuclear membrane disappears; centrioles migrate to opposite poles; chromosomes become visible as pairs of chromatids joined by a centromere; spindles form.	
Metaphase	Chromosomes line up on equator of spindle, attached to spindle fibres by their centromeres.	
Anaphase	Centromeres divide and daughter chromosomes move to opposite ends of spindle.	
Telophase	Spindle disappears; nuclear membranes form around each group of chromosomes; nucleoli form; chromosomes uncoil.	

5 Name three places where mitosis would be occurring in the body of a healthy adult human. Explain why cell reproduction is necessary in these places.

Answer: Any three of:

- Lining of the alimentary canal
- Cheek epidermis
- Skin
- Cervix
- Tongue

There is a lot of wear-and-tear in these areas, so cell reproduction is necessary for replacement of cells that are damaged and worn away.

6 How does mitosis ensure that each daughter cell has exactly the same genetic information as the parent cell?

Answer: Chromosomes replicate and at mitosis one of each copy separates into each daughter cell.

7 Explain the difference between a benign and a malignant tumour.

Answer: A malignant tumour is one that undergoes metastasis, giving rise to secondary tumours. Benign tumours do not spread to other parts of the body.

8 a What is a carcinogen?

Answer: Carcinogens are environmental factors that are known to cause malignant tumours.

b Give five examples of carcinogens.

Answer:

- X-rays
- UV radiation
- Certain viruses
- Radiation

Substances such as asbestos, organic solvents, soot, tar, tobacco tar and alcohol

9 For what cancers are screening programs currently being run in Australia?

Answer:

- Cervical cancer in women
- Breast cancer in women
- Bowel cancer

There is no screening program for prostate cancer in men but tests are available for men who wish to be checked.

10 Describe the most common tests for:

a bowel cancer

Answer: A test for blood in the faeces, known as a faecal occult blood test

b breast cancer

Answer: Mammogram, which is an X-ray of the breast

c prostate cancer

Answer: The most common test is a digital rectal examination. Blood tests for prostate specific antigen are also common.

d cervical cancer.

Answer: A Pap smear to test for abnormal cells from the cervix

Apply your knowledge

1 Skeletal muscle cells and most nerve cells remain in the G_0 phase of the cell cycle. Is it likely that these cells would be dividing? Explain your answer.

Answer: The cells would not be dividing because in the G_0 phase of the cell cycle cell division does not occur.

2 Explain the function and significance of the chromosome changes that occur in mitosis.

Answer: Before mitosis, chromosomes replicate to form two chromatids. During mitosis, the chromatids separate and one of each pair goes to each daughter cell. Thus, one copy of every chromosome enters the new daughter cells. The significance is that each daughter cell gets exactly the same genetic information as the parent cell.

3 What do you think would happen if the spindle fibres did not form in a cell that was undergoing mitosis?

Answer: The chromosomes would not separate, so when cytokinesis occurs the daughter cells would have random numbers of chromosomes. It is unlikely that a daughter cell would end up with one complete set of chromosomes.

4 Explain why medical scientists hope that many diseases that have so far been untreatable may be able to be treated using stem cells.

Answer: Stem cells, if conditions are appropriate, can differentiate into different types of specialised cells. Scientists hope that stem cells will provide replacement cells for diseased or damaged tissues.

5 a List as many reasons as you can for the fact that Australia has the highest incidence of skin cancer in the world.

Answer:

- Most of Australia has high levels of ultraviolet (UV) radiation.
- Australians are particularly fond of outdoor pursuits where they are exposed to UV.
- Australians are very keen on sport and most sports are played outdoors.
- A very high proportion of Australians have light skin with little melanin.
- Many Australians live close to the coast and enjoy swimming and other water-based activities.

b How can you change your habits to reduce the risk of skin cancer?

Answer: Answers will depend on the individual but may include:

- staying out of the sun during times of highest UV radiation
- wearing a hat or other protective clothing
- using sunscreen
- wearing sunglasses.

c Describe any recommended changes in beach wear that are aimed at reducing exposure to UV radiation.

Answer:

- Rash vests
- Legionnaire's hats or broad-brimmed hats
- T-shirts
- Close fitting, wraparound sunglasses
- Clothing made of material with high ultraviolet protection factor (UPF)

6 List reasons why our exposure to carcinogens is greater today than it has been in the past.

Answer:

- X-rays and medical scans have increased exposure to radiation.
- Synthetic materials are used more often, and may sometimes contain carcinogenic substances.
- Modern lifestyle increases exposure to carcinogenic agents.
- People are living longer, so the time available for exposure is increased.
- Higher population densities increase the spread of carcinogenic viruses.

7 Think carefully about your own lifestyle.

- a** What aspects of your lifestyle are already reducing your risk of developing cancer later in life?
- b** How could you change your lifestyle to further reduce your risk of developing cancer?

Answer: Answers to these questions will depend on the individual. There are no right or wrong answers – the aim of the questions is to make students think about their lifestyle.

8 Use references to research the advantages and disadvantages of diagnostic tests for prostate cancer. Draw up a table to list the advantages and disadvantages.

Answer:

Prostate cancer test	Advantages	Disadvantages
Digital rectal examination	Easily administered	Depends on the skill of the medical examiner It is not possible to feel all of the prostate
Blood test for PSA	Detects an increase in the prostate specific antigen (PSA)	Not all elevations in PSA are necessarily due to cancer
Biopsy	Determine if cancerous cells are present	Invasive and expensive because it involves surgery Requires skilled medical practitioners