

Strand 2: Living things and their environment

2.1: The cell

Section A

1. A
2. B
3. B
4. B
5. B
6. B
7. A
8. B
9. B
10. C
11. A
12. B
13. B

Section B

1.
 - (a) A temporary slide is a microscope specimen prepared for immediate or short-term observation and is not intended for long-term storage.
 - (b) Distilled water keeps the onion cells moist and prevents them from drying out. Coverslip. holds the specimen in place and protects the specimen and microscope lens. Iodine acts as a stain that increases the contrast of the cell structures, making structures such as the nucleus and cytoplasm easier to see under the microscope.
 - (c) Handle the coverslip carefully to avoid breaking it or trapping air bubbles. Use clean slides and equipment to prevent contamination of the specimen.
2.
 - (a) A – nucleus; B – cytoplasm; C – cell membrane; D – cell wall
 - (b) Nucleus - It stores genetic materials and controls all the activities of the cell.
Cytoplasm - It is a fluid containing water and dissolved substances where organelles are suspended. It is a medium through which chemical reactions take place.
Cell membrane - It controls or regulates materials getting in and out of the cell.
Cell wall- It provides mechanical support. It maintains the shape of the cell. It protects the plant against injury.
 - (c) Cell wall; chloroplast.
3.
 - (a) Place the prepared slide on the stage and secure it with the stage clips. Select the low-power objective lens. Use the coarse adjustment knob to bring the specimen into focus. Use the fine adjustment knob to obtain a clear, sharp image.
 - (b) Because it provides a wider field of view, making it easier to locate the specimen.

- (c) Carry the microscope with two hands, supporting the base and holding the arm.
Lower the objective lens carefully and avoid allowing it to touch the slide. Place the microscope on a flat stable surface.

4.

- (a) A – mounted needle, B – glass slide, C - beaker, D – coverslip
 - (b) It should be lowered gently to avoid trapping air bubbles under the coverslip and to prevent damage or breakage of the coverslip.
 - (c) Air bubbles can obscure the specimen and make the cells difficult to observe clearly.
5. Nucleus - Controls the activities of the cell. Chloroplast - Carries out photosynthesis in plant cells. Vacuole - Stores cell sap and helps maintain turgidity in plant cells. Mitochondrion - Releases energy through respiration.

6.

- (a) Total magnification = Eyepiece magnification $\times$ Objective magnification
 $= \times 10 \times \times 40$
 $= \times 400$
- (b) $= \times 5 \times \times 20$
 $= \times 100$
- (c) Amina observed the specimen under a higher magnification. Amina's total magnification was $\times 400$, while the other was $\times 100$.
- (d) Higher magnification makes small cell structures appear larger, allowing them to be observed and studied in greater detail.

7.

- (a) Thin onion epidermis. A prepared permanent animal tissue slide, such as a cheek epithelial cell slide.
- (b) Onion epidermal cells are easy to obtain and prepare for immediate observation. They can be placed on a slide, stained and observed without needing long-term preservation.
- (c) Permanent slides are preferred because they contain preserved animal cells or tissues and avoid the need to collect specimens directly from learners, which reduces the risk of contamination and infection.
- (d) They can be stored and used repeatedly for future observations. They reduce the risk of contamination or infection when studying animal tissues.

8.

- (a) Chloroplast.
- (b) Chloroplasts contain chlorophyll, which absorbs light energy needed for photosynthesis.
- (c) Because lack of light prevents chlorophyll production. As a result, the green chlorophyll is reduced or absent, making the leaves appear yellow or pale.
- (d) They enable plants to carry out photosynthesis and make their own food. They help provide chemical energy stored in glucose, which supports plant growth and other life processes.

9.

- (a) A – cell wall, B - cytoplasm, C – nucleus
- (b) Medium in which parts of a cell are suspended. Medium in which chemical reactions take place.

- (c) Has a central nucleus. Vacuoles are absent in most animal cells but when present they are small and scattered in the cytoplasm.

2.2: Movement of materials in and out of the cell

Section A

1. B
2. A
3. B
4. A
5. C
6. B
7. B
8. C
9. B
10. C
11. B
12. B
13. B
14. B

Section B

1.
 - (a) Cell membrane.
 - (b) It is selectively permeable. It is thin. It is flexible.
 - (c) Very high temperatures can damage the cell membrane, causing it to lose its selective permeability. As a result, substances may move into or out of the cell uncontrollably.
 - (d) It controls the movement of substances into and out of the cell. It separates and protects the contents of the cell from the surrounding environment.
2.
 - (a) Diffusion.
 - (b) Perfume particles moved from the region of higher concentration near the broken bottle to regions of lower concentration farther away. The particles continued spreading until they became more evenly distributed in the surrounding air.
 - (c) Gaseous exchange in plants and animals; absorption of digested food; removal of waste products from cells and single-celled organisms; prey smell reached the predators by diffusion; sniffer dogs sense and detect illegal drugs by smell that reaches them through diffusion; insect pollinators are attracted to flowers through scent from the flowers that reaches them through diffusion.
 - (d) Higher temperature gives particles more kinetic energy. They move faster, increasing the rate of diffusion.
3.
 - (a) Temperature.
 - (b) The hot water has a higher temperature than the cold water. Particles in the hot water have more kinetic energy and move faster. Therefore, potassium permanganate particles diffuse more quickly through the hot water, causing the purple colour to spread faster.

- (c) Concentration gradient; Surface area
- (d) Concentration gradient: A larger difference in concentration causes diffusion to occur faster. Surface area: A larger surface area provides more space for particles to cross, so diffusion occurs faster.

4.

- (a) Set-up A - The volume of liquid inside the Visking tubing increases. Set-up B - The volume of liquid inside the Visking tubing decreases.
- (b) Set-up A: The solution inside the Visking tubing is more concentrated than the distilled water outside. Water moves from the distilled water into the Visking tubing through the partially permeable membrane. This causes the volume of liquid inside the tubing to increase. Set-up B: The distilled water inside the Visking tubing is more concentrated in water than the salt solution outside. Water moves from inside the tubing into the salt solution through the partially permeable membrane. This causes the volume of liquid inside the tubing to decrease.
- (c) Osmosis.

5.

- (a) Both involve the movement of particles from a region of higher concentration to a region of lower concentration. Both are passive processes, so they do not require energy from the cell.
- (b)

Diffusion	Osmosis
Involves the movement of particles or molecules.	Involves the movement of water molecules.
Does not require a selectively permeable membrane.	Requires a selectively permeable membrane.
Particles move from high concentration to low concentration.	Water moves from a region of higher water concentration to lower water concentration.

- (c) A selectively permeable membrane allows water molecules to pass through while restricting certain solute particles. Without such a membrane, there is no barrier to control the movement of water relative to the solute concentration, so osmosis cannot occur.

6.

- (a) During the hot afternoon, leaves droop due to the loss of water from the leaf cells through osmosis. This drooping helps to reduce the surface area exposed to the sun, minimising water loss through transpiration.
- (b) The petiole cells absorb water from neighbouring cells through osmosis and become turgid again.
- (c) Osmosis.

7.

- (a) Salt creates a highly concentrated solution around the fish. Water moves out of the fish cells by osmosis. The reduced moisture prevents or slows the growth and reproduction of microorganisms that cause spoilage.
- (b) Osmosis.

- (c) Water moves out of the microorganisms by osmosis. The microorganisms become dehydrated, which inhibits their growth and may cause them to die.
- (d) Refrigeration; Drying; Smoking; Boiling

8.

- (a) The rat.
- (b) The rat is smaller than the giraffe. Smaller organisms generally have a larger surface area to volume ratio. This provides a relatively larger surface through which substances can diffuse compared with their body volume, making diffusion more efficient.
- (c) In very small organisms, most cells are close to the body surface, so substances can travel short distances by diffusion. In large organisms, many cells are far from the body surface, making diffusion alone too slow to supply substances to all cells. Large organisms therefore have specialised transport systems that move substances rapidly over long distances.

9.

- (a) Carbon (IV) oxide diffuses into leaves through the stomata for photosynthesis. Oxygen produced during photosynthesis diffuses out of the leaves through the stomata.
- (b) Oxygen diffuses from the alveoli into the blood. Carbon (IV) oxide diffuses from the blood into the alveoli.
- (c) Water moves from the soil into root hair cells by osmosis. Water enters plant cells, making them turgid and supporting the plant.
- (d) Water is reabsorbed from the kidney tubules into the blood by osmosis. Water moves into or out of animal cells depending on the concentration of the surrounding solution.

2.3: Reproduction in human beings

Section A

- 1. B
- 2. B
- 3. C
- 4. B
- 5. A
- 6. C
- 7. B
- 8. B
- 9. C
- 10. C
- 11. B
- 12. C

Section B

- I.
 - (a) Irregular.
 - (b) A typical menstrual cycle is about 28 days.
 - (c) Stress, medication, health conditions and eating disorders; when one is going through puberty, breastfeeding or menopause.

- (d) Treatment using medicine; weight management exercise; stress management activities; maintaining a balanced diet; nutritional therapy to manage eating disorders.

2.

- (a) Irregular periods, irregular bleeding, cramps, headache, missing periods

(b)

Irregular period	Treatment using medicine; weight management exercise; stress management activities; maintaining a balanced diet; nutritional therapy to manage eating disorders.
Irregular bleeding	Treatment using medicine; weight management exercise; stress management activities.
Cramps	Treatment using medicine; exercises; heat therapy using water bottles.
Headache	Treatment using medicine; sleeping or relaxation activities.
Missing periods	Treatment using medicine; weight management exercise; stress management activities; maintaining a balanced diet; nutritional therapy to manage eating disorders.

- (c) Tracking helps them know when to expect their next period and identify unusual changes such as very long, short or missed cycles that may require medical attention.

3.

- (a) Fertilisation is the fusion of a male gamete and a female gamete to form a zygote. Implantation is the attachment of the developing embryo to the lining of the uterus.
- (b) Fertilisation: Fallopian tube/oviduct. Implantation: Uterus, specifically the uterine lining/endometrium.
- (c) Release of sperms → Ovulation → Formation of a zygote → Implantation

4.

- (a) Ovulation.
- (b) A mature ovum is released from an ovary. The ovum enters the fallopian tube, where it may be fertilised if sperms are present.
- (c) The uterine lining becomes thick and well supplied with blood vessels to provide a suitable site for implantation and nourishment of the embryo.
- (d) The ovum eventually degenerates and the hormone levels supporting the uterine lining fall. The uterine lining breaks down and is shed as menstrual blood.

5.

- (a) HIV and AIDS; Gonorrhoea; Syphilis; Genital herpes
- (b) Abstaining or avoiding any form of sexual activity.
Use of protection such as condoms during sexual activity.
Being faithful to one partner for married couples.
Avoiding sharing needles and other piercing or cutting objects.

Going for regular testing.

6.

- (a) Abstaining from sexual activity. Avoiding multiple sexual partners. Using condoms correctly and consistently if sexually active.
- (b) They may cause infertility or reproductive complications. They may lead to serious long-term health problems and can increase the risk of transmitting the infection to others.
- (c) To detect infections early, including infections that may have no obvious symptoms.
To enable early treatment and reduce transmission to others.

7. Patient A- Genital herpes

Patient B – Gonorrhoea

Patient C – HIV and AIDS

Patient D – Syphilis