

## Q1. (2018)

- 12 The surface area of a single red blood cell is
- $1.5 \times 10^{-4} \text{ mm}^2$
- .

The volume is  $1 \times 10^{-7} \text{ mm}^3$ .

What is the surface area to volume ratio of a red blood cell?

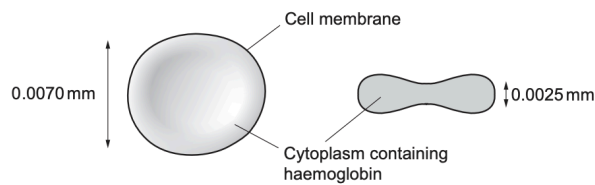
- A 0.0015 : 1
- B 0.7 : 1
- C 1.5 : 1
- D 1500 : 1

Your answer 

[1]

## Q2. (2018)

- 13 The diagram shows a red blood cell.



|   | Distance oxygen travels to get to haemoglobin from blood plasma | Surface area to volume ratio | Nucleus present |
|---|-----------------------------------------------------------------|------------------------------|-----------------|
| A | Large                                                           | Small                        | Yes             |
| B | Short                                                           | Large                        | Yes             |
| C | Short                                                           | Large                        | No              |
| D | Large                                                           | Large                        | No              |

Which row in the table shows how red blood cells are adapted for transport of oxygen?

Your answer 

[1]

## Q3. (2019)

- 11 A cell structure measures 1 micrometre in diameter.

What is the diameter of the cell structure in metres?

- A  $1 \times 10^{-3}$  metres
- B  $1 \times 10^{-6}$  metres
- C  $1 \times 10^{-9}$  metres
- D  $1 \times 10^{-12}$  metres

Your answer 

[1]

## Q4. (2019)

- 12 A human cell has 10000 mitochondria and a yeast cell has 10.

By how many orders of magnitude are there more mitochondria in a human cell than in a yeast cell?

- A 2
- B 3
- C 10
- D 1000

Your answer 

[1]

Q5. (2019)

20 A scientist clones a cauliflower plant.



He uses small pieces of the cauliflower plant called explants.

This is the method the scientist uses to get the explants:

- Place the equipment in a beaker of bleach and swab the bench with 70% alcohol.
- Collect a small piece of cauliflower and place on a white tile.
- Using a scalpel cut the piece of cauliflower lengthways into small 3–5 mm pieces called explants.
- Measure the mass of the explants.

A)

- (c) The scientist observes some of the tissues of the growing explants using a light microscope.

The diagram shows some of the plant cells.



The diameter of **X** has been magnified 500 $\times$ .

What is the actual diameter of **X**?

Give your answer in **standard form**.

Diameter = ..... mm [2]

B)

- (d) Transmission **electron** microscopes (TEM) work by passing a beam of electrons through a very thin slice of an object.

Suggest **one** advantage and **one** disadvantage of using TEM rather than a light microscope to look at cells.

advantage .....

.....

disadvantage .....

..... [2]

### Q6. (2020)

- 6 The resolution of an electron microscope is 0.1 nanometres.

The resolution of the eye is 100 micrometres.

How many times greater is the resolution of the electron microscope than the eye?

(1 micrometre = 1000 nanometres)

- A 1000  
B 10 000  
C 100 000  
D 1 000 000

Your answer

[1]

### Q7. (2020) – 16a

- 16 Some students investigate the effect of the surface area : volume ratio on the rate of diffusion in animal cells.

They use hydrochloric acid and gelatine cubes that have been stained blue using a pH indicator solution. The indicator will turn red in acidic conditions.

They put different sized cubes into 3 different test tubes of hydrochloric acid and time how long it takes for the cubes to completely change to red.

Fig. 16.1 shows the apparatus they use.

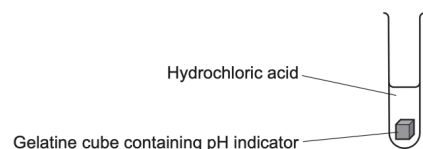


Fig. 16.1

The table shows the students' results.

| Length of each side of the cube (mm) | surface area : volume ratio | Time to completely change colour (seconds) |
|--------------------------------------|-----------------------------|--------------------------------------------|
| 2                                    | .....                       | 32                                         |
| 4                                    | 3 : 2                       | 61                                         |
| 6                                    | 1 : 1                       | 170                                        |

- (iii) Emphysema causes some of the walls of alveoli in the lungs to break down. This produces a smaller number of larger air sacs.

Use the results to explain the effect of emphysema on oxygen diffusing into the blood.

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.....

.....

..... [2]

### Q8. (2021)

- 6 Which feature of electron microscopy has allowed scientists to increase their understanding of sub-cellular structures?
- A The ability to increase magnification using an eyepiece and objective lens.
- B The ability to magnify  $\times 1500$ .
- C The ability to view living cells.
- D The ability to view and identify two structures 1 nm apart.

Your answer

☐

[1]

### Q9. (2021)

- 15 A cheek cell is  $70\text{ }\mu\text{m}$  and a red blood cell  $7\text{ }\mu\text{m}$ .

What is the order of magnitude difference between a cheek cell and a red blood cell?

- A 0
- B 1
- C 2
- D 3

Your answer

☐

[1]

### Q10. (2022)

- 9 A student cuts a cube of potato to use in an experiment. Each face of the cube is 2 cm by 2 cm.

What is the surface area : volume ratio of the cube?

- A 3 : 1
- B 4 : 8
- C 8 : 24
- D 16 : 8

Your answer

☐

[1]

### Q11. (2022)

- 19 In 2018, a newspaper headline suggested that a cure for blindness had been found.

The newspaper was reporting on a study looking at operations in patients with age-related macular degeneration (AMD). In AMD, part of the retina is damaged.

A)

- (a) Describe the role of the retina **and** suggest why damage to this part of the eye could cause blindness.

.....

.....

.....

..... [2]

B)

- (b) There are two types of AMD, wet and dry.

In wet AMD, tiny blood vessels 5 – 10  $\mu\text{m}$  in size grow as the body tries to repair the retina.

Name the type of blood vessels that grow.

..... [1]

C)

- (c) During the study, researchers used embryonic stem cells to try to repair the sight of two individuals with wet AMD.

- (i) One year later, both patients' eyesight had improved.

Explain why the newspaper headline claim of a cure may be misleading.

.....  
 .....  
 .....  
 ..... [2]

D)

- (ii) Suggest **one other** factor the researchers need to find out before this treatment is made widely available to all people with AMD.

.....  
 ..... [1]

Q12. (2022)

24 Fig. 24.1 shows how stem cells in bone marrow differentiate into red blood cells.

Fig. 24.2 shows how the concentration of RNA and haemoglobin changes as the stem cell differentiates and the area of the nucleus changes.

Fig. 24.1

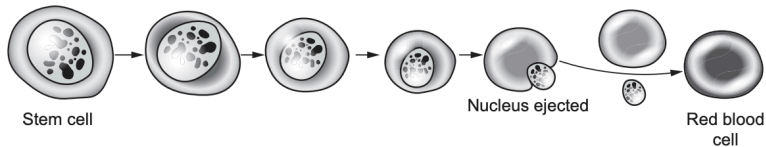
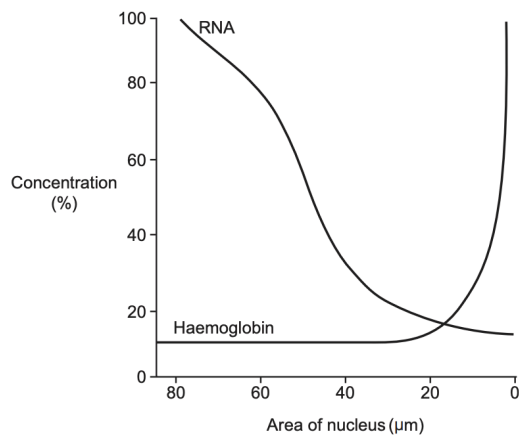


Fig. 24.2

Red blood cell development



(b) A male has:

- 4.7 million red blood cells per microlitre of blood.
- 4.5 litres of blood.

(1 litre = 1 000 000 microlitres)

Calculate how many red blood cells are in his blood.

Give your answer in standard form.

Number of red blood cells = ..... [3]

Q13. (2023) – 16b

(b) The image is of a mitochondrion.



A)

(i) Draw the mitochondrion in the box. Your drawing should be a scientific drawing.



[2]

B)

(ii) What type of microscope was used to create the image of the mitochondrion?

Explain your answer.

Type of microscope .....

Reason .....

[2]

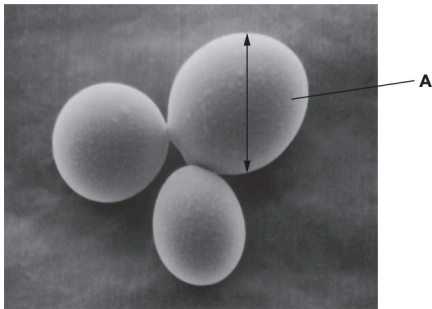
C)

(c) Name **one** structure found in both an animal cell and a prokaryotic cell.

..... [1]

Q14. (2024) – 21b

- (b) The image is of some yeast cells taken using an electron microscope.



The actual diameter of the yeast cell labelled **A** is  $2.8\text{ }\mu\text{m}$ .

( $1\text{ mm} = 1000\text{ }\mu\text{m}$ )

Calculate the magnification used to produce this image.

Give your answer to **3** significant figures.

Magnification = ..... **[4]**