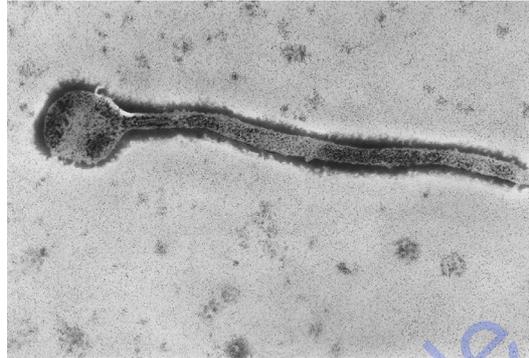


- 1 What is the definition of the resolution of a light microscope?
- A** the degree of sharpness produced by the microscope
- B** the greatest distance between two objects visible in the same field of view
- C** the minimum distance that allows two objects to be viewed as separate
- D** the size of the smallest object visible using the microscope
- 2 The electron micrograph shows a type of virus at a magnification of  $\times 30\,000$ .



What is the length of the virus?

- A**  $2.2 \times 10^3$  nm
- B**  $2.2 \times 10^2$  nm
- C**  $2.2 \times 10^1$  nm
- D**  $2.2 \times 10^0$  nm
- 3 Which row correctly shows a feature of a cell structure?

|          | site of protein synthesis    | makes lysosomes              |
|----------|------------------------------|------------------------------|
| <b>A</b> | smooth endoplasmic reticulum | rough endoplasmic reticulum  |
| <b>B</b> | ribosomes                    | Golgi body                   |
| <b>C</b> | rough endoplasmic reticulum  | ribosomes                    |
| <b>D</b> | Golgi body                   | smooth endoplasmic reticulum |

- 4 Four students were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed by a number.

- 1 organises microtubules to produce the spindle during cell division
- 2 synthesis of polypeptides
- 3 packaging of hydrolytic enzymes that will remain in the cell

The appearances were listed by a letter.

- V membranes which surround an enclosed inner cavity
- W non-membrane bound, spherical structures
- X a double membrane with many pores
- Y non-membrane bound, cylindrical structures
- Z membrane-bound sacs, arranged as a flattened stack

Which student correctly matched the numbered function with the appearance of the cell structure?

|   | 1 | 2 | 3 |
|---|---|---|---|
| A | W | X | Y |
| B | W | Z | W |
| C | Y | W | Z |
| D | Y | Z | Z |

- 5 The features of some cells and cell structures that make ATP are listed.

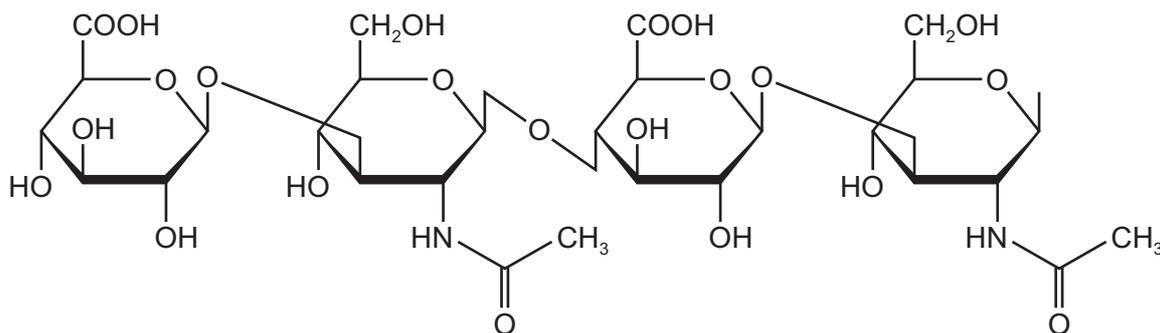
- 1 has outer boundary membrane and folded inner membrane
- 2 has peptidoglycan cell wall outside an outer boundary membrane
- 3 has a double boundary membrane and stacks of inner membranes

Which row identifies these components?

|   | 1             | 2             | 3             |
|---|---------------|---------------|---------------|
| A | bacterium     | chloroplast   | mitochondrion |
| B | chloroplast   | bacterium     | mitochondrion |
| C | chloroplast   | mitochondrion | bacterium     |
| D | mitochondrion | bacterium     | chloroplast   |



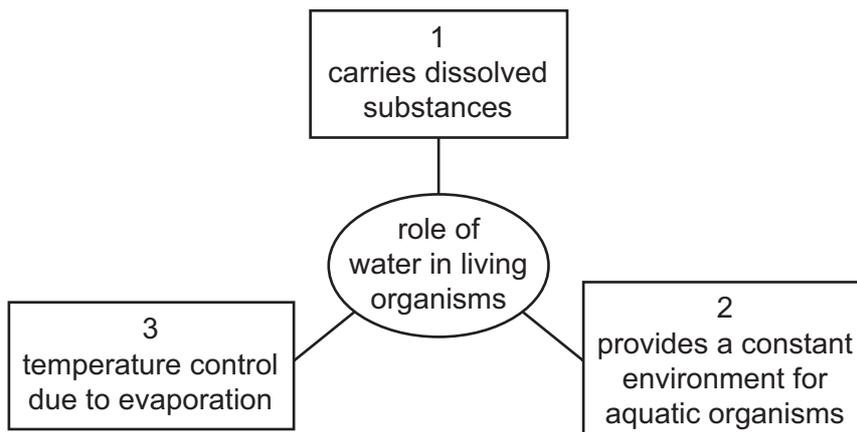
- 9 The diagram shows part of the chemical structure of a naturally occurring polysaccharide.



What types of glycosidic bonds are present?

- A**  $\alpha$ -1,3 and  $\alpha$ -1,4  
**B**  $\alpha$ -1,4 and  $\alpha$ -1,6  
**C**  $\beta$ -1,3 and  $\beta$ -1,4  
**D**  $\beta$ -1,4 and  $\beta$ -1,6
- 10 What is the maximum number of water molecules produced when a triglyceride is synthesised?
- A** 3                      **B** 2                      **C** 1                      **D** 0
- 11 What occurs during the formation of a peptide bond between two amino acids?
- A** OH is removed from COOH and H is removed from an R group.  
**B** OH is removed from COOH and H is removed from NH<sub>2</sub>.  
**C** H is removed from COOH and OH is removed from an R group.  
**D** O is removed from COOH and 2H is removed from NH<sub>2</sub>.

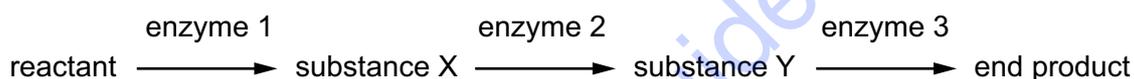
12 The diagram represents roles of water in living organisms.



Which roles are dependent upon hydrogen bonds between water molecules?

- A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

13 The diagram shows a metabolic pathway.



What would be the effect of adding a small amount of a non-competitive inhibitor of enzyme 2?

- A** Enzyme 2 would be partially denatured.  
**B** Substance X would increase in concentration.  
**C** Substance Y would no longer be formed.  
**D** The initial reactant would no longer be metabolised.

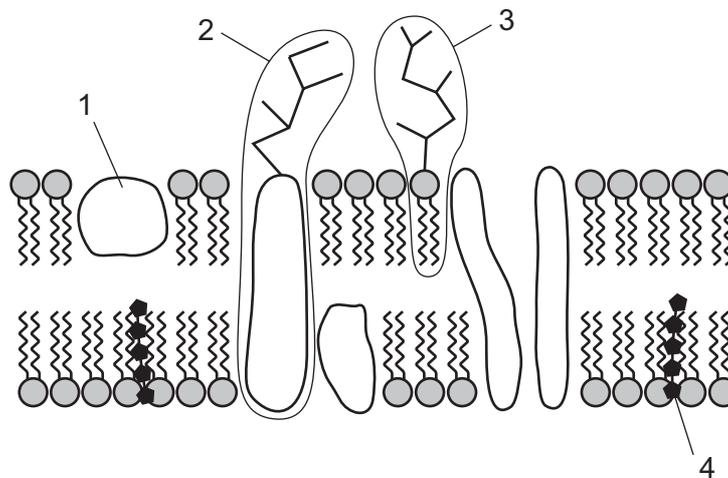
14 Two enzymes are added to a solution containing a low concentration of a substrate that they can both use.

Which statement is correct?

- A** Both enzymes will use equal amounts of the substrate.  
**B** Neither enzyme will be able to use the substrate.  
**C** The enzyme with the lower  $V_{\max}$  will use less of the substrate than the other enzyme.  
**D** The enzyme with the lower  $V_{\max}$  will use more of the substrate than the other enzyme.

15 The diagram shows the fluid mosaic model of membrane structure.

Structures 1, 2, 3 and 4 are types of molecule.



Which types of molecules are always identical?

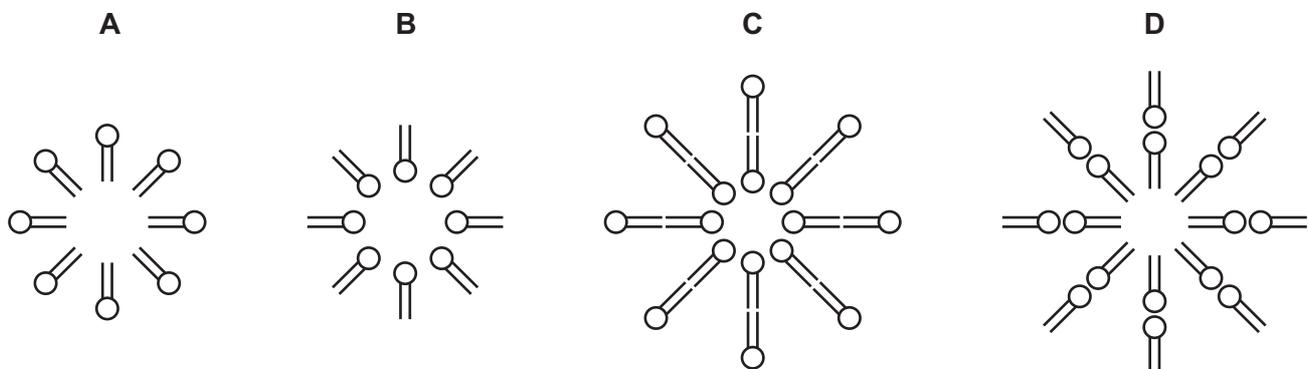
- A** 1, 2 and 3      **B** 1 and 4      **C** 2 and 3 only      **D** 4 only

16 What is the role of G protein in cell signalling?

- A** to act as a membrane-bound enzyme  
**B** to act as a switch releasing a second messenger  
**C** to amplify the original signal  
**D** to change the shape of the protein receptor

17 When a small quantity of phospholipid is added to a test-tube of water and then shaken vigorously, an emulsion is formed by small droplets called liposomes.

Which diagram shows the arrangement of phospholipid molecules in a cross-section of a liposome?



18 What are the features of facilitated diffusion?

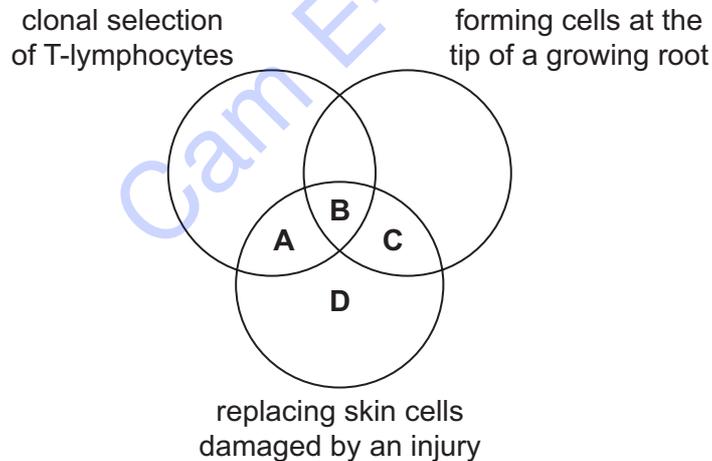
- 1 It uses protein channels in the membrane and is driven by the energy from ATP.
- 2 It moves molecules from regions of higher concentration to lower concentration and is driven by the kinetic energy of the molecules which are diffusing.
- 3 It uses protein channels in the membrane, and the maximum rate of diffusion depends on the number of these channels.

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

19 Which description of chromosome structure is correct?

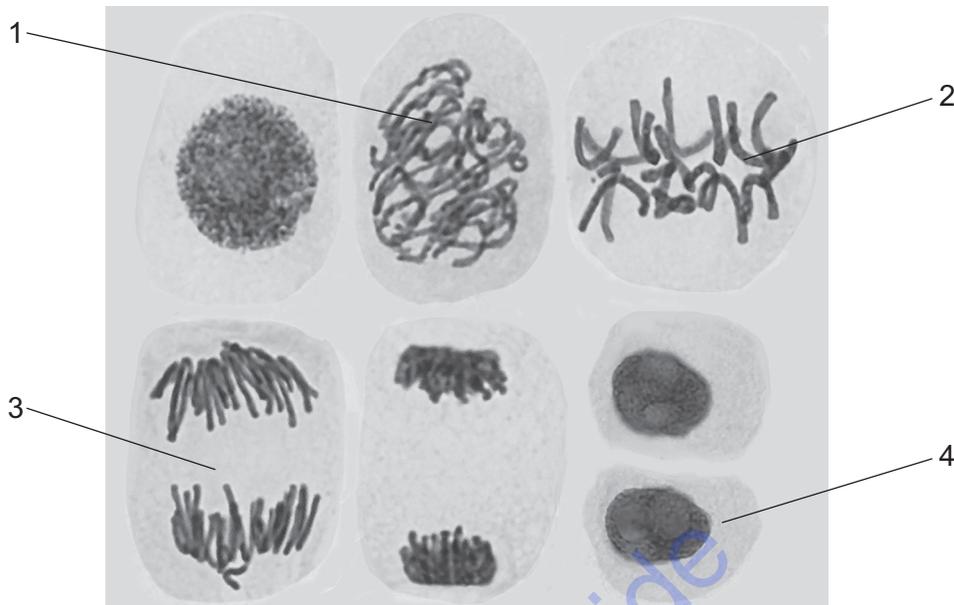
- A** A chromosome at the beginning of interphase consists of two identical chromatids, each containing one linear molecule of DNA.
- B** Telomeres are lengths of non-coding DNA found at one end of each chromatid to prevent loss of genes during cell division.
- C** The two identical chromatids of a chromosome are held together by a centromere in which there is no DNA.
- D** The very long DNA molecule of each chromatid is coiled and held together by proteins called histones.

20 Which processes involve mitosis?



- 21** A drug has been developed to treat certain types of cancer. It prevents mitosis by binding to the spindle and preventing sister chromatids being separated and moving to opposite poles of the cell.

The photomicrograph shows cells in different phases of mitosis.



What represents the stages of mitosis that will be able to occur in a cell which is entering prophase when treated with this drug?

- A** 1 and 2      **B** 2 and 3      **C** 2 only      **D** 3 and 4
- 22** Some viruses have single-stranded DNA as their genetic material. This DNA molecule has to be folded to fit in the protein coat.

Which statements about single-stranded DNA are correct?

- 1 Single-stranded DNA cannot replicate semi-conservatively.
- 2 If only the percentage of cytosine is known, then the percentage of guanine can be calculated, but the percentage of adenine and thymine cannot be calculated.
- 3 Hydrogen bonds may be present within the DNA molecule.

- A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

- 23** How many statements are true for semi-conservative replication of DNA in a eukaryotic cell?

- 1 The process takes place in the nucleus.
- 2 Adenine will line up against uracil on the complementary strand.
- 3 Each new molecule will contain one strand of the original molecule.
- 4 If the original molecule contained 40% guanine each new molecule will contain 20% guanine.

- A** 1      **B** 2      **C** 3      **D** 4

- 24 Part of the nucleotide sequence of an mRNA molecule is shown, with spaces between the codons.

CAG UAC AGC AAU CUA UAA

The translation of the codons is provided.

| codon | amino acid or STOP |
|-------|--------------------|
| AAU   | asn                |
| AGC   | ser                |
| CAG   | gln                |
| CUA   | leu                |
| UAA   | STOP               |
| UAC   | tyr                |
| UAU   | tyr                |

Which events will cause the termination of polypeptide synthesis during translation?

- 1 Deletion of C from the leu codon.
- 2 Deletion of C from the tyr codon.
- 3 The ribosome reaching the UAA codon.

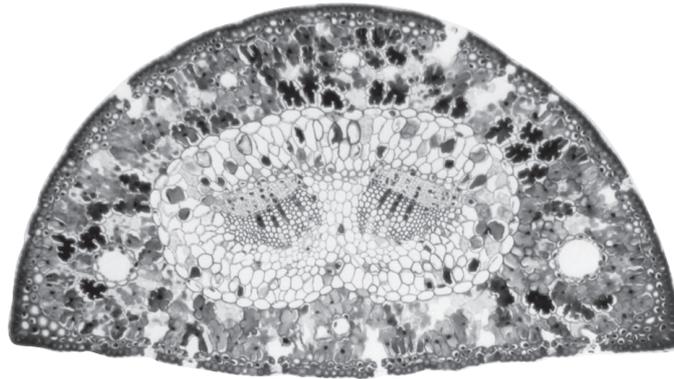
**A** 1, 2 and 3    **B** 1 and 2 only    **C** 1 and 3 only    **D** 2 and 3 only

- 25 External factors change the rate of transpiration, which also affects the water potential gradient of cells in the leaf.

Which combination is correct?

|          | external factor changing the rate of transpiration | water potential gradient in the leaf |
|----------|--|--------------------------------------|
| <b>A</b> | decreasing temperature                             | increases                            |
| <b>B</b> | decreasing wind speed                              | increases                            |
| <b>C</b> | increasing relative humidity                       | decreases                            |
| <b>D</b> | increasing sunlight                                | decreases                            |

26 The photomicrograph shows a transverse section through a leaf.



□50

Which features of a xerophytic leaf are visible in this section?

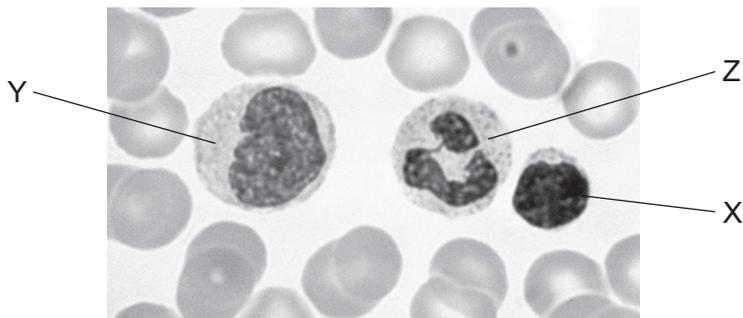
- 1 sunken stomata
- 2 two layers of epithelium
- 3 thick cuticle
- 4 small surface area to volume

**A** 1, 2, 3 and 4    **B** 1 and 2 only    **C** 1 and 3 only    **D** 3 and 4 only

27 Which changes occur as carbohydrates move out of a root cell into a phloem sieve tube?

|          | water potential in a phloem sieve tube becomes | volume of liquid in phloem sieve tube |
|----------|--|---------------------------------------|
| <b>A</b> | less negative                                  | decreases                             |
| <b>B</b> | less negative                                  | increases                             |
| <b>C</b> | more negative                                  | decreases                             |
| <b>D</b> | more negative                                  | increases                             |

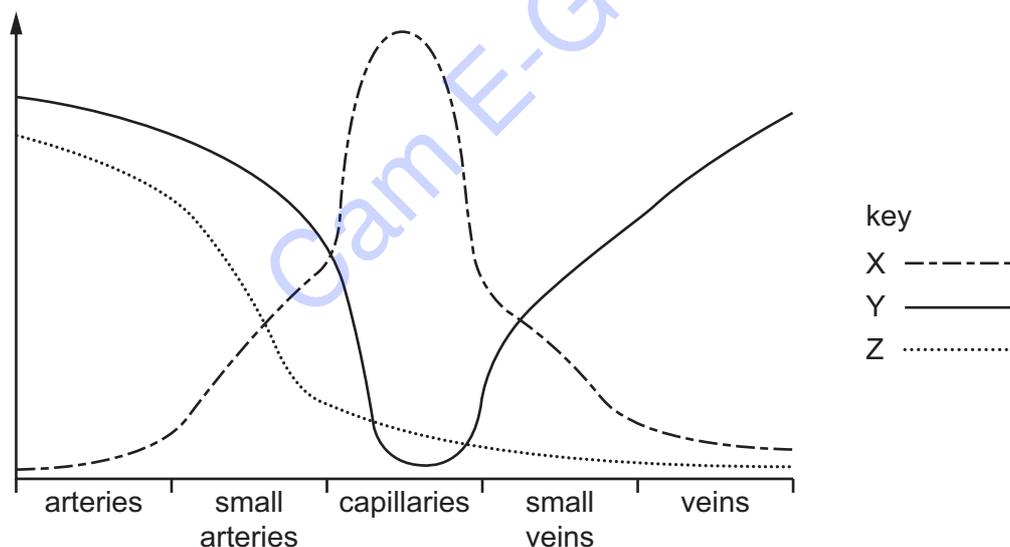
28 The photomicrograph shows three white blood cells labelled X, Y and Z.



Which row correctly identifies these cells?

|          | cell X     | cell Y     | cell Z     |
|----------|------------|------------|------------|
| <b>A</b> | lymphocyte | monocyte   | neutrophil |
| <b>B</b> | lymphocyte | neutrophil | monocyte   |
| <b>C</b> | monocyte   | neutrophil | lymphocyte |
| <b>D</b> | neutrophil | monocyte   | lymphocyte |

29 The graph represents data on blood vessels and blood flow.



Which row correctly identifies the curves?

|          | speed of blood flow | pressure of blood | total cross-sectional area |
|----------|---------------------|-------------------|----------------------------|
| <b>A</b> | X                   | Y                 | Z                          |
| <b>B</b> | X                   | Z                 | Y                          |
| <b>C</b> | Y                   | Z                 | X                          |
| <b>D</b> | Z                   | X                 | Y                          |

30 Which components of blood are present in lymph?

|          | white blood cells | proteins | sodium ions |                                       |
|----------|-------------------|----------|-------------|---------------------------------------|
| <b>A</b> | ✓                 | ✓        | ✓           | key<br>✓ = present<br>x = not present |
| <b>B</b> | ✓                 | x        | ✓           |                                       |
| <b>C</b> | x                 | ✓        | ✓           |                                       |
| <b>D</b> | x                 | ✓        | x           |                                       |

31 What correctly describes the significance of the increase of the red blood cell count of humans who move from living at low altitude to high altitude?

- A** After a few weeks at high altitude, the number of red blood cells increases to compensate for the lower availability of oxygen in the air.
- B** At high altitude, the bone marrow produces more red blood cells to provide binding sites for the increased number of oxygen molecules available.
- C** At high concentrations of oxygen in the blood, a cytokine stimulates the production of red blood cells to increase the oxygen-carrying capacity of the blood.
- D** After only a few days at high altitude the number of red blood cells increases considerably to compensate for the lower availability of oxygen in the air.

32 Which structures of the human gas exchange system are supported by cartilage?

|          | bronchus | bronchiole | trachea |   |
|----------|----------|------------|---------|---|
| <b>A</b> | x        | ✓          | ✓       | key<br>✓ = cartilage present<br>x = cartilage not present |
| <b>B</b> | x        | ✓          | x       |   |
| <b>C</b> | ✓        | ✓          | ✓       |   |
| <b>D</b> | ✓        | x          | ✓       |   |

33 Carbon monoxide, nicotine and tar are components of tobacco smoke.

Which row correctly describes their effect on a smoker's body?

|          | carbon monoxide   | nicotine                                      | tar  |
|----------|---|---|--|
| <b>A</b> | causes loss of consciousness at very low concentrations | increases the diameter of blood vessels       | destroys cilia on cells lining the airways |
| <b>B</b> | forms a stable compound with haemoglobin                | increases blood pressure                      | stimulates goblet cells to secrete mucus   |
| <b>C</b> | forms carbaminohaemoglobin                              | increases the diameter of the coronary artery | settles on cells lining the airways        |
| <b>D</b> | forms carboxyhaemoglobin                                | decreases the heart rate                      | contains carcinogens                       |

34 Which statements about chronic obstructive pulmonary disease (COPD) are correct?

- 1 The disease can often be reversed by treatment.
- 2 The patient's symptoms normally do not change.
- 3 The patient is normally over 30 years old.
- 4 The patient coughs frequently, producing a lot of mucus.

**A** 1, 2 and 3      **B** 1, 2 and 4      **C** 1, 3 and 4      **D** 2, 3 and 4

35 Which of these causative agents of disease can be transmitted by droplet infection?

- 1 *Vibrio*
- 2 *Mycobacterium*
- 3 *Morbillivirus*

**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1 and 3 only      **D** 2 and 3 only

- 36 The table compares total antibiotic use (X) and the percentage of antibiotic-resistant pneumonia cases (Y) in five countries.

| country | (X) total antibiotic use / defined dose per 1000 people per day | (Y) percentage of penicillin-resistant pneumonia cases |
|---------|---|--|
| Austria | 13  | 10   |
| Denmark | 11  | 4  |
| Iceland | 17  | 15   |
| Spain   | 30  | 50   |
| USA     | 24  | 33   |

What is supported by the data?

- A When X decreases there is an increase in Y.
  - B When X increases there is an increase in Y.
  - C When X increases it causes an increase in Y.
  - D There is no relationship between X and Y.
- 37 Which statement about the development of resistance to antibiotics in bacteria is correct?
- A All mutations in bacteria result in resistance to antibiotics.
  - B Antibiotics increase the rate of mutation in bacteria.
  - C Mutations leading to antibiotic resistance only occur when antibiotics are used to treat pathogenic bacteria.
  - D The proportion of antibiotic-resistant bacteria in a population only increases if the antibiotic is used.
- 38 A blood cell count can indicate how many white blood cells there are in the blood.

Where else in the body are white blood cells found?

- 1 bone marrow
  - 2 lymph
  - 3 lungs
- A 1, 2 and 3    B 1 and 2 only    C 1 and 3 only    D 2 and 3 only

- 39** Myasthenia gravis is a disease that results from the immune system failing to distinguish between self and non-self. Antibodies bind to a component of the junctions between a muscle and its nerve.

What correctly describes Myasthenia gravis?

- A** Impulses in the nerve to the affected muscle cannot be blocked.
  - B** The affected muscle cannot be repeatedly stimulated.
  - C** The affected muscle is permanently stimulated.
  - D** The nerve to the affected muscle does not carry any nerve impulses.
- 40** A monoclonal antibody, specific for a virus, was treated with an enzyme to break the bonds between the variable and constant regions.

The separated variable and constant regions were then added to cells infected with the virus.

Which statements are correct?

- 1 The constant regions would bind to different parts of the virus antigens.
- 2 The viruses could be engulfed by phagocytes if they were present.
- 3 The variable regions would all bind to the same part of the virus antigens.

- A** 1 and 2      **B** 1 and 3      **C** 2 only      **D** 3 only

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