



Give **three** properties of water that are important in biology.

**[3 marks]**

1

2

3

**0 1** . **3** Contrast the structures of DNA and mRNA molecules to give **three** differences.

**[3 marks]**

1

2

3











Give **three** properties of water that are important in biology.

**[3 marks]**

1 Accept **any three** suitable properties e.g.

1. Is a metabolite
2. Is a solvent
- 2 3. Has a (relatively) high heat capacity
4. Has a (relatively) large latent heat of vaporisation / evaporation
5. Has cohesion / hydrogen bonds between molecules;;;

3

No explanations are needed  
However do not accept 'polar' unqualified

**0 1 . 3**

Contrast the structures of DNA and mRNA molecules to give **three** differences.

**[3 marks]**

1

1. DNA double stranded/double helix and mRNA single-stranded;
2. DNA (very) long and RNA short;
3. Thymine/T in DNA and uracil/U in RNA;
4. Deoxyribose in DNA and ribose in RNA;

2

5. DNA has base pairing and mRNA doesn't/ DNA has hydrogen bonding and mRNA doesn't;
6. DNA has introns/non-coding sequences and mRNA doesn't;

3

Contrast requires both parts of the statement  
2. Accept 'RNA shorter' or 'DNA bigger/longer'  
4. R Deoxyribonucleic/ ribonucleic acid  
Ignore ref. to histones  
Ignore ref. to helix and straight chain alone  
6. Ignore ref to splicing



The nucleus and a chloroplast of a plant cell both contain DNA.

Give **three** ways in which the DNA in a chloroplast is different from DNA in the nucleus.

**[3 marks]**

In chloroplasts

1. DNA shorter;
2. Fewer genes;
3. DNA circular not linear;
4. Not associated with protein/histones, unlike nuclear DNA;
5. Introns absent but present in nuclear DNA;

Must be comparative statements.

Accept alternatives in context of nuclear DNA

1. Accept smaller
  3. Accept DNA in a loop not linear
  3. Accept no chromosomes (in chloroplast) unlike nucleus
- Ignore references to double and single stranded DNA

Explain how the active site of an enzyme causes a high rate of reaction.

**[3 marks]**

1. Lowers activation energy;
2. Induced fit **causes** active site (of enzyme) to change shape;
3. (So) enzyme-substrate complex **causes** bonds to form/break;

3. Accept: description, of induced fit

3. Accept: enzyme- substrate complex causes stress/strain on bonds.



Suggest and explain how **two** environmental variables could be changed to increase the growth rate of these cells.

**[4 marks]**

Principle of marking pairs:

Named environmental variable;

Correct effect on growth rate;

Examples

1. Increased (concentration of) glucose;
2. Increased respiration;
  
3. Increased (concentration of) oxygen;
4. Increased respiration;
  
5. Increased temperature;
6. Increased enzyme activity;
  
7. Increased (concentration of) phosphate;
8. Increased ATP/DNA/RNA;
  
9. Increased (concentration of) nucleotides;
10. Increased DNA synthesis;





Eukaryotic cells produce and release proteins.

Outline the role of **organelles** in the production, transport and release of proteins from eukaryotic cells.

Do **not** include details of transcription and translation in your answer.

**[4 marks]**

4 max

1. DNA in nucleus is code (for protein);
2. Ribosomes/rough endoplasmic reticulum produce (protein);
3. Mitochondria produce ATP (for protein synthesis);
4. Golgi apparatus package/modify;  
**OR**  
Carbohydrate added/glycoprotein produced by Golgi apparatus;
5. Vesicles transport  
**OR**  
Rough endoplasmic reticulum transports;
6. (Vesicles) fuse with cell(-surface) membrane;

2. and 5. Accept rER for 'rough endoplasmic reticulum'
4. Accept body for 'apparatus'
6. Accept exocytosis at cell membrane



Scientists investigated the effect of different concentrations of a kinesin inhibitor (KI) on mitosis of human bone-cancer cells grown in a culture.

**Table 3** shows the scientists' results.

**Table 3**

Concentration of kinesin inhibitor / $\text{nmol dm}^{-3}$	Percentage of dividing human bone-cancer cells showing a monopolar mitotic spindle
0	0
1	0
10	8
100	93
1000	100
10 000	100

A student who saw these results concluded that in any future trials of this kinesin inhibitor with people, a concentration of  $100 \text{ nmol dm}^{-3}$  would be most appropriate to use.

Do these data support the student's conclusion? Give reasons for your answer.

**[4 marks]**

1. (No, because) at 100 there are still some (7%) cancer cells dividing/undergoing mitosis;
2. So, cancer not destroyed/may continue to grow/spread/form tumours;
3. Best concentration may be between 100 and 1000/need trials between 100 and 1000;
4. This research in culture, don't know effect of KI on people;
5. Yes, because) above 100 produces little increase in % of cells not dividing/undergoing mitosis/at 100, most (93%) cancer cells unable to divide/dead;
6. Above 100 may be harmful (to body);
7. Higher concentrations more expensive;
8. (above 100) will have more effect on (rapidly dividing) cancer cells;

1. Accept idea that all division stops only at 1000
2. Must refer to cancer spreading not cells dividing
4. Reject 'not tested on humans'
4. Reject 'done in animals'
5. Must clearly link lack of monopolar mitotic spindles with cell division
6. Accept 'above 100/high concentrations produce harmful side effects/named effects'
8. Must relate to 100