1(a). Bacteria are found in milk.

They can cause the milk to decompose.

Enzymes from the bacteria convert sugar in the milk into lactic acid.

Some students investigate the effect of temperature on the decomposition of milk.

This is the method the students use:

- Pour 20 cm^3 of milk into 3 different beakers.
- Keep each beaker in a water bath at a different temperature: 15 °C, 25 °C and 35 °C.
- Measure the pH of the milk at different times over 4 days.

The table shows their results.

	pH of milk				
Temperature (°C)	at the start	after 12 hours	after 24 hours	after 48 hours	after 72 hours
15	6.5	6.4	6.3	6.1	5.8
25	6.5	6.3	6.2	5.9	5.5
35	6.5	6.3	6.1	5.5	4.9

Explain the effect of increasing the temperature on the decomposition of the milk in the experiment.

[3]

(b). The students plan a further experiment where they boil the milk first before placing it in the beaker.

Predict what effect this would have on the results.

Explain your answer.

Prediction

Explanation

[2]

2. Acrylamide is a chemical that is formed when bread is toasted.

During toasting, acrylamide is made from a chemical called asparagine.

Asparagine is produced in plant cells by an enzyme called asparagine synthetase.

The gene coding for asparagine synthetase needs to be switched on by other proteins.

i. Complete these sentences about how genes are expressed.

Use words from the list.

coding DNA	**denaturing**	**non-coding DNA**
nucleus	**ribosomes**	**transcription**
translation	**tRNA**	

Gene expression can be switched on by the action of other proteins on ..... .

When a gene is expressed, ... occurs which makes mRNA.

The mRNA then moves to the ..... .

Proteins, such as asparagine synthetase are then made by the process of ..... .

[4]

ii. Scientists want to produce a variety of wheat that contains less asparagine.

This is done by preventing expression of the gene that codes for asparagine synthetase.

Describe the difference between this process and genetic engineering.

[1]

3. All types of white blood cell contain a nucleus.

Which function of white blood cells does **not** require a nucleus?

A Changing shape to squeeze out of capillaries
B Dividing by mitosis after detecting a pathogen
C Producing antibodies which are made of proteins
D Producing enzymes to digest pathogens

Your answer ☐ **[1]**

4. Glycogen storage disease is caused by a mutation in the DNA that codes for an enzyme (a protein) that converts glycogen into glucose.

The mutation changes the triplet codes in the DNA.

Describe how a change to the triplet codes in the DNA can prevent the enzyme working and how this can affect the person's blood glucose level.

[6]

5. A section of DNA is analysed to find the percentage of each of the four bases present.
16% of the DNA is guanine.

What is the percentage of the other bases in this section of DNA?

A 16% Adenine, 16% Cytosine, 52% Thymine
B 16% Adenine, 34% Cytosine, 34% Thymine
C 34% Adenine, 16% Cytosine, 34% Thymine
D 34% Adenine, 34% Cytosine, 16% Thymine

Your answer ☐ **[1]**

6. Which statement about DNA is correct?

A DNA codes for the production of amino acids.
B DNA contains specific sequences of amino acids and bases.
C DNA is a polymer made of three different nucleotides.
D DNA nucleotides consist of a base, a sugar and a phosphate.

Your answer ☐ **[1]**

7. Beta thalassaemia is a genetic disorder caused by a mutation in DNA.

In this mutation, some bases are inserted into the gene that codes for the production of the haemoglobin protein.

Explain how this mutation causes a different haemoglobin protein to be produced.

Use your knowledge of DNA and protein synthesis.

[6]

8(a). A student makes pineapple jelly using two different methods. Both methods use a protein called gelatin which causes the jelly to set.

Tinned pineapple is fresh pineapple which has been treated with heat.

Method 1	**Method 2**
Fresh pineapple is added to the gelatin. It is left for 2 hours. The jelly does not set.	Tinned pineapple is added to the gelatin. It is left for 2 hours. The jelly sets.

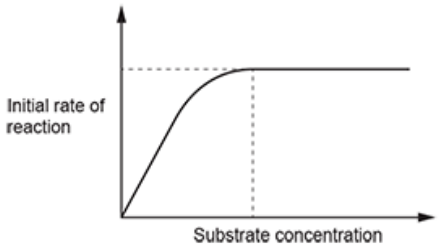
Pineapple contains an enzyme called bromelain. Bromelain digests proteins.

Explain why the jelly made with fresh pineapple does **not** set but the jelly made with tinned pineapple does set.

Use your knowledge of enzymes.

[4]

(b). The graph shows the rate of an enzyme catalysed reaction as the concentration of substrate is changed.



Draw an **X** on the graph to show where approximately 50% of the enzymes' active sites are occupied with substrate.

Explain your decision.

[2]

9. Which molecules are all polymers?

A DNA, amino acids and starch
B Fatty acids, glycerol and amino acids
C RNA, glucose and fatty acids
D Starch, protein and DNA

Your answer ☐ **[1]**

10. Amyloidosis is a group of inherited conditions that affect people's health.

The most common type of amyloidosis is caused by a dominant allele (**A**) of a gene.

Scientists are now developing a new treatment called gene silencing.
They have developed a drug that destroys the mRNA that codes for the amyloid protein.

Explain why this technique is called **gene silencing**.

[2]

11(a).

The statements **A–E** describe parts of the process of protein synthesis.
They are **not** in the correct order.

A A copy of DNA is formed during transcription; this is a molecule called mRNA.
B Amino acids are joined in the correct order during translation.
C DNA unzips and unwinds.
D The mRNA attaches to a ribosome in the cytoplasm.
E The mRNA leaves the nucleus.

Write **A, B, C, D** or **E** in each box to show their correct order in protein synthesis.

One letter has been done for you.

		E		

[2]

(b). Describe how the triplet code determines the structure of a protein.

[2]

(c). Scientists used to think that one gene coded for only one protein.

They have now discovered that one gene can code for more than one protein.

The diagram below shows the order of three sections of RNA.

(In RNA the base T is replaced with the base U.)

AUC	CAG		UAU	CCG		GCA	AAU
Section 1			Section 2			Section 3	

The order of these sections in a molecule of RNA made by transcription can be changed.

i. Use the diagram to explain how changing the order of the sections would produce a different protein.

_____

_____

_____

_____ **[2]**

ii. Write down how many different proteins could be made from the three sections of RNA.

Number of proteins =..... **[1]**

12. 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

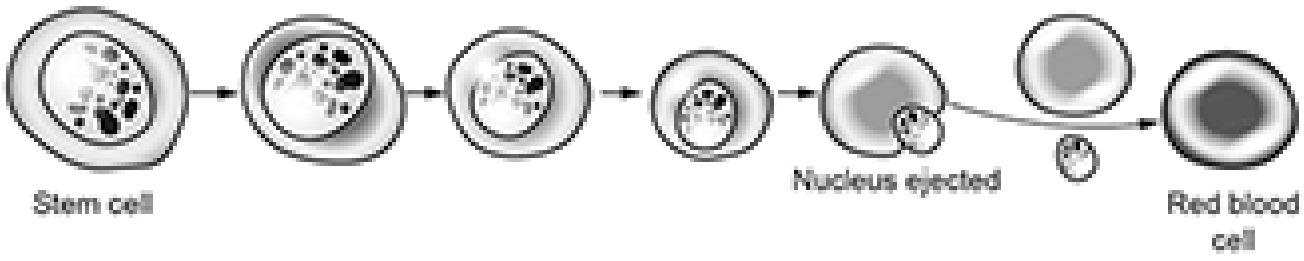
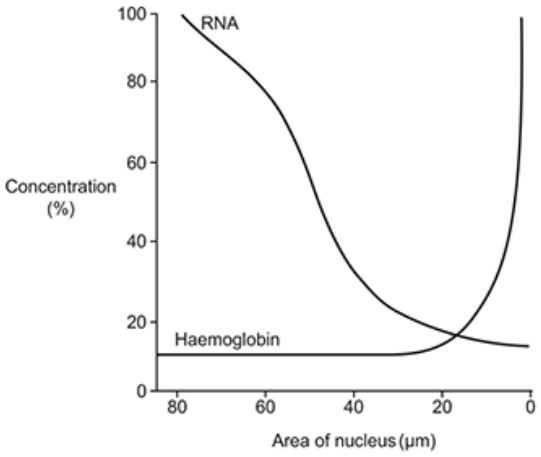


Fig. 24.2

Red blood cell development



* Use **Fig. 24.1**, **Fig. 24.2** and your knowledge of cell differentiation to describe and explain the formation of red blood cells.

[6]

13. Liver cells are active cells producing many protein molecules.

Which organelles are present in liver cells?

A Chloroplasts and mitochondria
B Mitochondria and plasmids
C Nuclei and ribosomes
D Ribosomes and plasmids

Your answer ☐ **[1]**

14. In a sample of DNA, 37% of the bases are thymine (T).

What will be the percentage of the other bases in this sample?

A Adenine (A) 13%, Cytosine (C) 13%, Guanine (G) 37%
B Adenine (A) 37%, Cytosine (C) 13%, Guanine (G) 13%
C Adenine (A) 0%, Cytosine (C) 37%, Guanine (G) 26%
D Adenine (A) 21%, Cytosine (C) 21%, Guanine (G) 21%

Your answer ☐ **[1]**

END OF QUESTION PAPER