

**AH Homework 2**  
**Proteins**

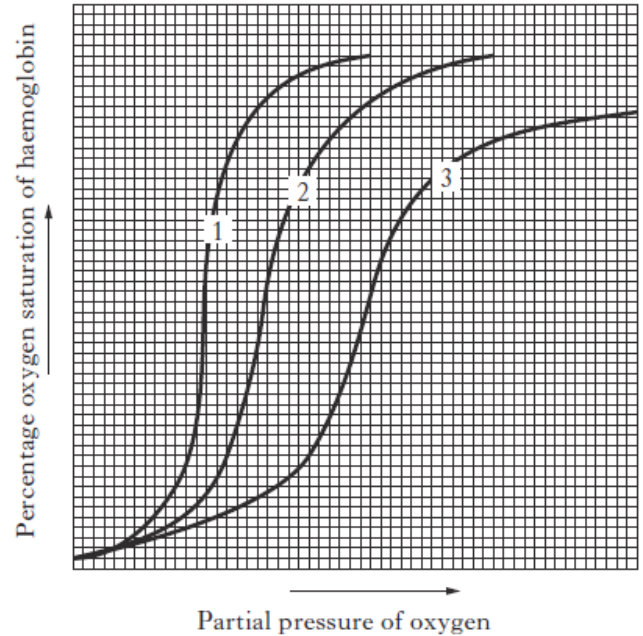
Each molecule of oxygen that binds to a subunit of haemoglobin has the effect of increasing the affinity of the remaining subunits to oxygen. This type of interaction is known as

- A cooperativity
- B facilitated transport
- C induced fit
- D positive modulation.

2. Which line in the table below correctly describes the charges on the two components of nucleosomes?

	<i>DNA</i>	<i>Histone proteins</i>
A	negative	negative
B	positive	negative
C	positive	positive
D	negative	positive

3. Temperature influences the binding and release of oxygen in haemoglobin. The graph below shows the percentage oxygen saturation of haemoglobin at three different temperatures, 34 °C, 37 °C and 42 °C.



Which line in the table correctly identifies these temperatures?

	<i>Curve 1</i>	<i>Curve 2</i>	<i>Curve 3</i>
A	34 °C	37 °C	42 °C
B	37 °C	42 °C	34 °C
C	34 °C	42 °C	37 °C
D	42 °C	37 °C	34 °C

4. In the post-translational modification of a protein, which of the following enzymes would remove a phosphate?

- A proteinase
- B ATPase
- C phosphatase
- D kinase

3. Which line in the table below correctly represents an allosteric enzyme binding with a positive modulator?

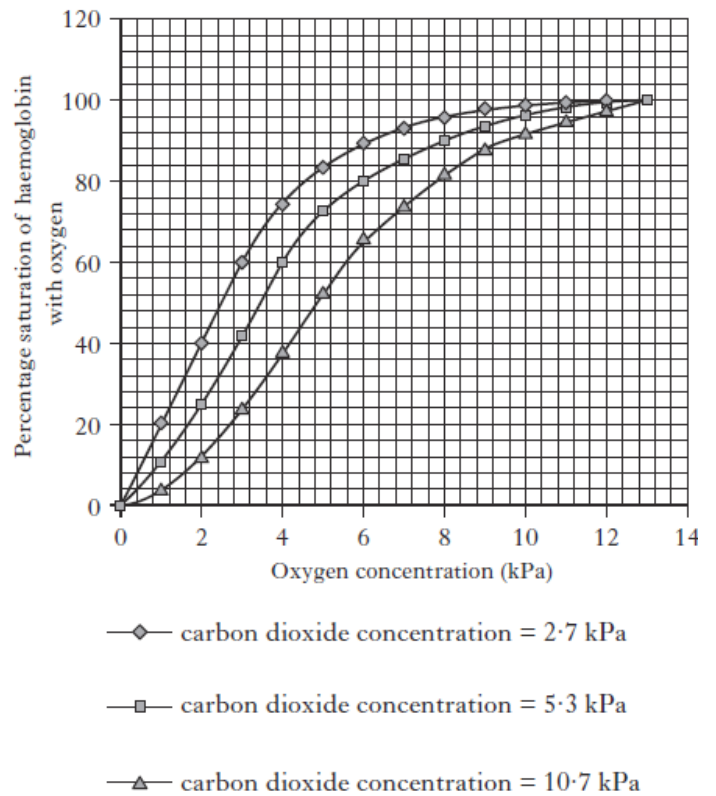
	Modulator binding site		Affinity of enzyme for substrate	
	active site	secondary site	increased	decreased
A	✓		✓	
B		✓		✓
C		✓	✓	
D	✓			✓

4. The stages of muscle contraction are listed below.
- 1 Phosphate ion released from myosin head.
  - 2 ATP binds to myosin head and causes it to detach from actin filament.
  - 3 Myosin head swings forward and attaches to actin filament.
  - 4 Myosin head drags along actin filament.

The sequence in which these stages occur is

- A 2, 1, 3, 4
- B 2, 3, 1, 4
- C 3, 2, 1, 4
- D 3, 2, 4, 1.

10. The graph below shows the effect of carbon dioxide concentration on the affinity of haemoglobin for oxygen at different concentrations of oxygen.



A list of possible conclusions is given below.

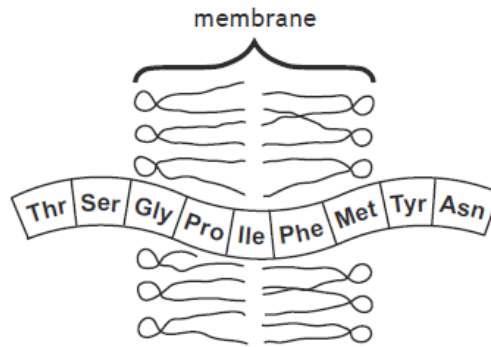
- 1 Increasing the concentration of carbon dioxide decreases the affinity of haemoglobin for oxygen.
- 2 Increasing the concentration of carbon dioxide increases the affinity of haemoglobin for oxygen.
- 3 Increasing the concentration of oxygen decreases the affinity of haemoglobin for oxygen.
- 4 Increasing the concentration of oxygen increases the affinity of haemoglobin for oxygen.

Which conclusions are valid for the data shown in the graph between oxygen concentrations of 2 kPa and 10 kPa?

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

**AH Homework 2**  
**Proteins**

2. The following diagram shows a small polypeptide integrated into a membrane.



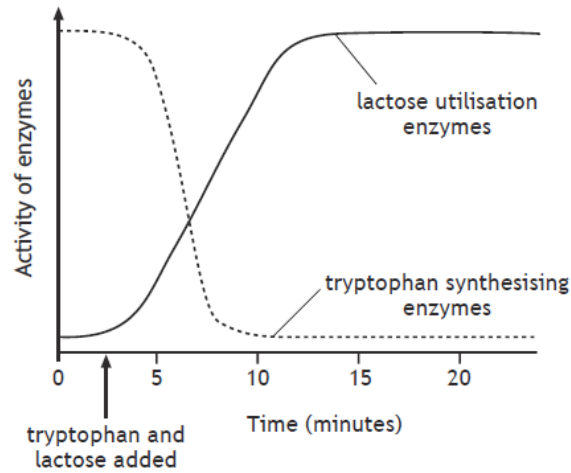
Which row in the table below classifies amino acids in this polypeptide?

	<i>polar</i>	<i>non-polar</i>
A	Thr	Pro
B	Ile	Tyr
C	Asn	Ser
D	Phe	Gly

3. In the post-translational modification of a protein, which of the following enzymes would remove a phosphate?
- A proteinase
  - B ATPase
  - C phosphatase
  - D kinase

**AH Homework 2**  
**Proteins**

4. The graph below shows the changes in the activity of enzymes that synthesise tryptophan and utilise lactose in a cell after the addition of tryptophan and lactose.



What valid conclusion may be made from the graph?

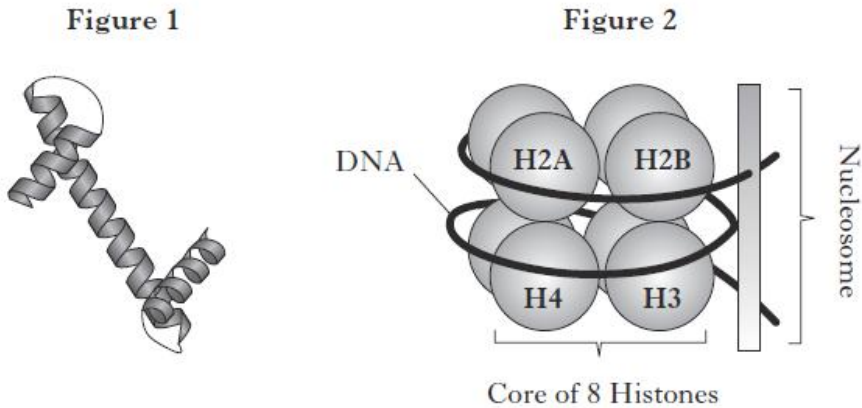
- A Addition of lactose acts as a negative enzyme modulator.
  - B Addition of tryptophan acts as a positive enzyme modulator.
  - C Enzyme induction is occurring in lactose utilisation enzymes.
  - D Enzyme induction is occurring in tryptophan synthesising enzymes.
5. Which row in the table below describes the charges on the two components of nucleosomes?

	DNA	histone proteins
A	negative	negative
B	positive	negative
C	positive	positive
D	negative	positive

**AH Homework 2**  
**Proteins**

*Marks*

3. Figure 1 below shows the structure of a histone protein molecule, histone 4 (H4). Figure 2 represents a nucleosome showing the arrangement of the histones that make up its core.



- (a) Name the type of bonding that maintains the shape of an alpha helix in a protein. 1
- (b) What level of protein structure is shown in Figure 1? 1
- (c) What is the importance of DNA being bound in nucleosomes? 1
- (d) Over 20% of the amino acids in histones are lysine and arginine.  
Explain why the high abundance of these positively charged amino acids is significant in the formation of a nucleosome. 1
- (4)**

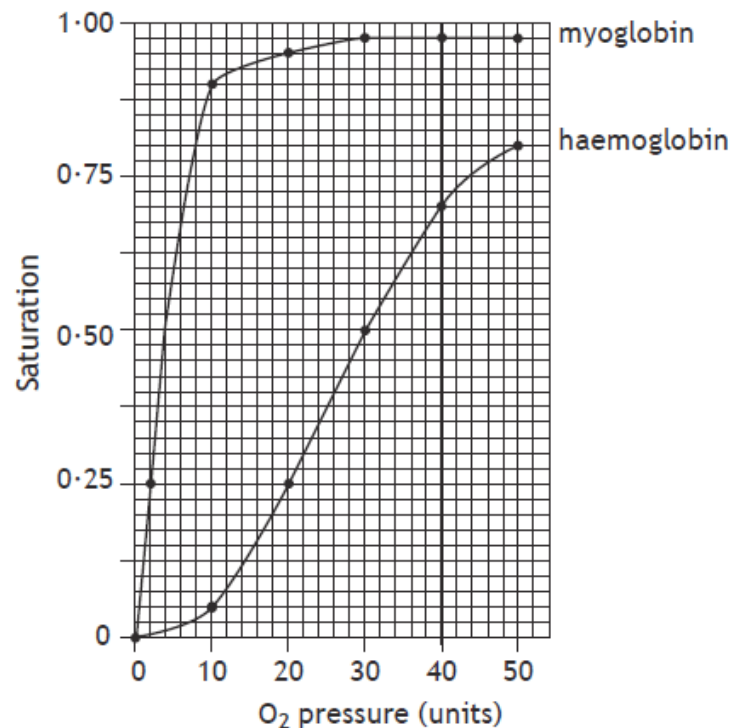
**AH Homework 2**  
**Proteins**

Myoglobin and haemoglobin are oxygen-carrying proteins. Myoglobin has one polypeptide chain and is found in muscle. Haemoglobin has four polypeptide chains and is found in red blood cells. The tertiary structures of the myoglobin and the haemoglobin chains are very similar. Each chain has one binding site for oxygen.

The proportion of binding sites occupied by oxygen is known as saturation.

$$\text{saturation} = \frac{\text{number of oxygen binding sites occupied}}{\text{total number of oxygen binding sites}}$$

The graph below shows the binding of oxygen to haemoglobin and myoglobin as the available oxygen is increased.



- (a) (i) Use the data to compare the saturation of myoglobin and haemoglobin between 0 and 30 units. 1

---

---

- (ii) Explain how the information shows that quaternary structure affects the binding of oxygen to haemoglobin. 2

---

---

**AH Homework 2**  
**Proteins**

4. (continued)

- (b) Use the formula to calculate the change in the number of oxygen molecules bound to haemoglobin as the oxygen pressure is reduced from 30 to 20 units.

1

*Space for calculation and working*

- 
- (c) Haem groups are an example of non-polypeptide components present in proteins.

1

State the term that describes such components.

---