Medical Science SIL

Year 12 to Year 13

Use metacognitive techniques. Test yourself on the content. Then use the Unit 1 knowledge booklet to mark all your answers when you have finished

You will be given an assessment at the start of Y13 based on the core content from the SIL

The highly recommended content will help you understand the units taught in Y13

Biological molecules – carbohydrates

What is a monomer?

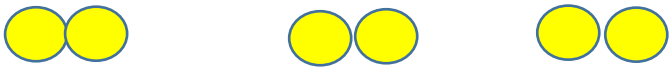
What is a polymer?

What is a condensation reaction?

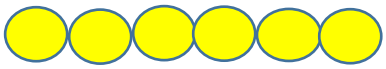
What is a hydrolysis reaction?

The monomers of carbohydrate molecules are called……

Two carbohydrates molecules chemically joined are called……



Polymers of carbohydrate molecules are called……..



Monosaccharides

The general formula for a monosaccharide is $C_n (H_2O)_n$

This means that for every 1 carbon, there is 1 H_2O present

1. **Write the formula for a monosaccharide with 3 carbons.**

2. **Write the formula for a monosaccharide with 5 carbons.**

3. **Write the formula for a monosaccharide with 4 oxygen atoms.**

***Triose* monosaccharides:**

Triose monosaccharides are recognisable due to the presence of only …… carbon atoms.

Triose monosaccharides have the general formula ……

The example you need to recognise is ……

Pentose monosaccharides:

Pentose monosaccharides are recognisable due to the presence of only ……. carbon atoms.

Pentose monosaccharides have the general formula ……

The two examples you need to recognise are …….. and ……

Hexose monosaccharides:

Hexose monosaccharides are recognisable due to the presence of only ……carbon atoms.

Hexose monosaccharides have the general formula …….

The four examples you need to recognise are ……., ……., ……., and ……

What is an isomer? ……..

……

Hexose disaccharides

They are formed when two monosaccharides are chemically joined by a …… bond.

The general formula for a hexose disaccharide is …….

This is because hexose monosaccharides have the formula ……

So when two hexose monosaccharides are chemically joined, a water molecule is removed (condensation reaction) – leaving …….

The 3 saccharides you must know are ……., ……., and ……...

Using an equation, describe how these 3 disaccharides are formed in a condensation reaction.

……

……

……

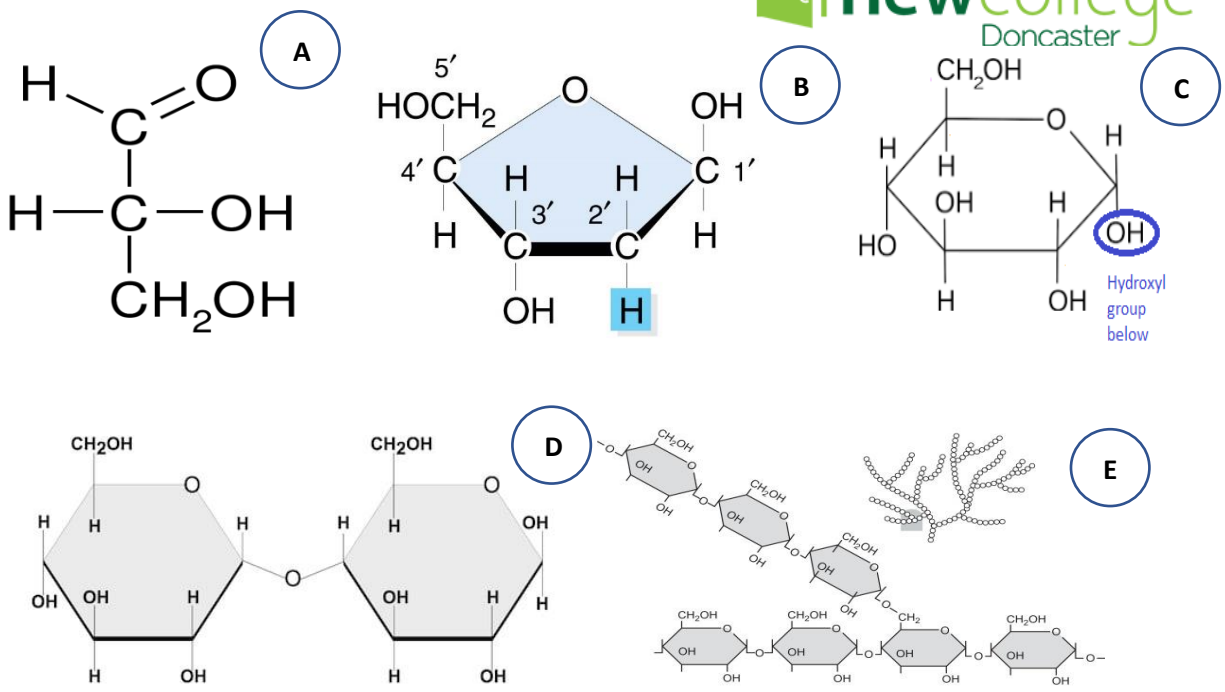
Describe the functions on monosaccharides and disaccharides linked to their properties.

……

……

……

……



The molecules above, A-E, represent different types of carbohydrates. Write the correct letter (s), A-E, to match each of the statements below.

These three molecules are monosaccharides

This molecule is a polysaccharide

This molecule is a pentose monosaccharide

This molecule is a disaccharide

These molecules contain glycosidic bonds

This molecule is a triose monosaccharide

This molecule is glyceraldehyde

This molecule is a hexose monosaccharide

This molecule is made up of two glucose monosaccharides

This molecule is found in DNA

This molecule is the monomer of glycogen and starch

Molecule C has a well-known isomer. Describe what an isomer is (1)

Name this isomer (1)

Polysaccharides

A polysaccharide is formed when many monosaccharides are chemically joined together. This means there are many glycosidic bonds present in a polysaccharide.

The example of a polysaccharide you need to know is glycogen.

What is the monomer of glycogen? .....

Where in the body would glycogen be found? .....

What is the function of glycogen? .....

Explain how the structure and properties of glycogen are linked with its function as a storage molecule (4)

.....

.....

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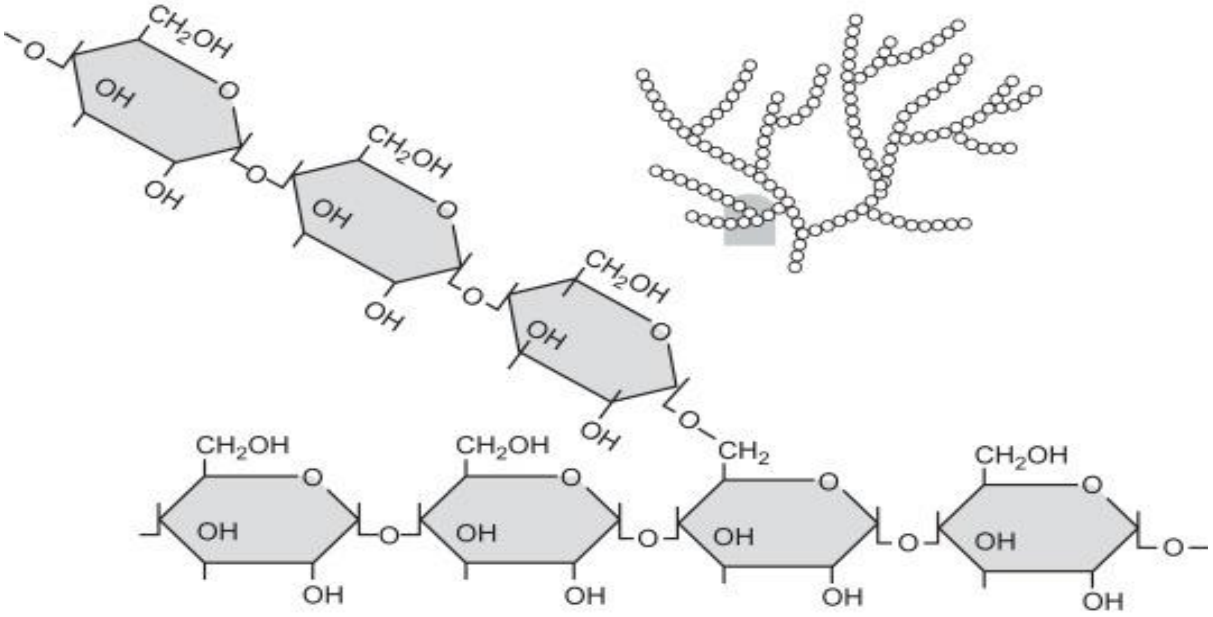
.....



In mammals, in the early stages of pregnancy, a developing embryo exchanges substances with its mother via cells in the lining of the uterus. At this stage, there is a high concentration of glycogen in cells lining the uterus.

(a) Describe the structure of glycogen.

_____

_____

_____

_____

(2)

(b) What is the function of glycogen?

_____

_____

_____

(1)

(c) Explain why it is an advantage for glycogen to be helical in shape

_____

_____

(1)

d) Explain why it is an advantage for glycogen to be insoluble

_____

_____

(1)

e) Explain why it is an advantage for glycogen to highly branched

_____

_____

_____

(1)

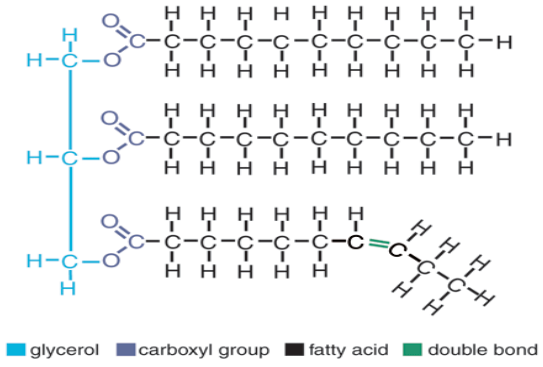
f) Explain why it is an advantage for glycogen to be large

_____

_____

_____

Triglycerides



Draw the simplified box diagram to represent a triglyceride:

Describe the structure of triglycerides……

……

Why are triglycerides not polymers? ……..

Triglycerides are hydrophobic molecules. What does this mean? ……

……

Draw the structure of glycerol

Draw the general formula for a fatty acid

Define the following terms:

Saturated fatty acid ……

Monounsaturated fatty acid ……

Polyunsaturated fatty acid ……

Describe and explain the role/ function of triglycerides within cells

……

……

……

Phospholipids

Draw and label the phospholipid structure

Simplified box diagram:

Describe the structure of a phospholipid

……

……

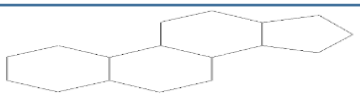
……

……

Fatty acids on phospholipids may also be …… or ……

What is the function of phospholipids? ……

Draw and label the arrangement of phospholipids in the membrane bilayer:



Steroids

What are steroids? ……

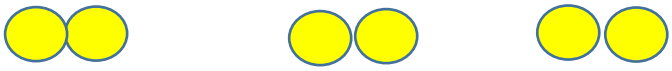
Give 3 examples of steroids……

……

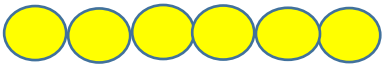
Proteins

The monomers of protein molecules are called……

Two protein monomers chemically joined are called……



Polymers of protein molecules are called……..



Draw and label the structure of an amino acid

Explain how the 20 amino acids differ ……

……

How does a dipeptide form? ……

……

……

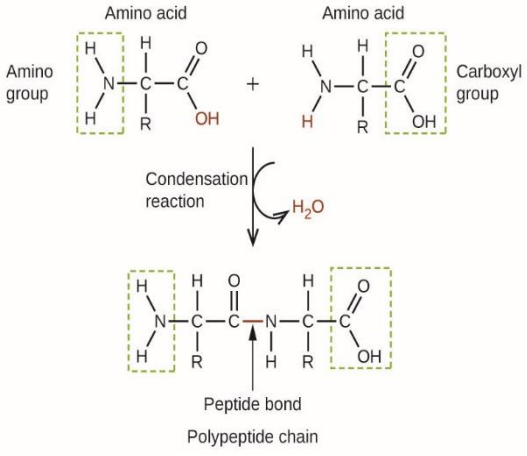
……

How does a dipeptide break down? ……

……

……

……



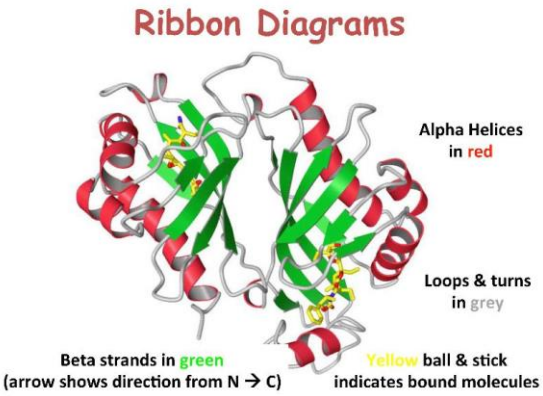
Describe the primary structure of a protein

Describe the secondary structure of a protein

Describe the tertiary structure of a protein

Describe the quaternary structure of a protein

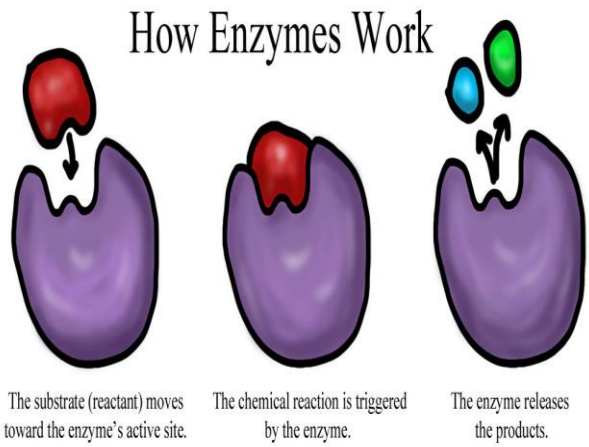
Describe how a ribbon diagram can represent protein structure



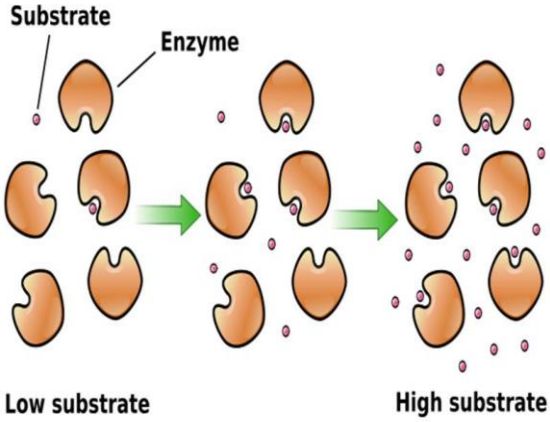
Describe the functions of proteins, using 2 examples.

Enzymes

What are enzymes?



Describe the collision theory of enzyme action:

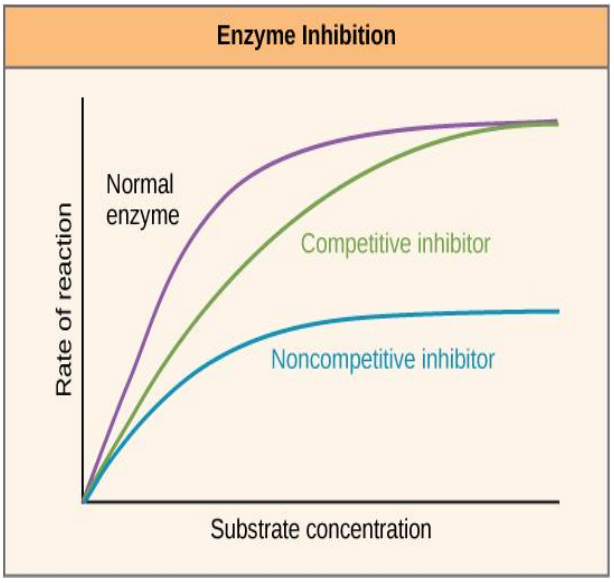


Describe the lock and key model of enzyme action

Describe the induced fit model

Describe the effect of competitive and non-competitive inhibitors on the rate of an enzyme-controlled reaction:

Describe and explain the effect of increasing substrate concentration in the presence of inhibitors:

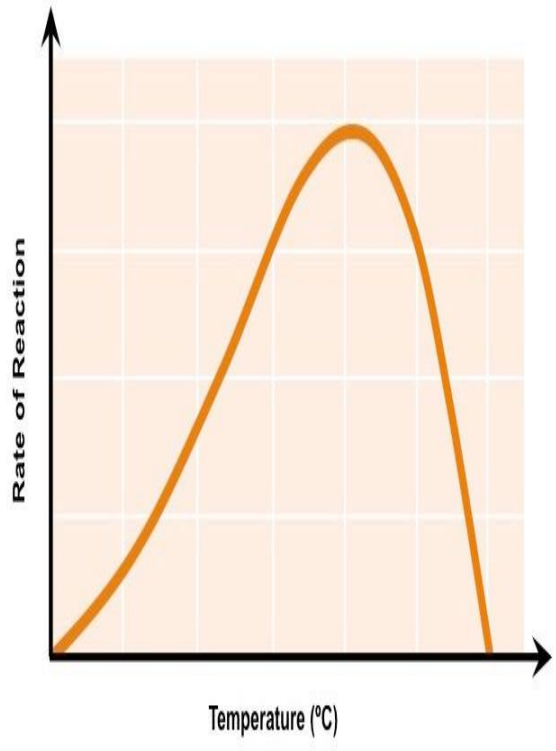


Describe how reversible enzyme inhibitor occurs:

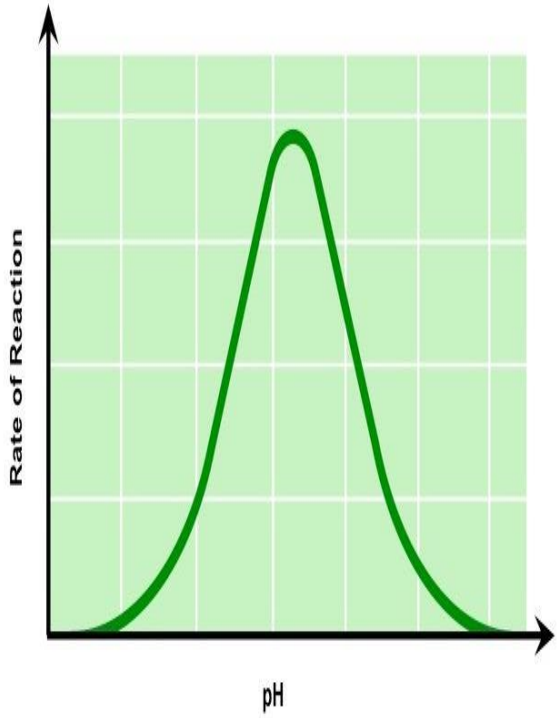
Describe how irreversible enzyme inhibition occurs:

Factors affecting enzymes

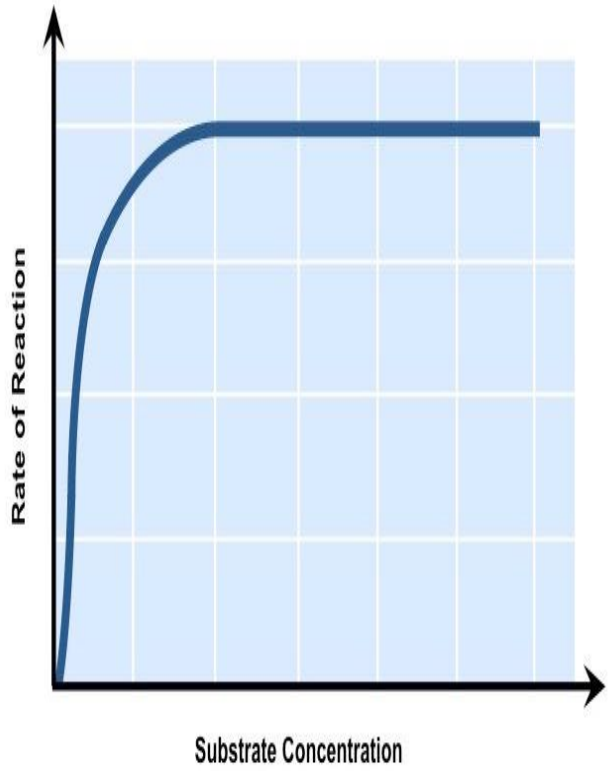
Effect of temperature on the rate of an enzyme controlled reaction:



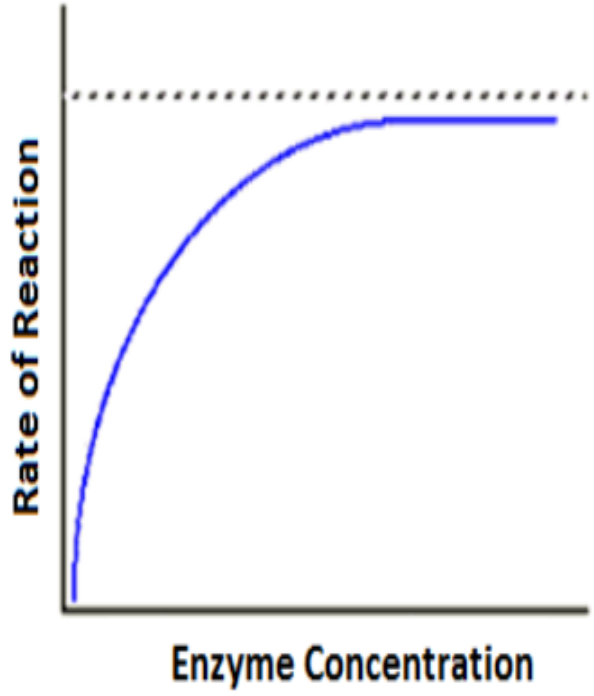
Effect of pH on the rate of an enzyme controlled reaction:



Effect of substrate concentration on the rate of an enzyme controlled reaction:



Effect of enzyme concentration of the rate of enzyme controlled reaction:



Nucleic acids – DNA and RNA

A monomer of a nucleic acid is called a ……

Two monomers chemically joined together is called a ……

Many monomers chemically joined together is called a ……

What does DNA stand for? ……

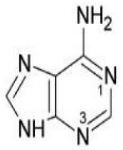
Draw a labelled DNA nucleotide

Name the 4 possible DNA bases:

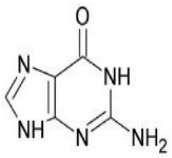
Draw a labelled DNA polynucleotide strand Draw a labelled DNA double strand

The four DNA bases can be separated into 2 categories: purines and pyrimidines.

What is a purine and which bases are these?

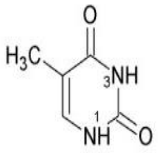


Adenine

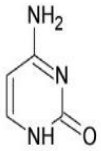


Guanine

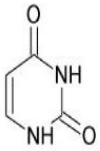
What is a pyrimidine and which bases are these?



Thymine



Cytosine



Uracil

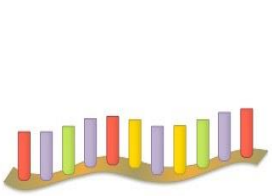
What does RNA stand for? .....

Draw a labelled RNA nucleotide

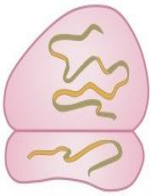
Name the 4 possible RNA bases:

Draw a labelled RNA polynucleotide strand

Describe the 3 types of RNA



Messenger RNA (mRNA)



Ribosomal RNA (rRNA)

Transfer RNA (tRNA)

Type of RNA	Messenger RNA (mRNA)	Transfer RNA (tRNA)	Ribosomal RNA (rRNA)
Size			
Where found?			
Shape			
Stability			

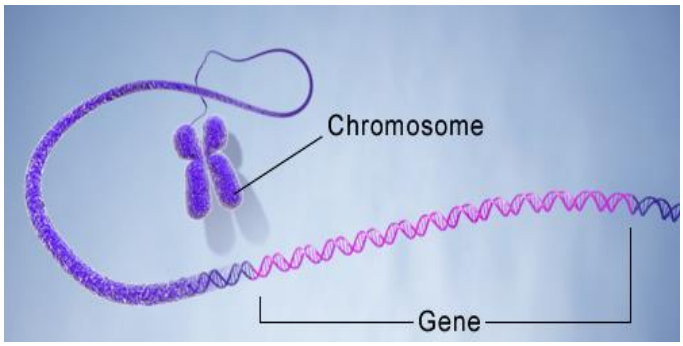
Compare and contrast the structure of DNA and RNA (5)

DNA replication - semi-conservative replication

Use the spaces underneath to illustrate the five stages in the semi-conservative replication of DNA. Draw diagrams of the five stages on the left, and describe what is happening during each stage on the right.

The genetic code

What is a gene?



What is a locus?

How many different genes to humans have?

What is a chromosome?

How many chromosomes do humans have?

What is the genetic code?

	T	C	A	G	
T	TTT phe TTC phe	TCT ser TCC ser TCA ser TCG ser	TAT tyr TAC tyr	TGT cys TGC cys	T
	TTA leu TTG leu		TAA stop TAG stop	TGA stop TGG trp	C A G
C	CTT leu CTC leu CTA leu CTG leu	CCT pro CCC pro CCA pro CCG pro	CAT his CAC his	CGT arg CGC arg CGA arg CGG arg	T C
			CAA gln CAG gln		A G
A	ATT ile ATC ile ATA ile	ACT thr ACC thr ACA thr ACG thr	AAT asn AAC asn	AGT ser AGC ser	T C
	ATG met		AAA lys AAG lys	AGA arg AGG arg	A G
G	GTT val GTC val GTA val GTG val	GCT ala GCC ala GCA ala GCG ala	GAT asp GAC asp	GGT gly GGC gly GGA gly GGG gly	T C A G
			GAA glu GAG glu		

1. Use the genetic code above to write out the amino acid sequence if the DNA base sequence reads ATG GCA CAG ACG CCC CAT TCG TAG

2. Write out the amino acid sequence if the DNA base sequence reads ATG AGG GGG ATT CCT CAG TGT TAG

Describe the 5 key features of the genetic code:

	T	C	A	G	
T	TTT phe TTC phe	TCT ser TCC ser TCA ser TCG ser	TAT tyr TAC tyr	TGT cys TGC cys	T
	TTA leu TTG leu		TAA stop TAG stop	TGA stop TGG trp	C A G
C	CTT leu CTC leu CTA leu CTG leu	CCT pro CCC pro CCA pro CCG pro	CAT his CAC his	CGT arg CGC arg CGA arg CGG arg	T C A G
			CAA gln CAG gln		
A	ATT ile ATC ile ATA ile	ACT thr ACC thr ACA thr ACG thr	AAT asn AAC asn	AGT ser AGC ser	T C
	ATG met		AAA lys AAG lys	AGA arg AGG arg	A G
G	GTT val GTC val GTA val GTG val	GCT ala GCC ala GCA ala GCG ala	GAT asp GAC asp	GGT gly GGC gly GGA gly GGG gly	T C A G
			GAA glu GAG glu		

Degenerate:

Non-overlapping:

Universal:

Unambiguous:

Linear:

Protein synthesis

Messenger RNA recap

What does RNA stand for?	
Describe the 3 components of an RNA nucleotide	
Name the 4 bases found in RNA	
Is RNA single or double stranded?	

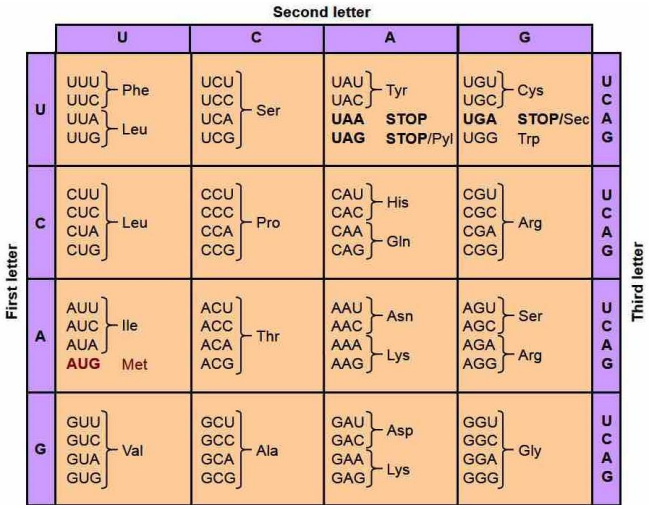
Is RNA longer or shorter than DNA?	
What shape is mRNA?	
How stable is mRNA?	
How big is mRNA compared to the other RNA types?	
Where is mRNA found in the cell?	

Write the mRNA sequence complementary to the DNA sequence is CGGTAAATGCCA

Write the mRNA sequence complementary to the DNA sequence is AATAGATACAT

Write the amino acid sequence if the mRNA sequence is AUG CCG AGU ACC UAG

Write the amino acid sequence of the mRNA sequence is AUG GGU GUC UAU ACG UGA

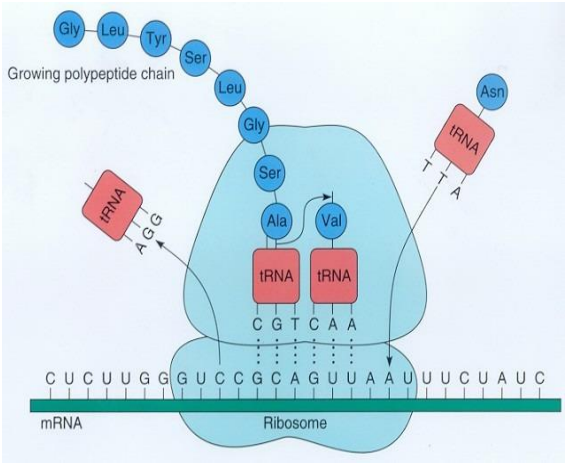


Transcription

Draw a diagram to illustrate the stages of transcription on the left, and describe the stages on the right.

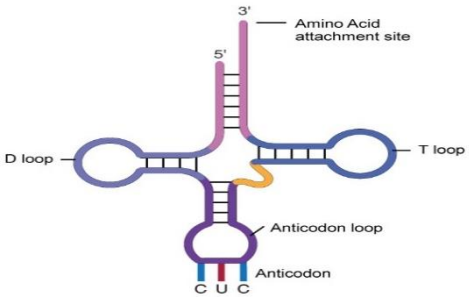
Translation

Describe the structure of a ribosome:



Transfer RNA recap

What does RNA stand for?	
Describe the 3 components of an RNA nucleotide	
Name the 4 bases found in RNA	
Is RNA single or double stranded?	
Is RNA longer or shorter than DNA?	
What shape is tRNA?	
How stable is tRNA?	
How big is tRNA compared to the other RNA types?	
Where is tRNA found in the cell?	
Which molecule binds to tRNA at the top?	



Describe the process of translation:

ATP

What does ATP stand for?

What is ATP?

Draw a labelled diagram to represent the structure of ATP

Draw a diagram to represent the ATP cycle

What does ADP stand for?

What does Pi stand for?

Describe the formation of ATP

Describe the hydrolysis of ATP

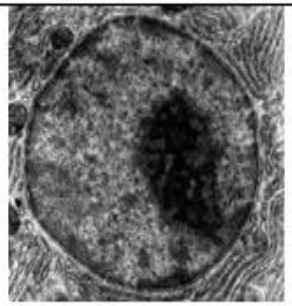
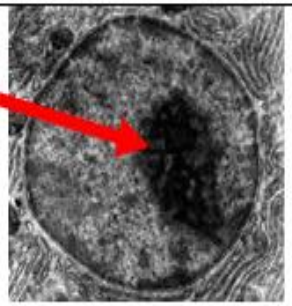
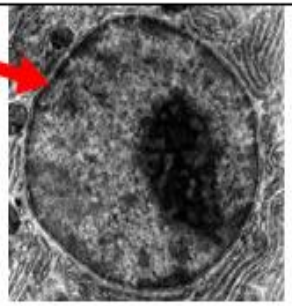
What is the energy from ATP hydrolysis used for in cells?

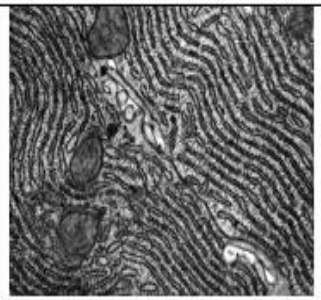
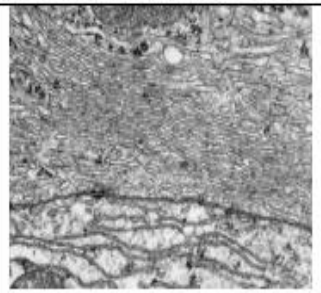
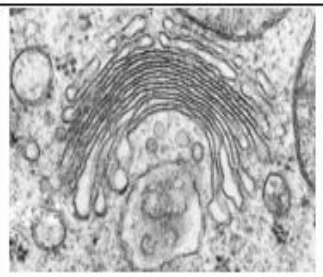
1. –
2. –
3. –
4. –

Explain how the structure and properties of ATP are related to its function.

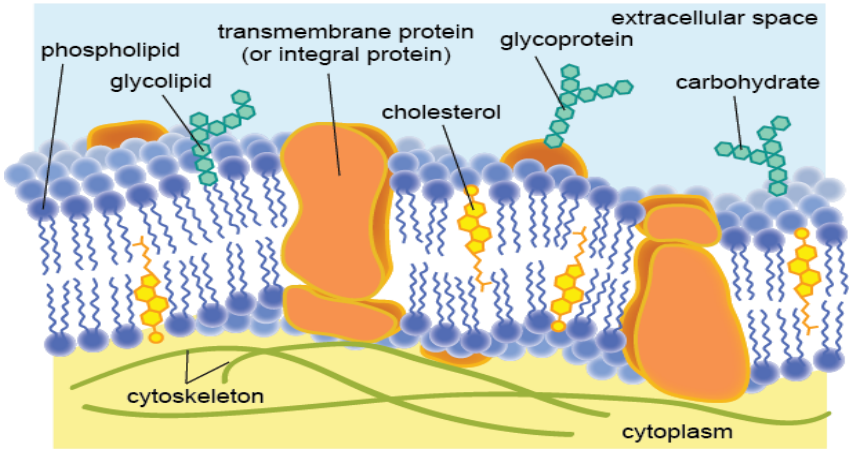
1. –
2. –
3. –
4. –
5. –

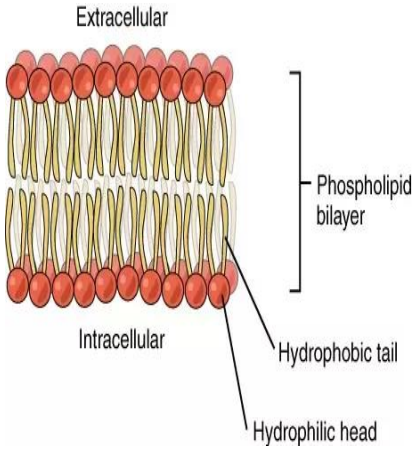
Structure of human cells

Name of organelle	Electron micrograph	Draw a diagram to represent the organelle	Structure	Function
Nucleus				
Nucleolus				
Nuclear envelope				

Mitochondria				
Rough endoplasmic reticulum (rough ER)				
Smooth endoplasmic reticulum (smooth ER)				
Golgi apparatus				

The plasma membrane

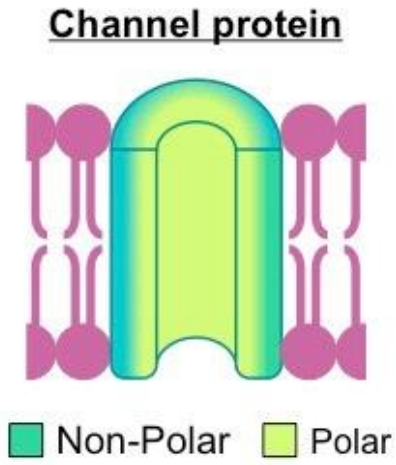




What is the plasma membrane?

Describe and explain the main constituents of the plasma membrane

Describe how the polarity of intrinsic membrane protein molecules affects their position in the membrane



The extracellular surface of extrinsic membrane proteins can be glycosylated. What does this mean?

State the term used to describe the plasma membrane structure.

Why is this term used to describe the structure of the plasma membrane?

Transport across cell membranes

List the 6 methods in which molecules can be transported across a cell membrane

The polarity of a molecule is important when a molecule is being transported across a cell membrane.

What is a polar molecule?

What is a non-polar molecule?

List the 5 factors which affect how a molecule is transported across a cell membrane.

Explain how the size of the concentration gradient affects transport across a membrane.

Explain how temperature affects transport across a membrane.

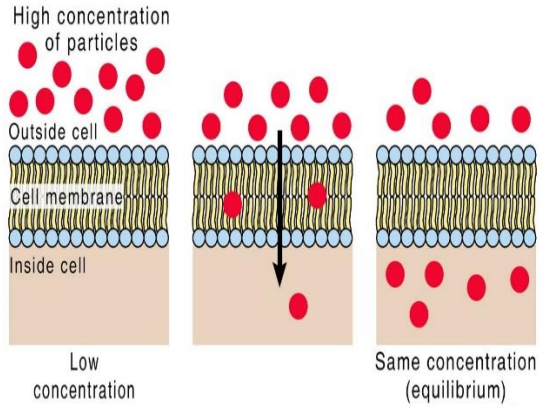
Explain how the size of a molecule affects transport across a membrane.

Explain how lipid solubility affects transport across a membrane.

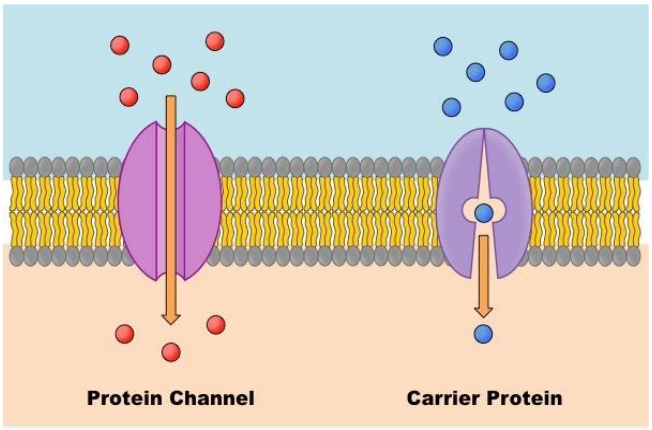
Explain how the thickness of the membrane affects transport across a membrane.

Methods of membrane transport

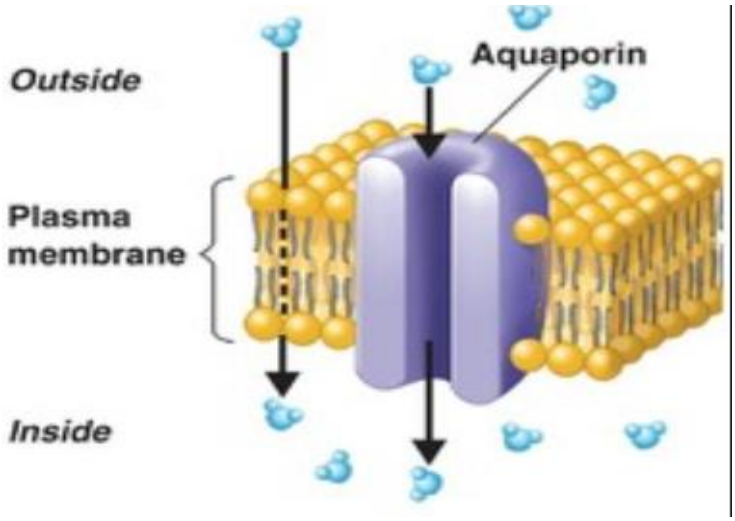
Describe what simple diffusion is and explain which types of molecules move by simple diffusion.



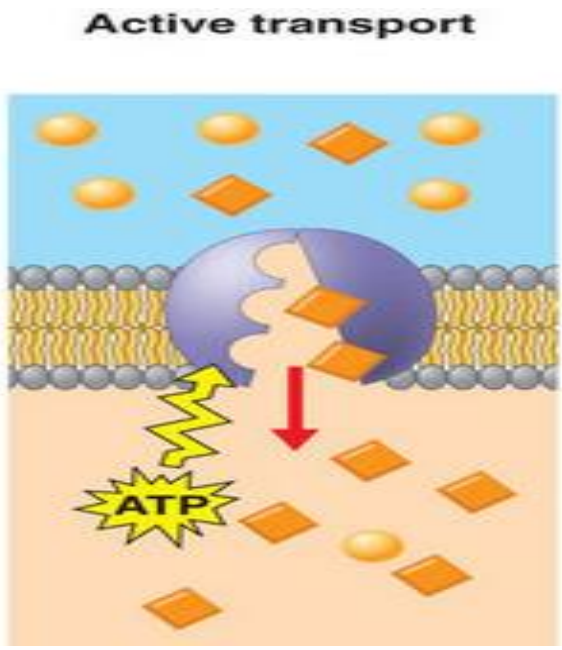
Describe what facilitated diffusion is and explain which types of molecules move by simple diffusion.



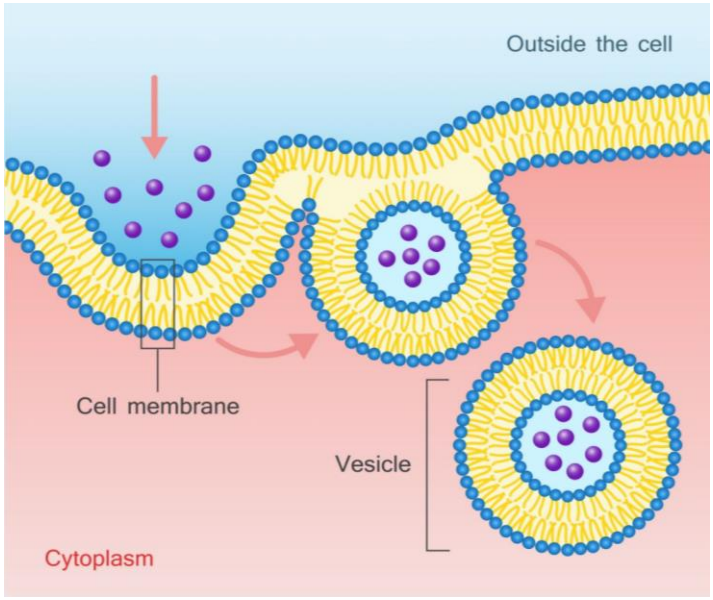
Describe what osmosis is.



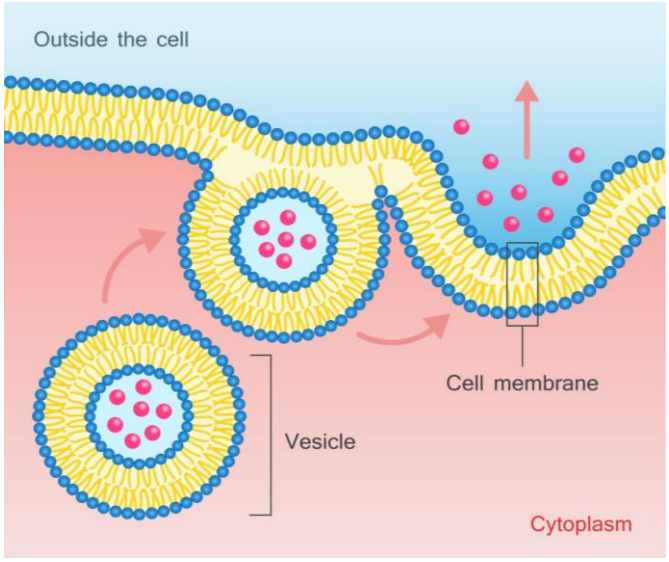
Describe what active transport is.



Describe what endocytosis is.



Describe what exocytosis is.



Control of blood glucose by the endocrine system

What is the purpose of the endocrine system?

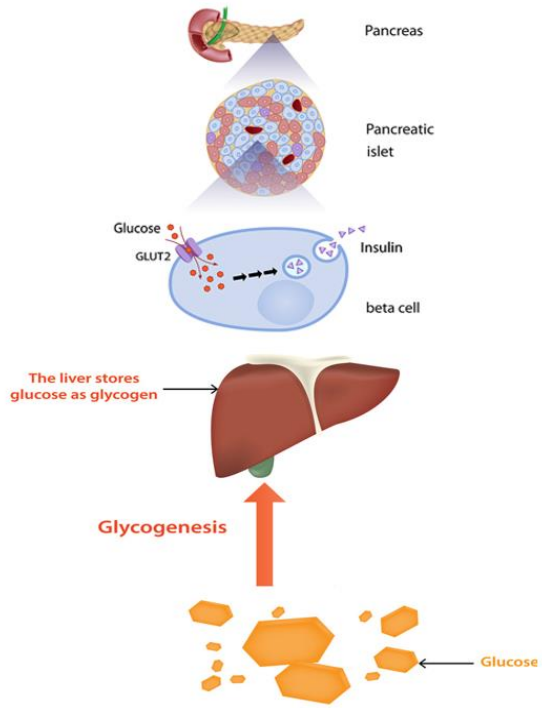
Which cells are involved in the regulation of blood glucose?

Why is it important that blood glucose is regulated?

Define the term 'glycogenesis'.

Define the term 'glycogenolysis'.

Explain how the endocrine system responds when blood glucose is too high.

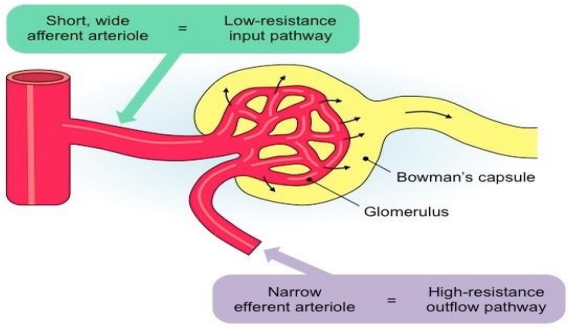


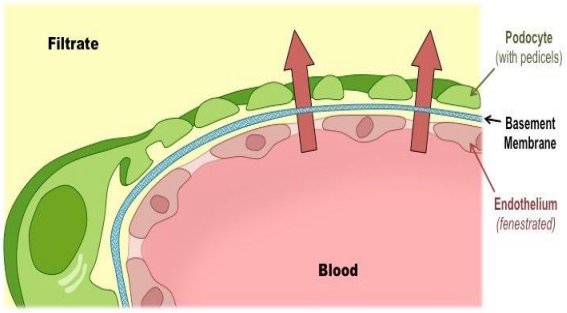
Explain how the endocrine system responds when blood glucose is too low.

Role of the kidney in the endocrine system – ultrafiltration and selective reabsorption

Why is it important that the concentration of water in the blood is regulated?

Describe the process of ultrafiltration in the nephron.

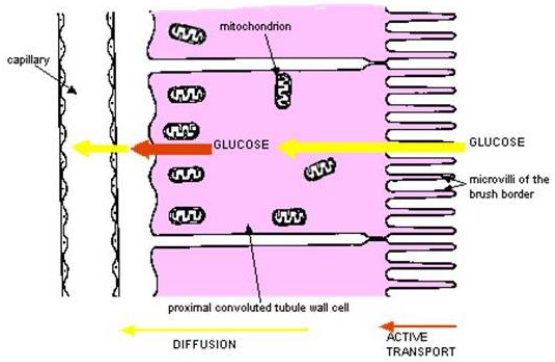




Describe which molecules are part of the glomerular filtrate, and which are not.

Describe the process of selective reabsorption in the nephron.

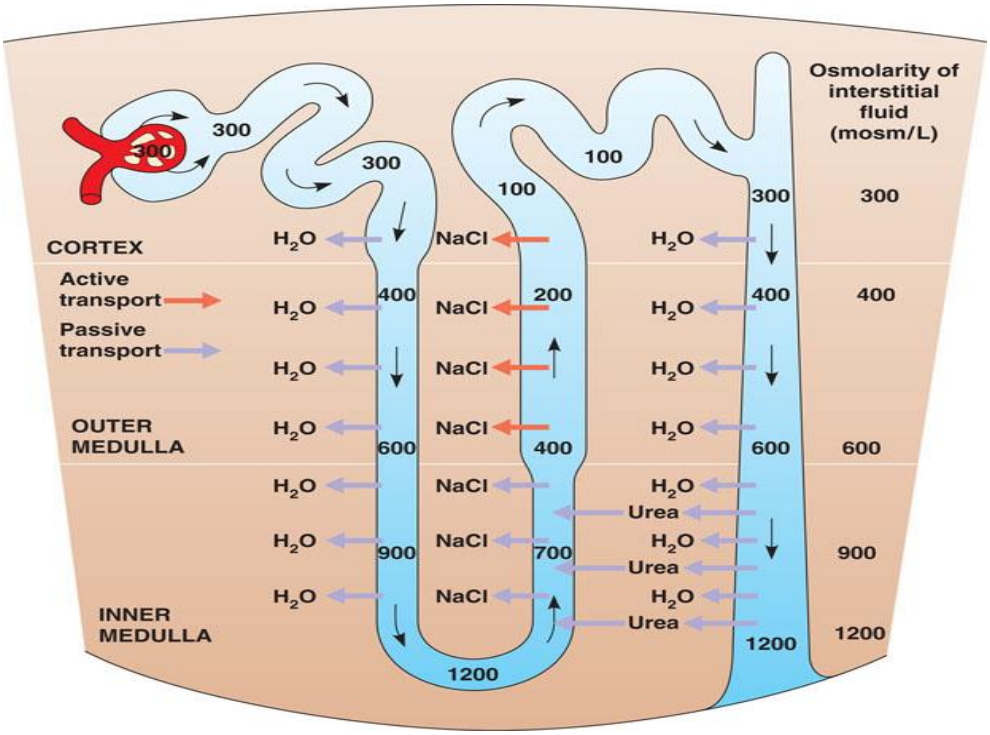
Explain the adaptations proximal convoluted tubule (PCT) cells have for selective reabsorption



Osmoregulation

What does osmoregulation mean?

Describe how osmoregulation occurs in the loop of Henle.



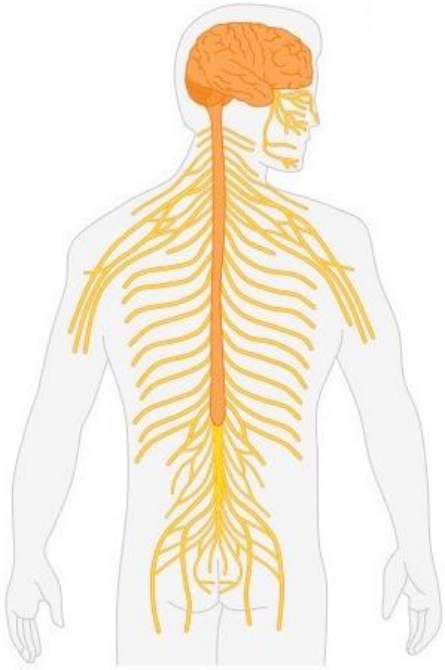
What is ADH and what does it do?

Describe how ADH enables more concentrated urine to be formed

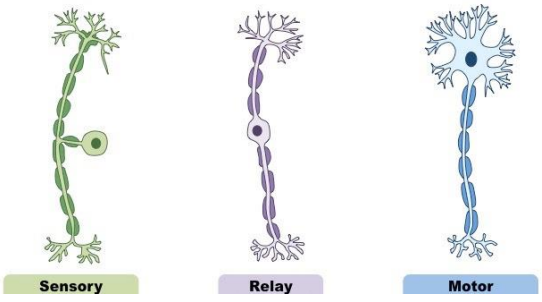
The structure of the nervous system

Describe the role of the nervous system

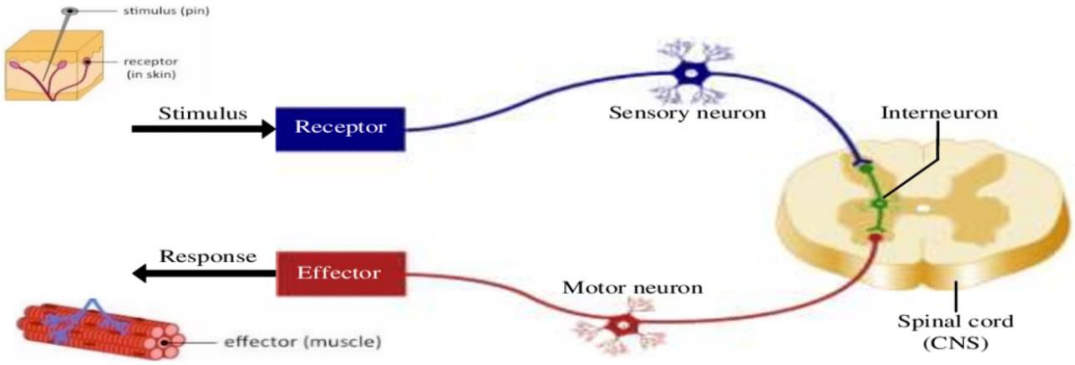
Describe the general structure of the nervous system



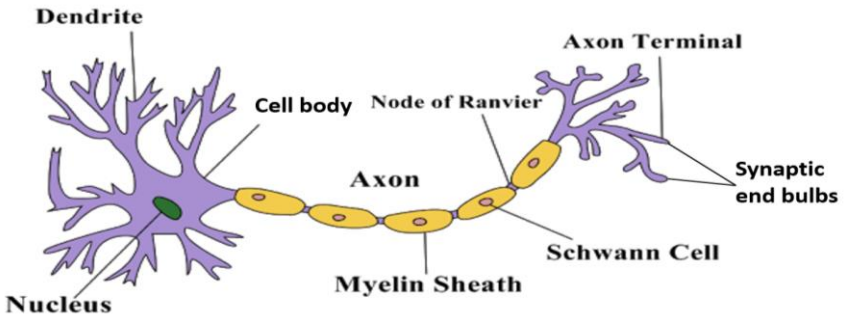
Describe the 3 types of neurones involved in the nervous system



Describe the reflex arc

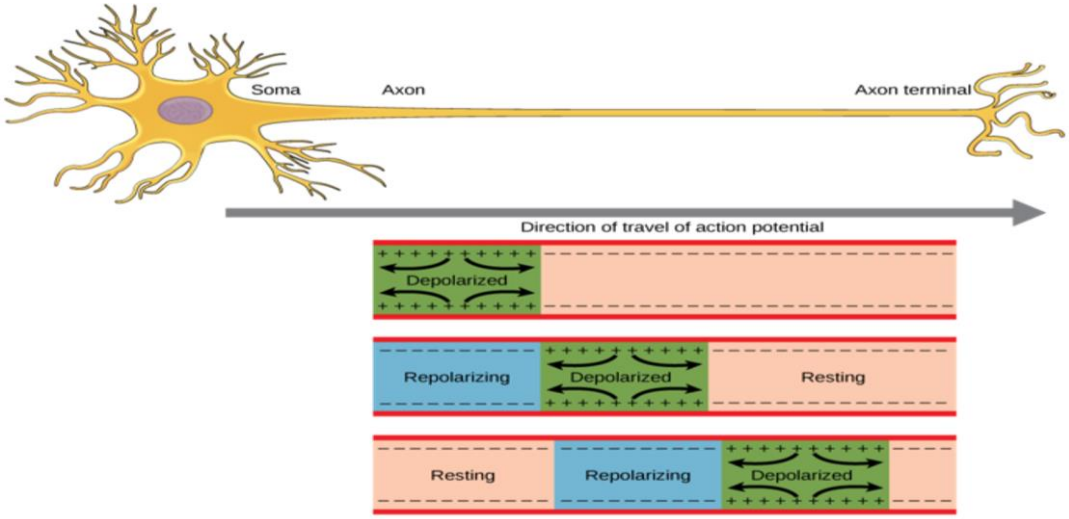


Describe the structure and function of a motor neurone

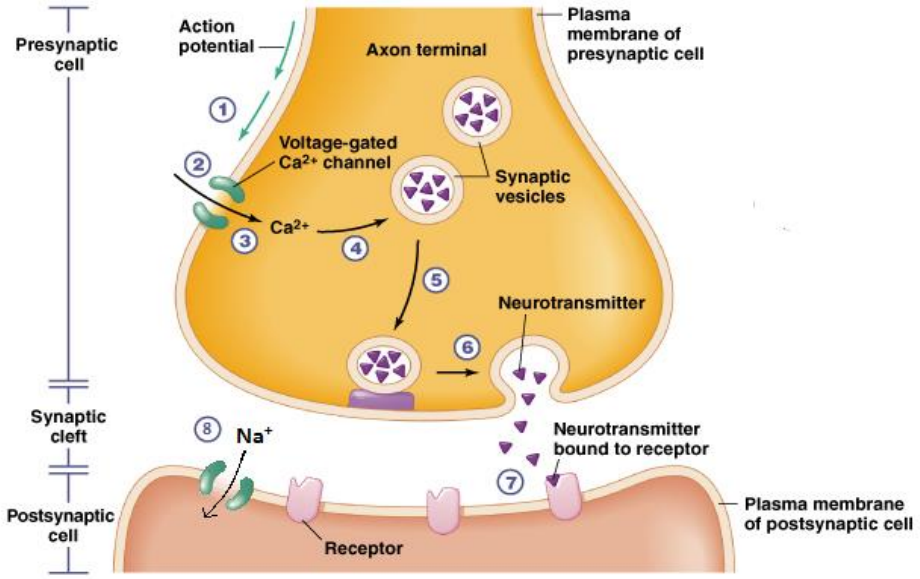


Transmission of a nerve impulse along an axon

Describe how a nerve impulse is transmitted across an axon

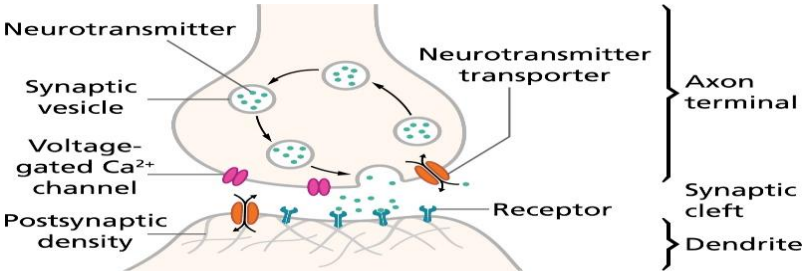


Synaptic transmission



Describe how the formation of a synapse leads to depolarisation in the post-synaptic neurone:

Describe how the merging of nerve impulses is prevented:



A synapse ensures one-way flow of nerve impulses. Describe how.

<u>Explain the role of the following in synaptic transmission:</u>

Synaptic vesicles

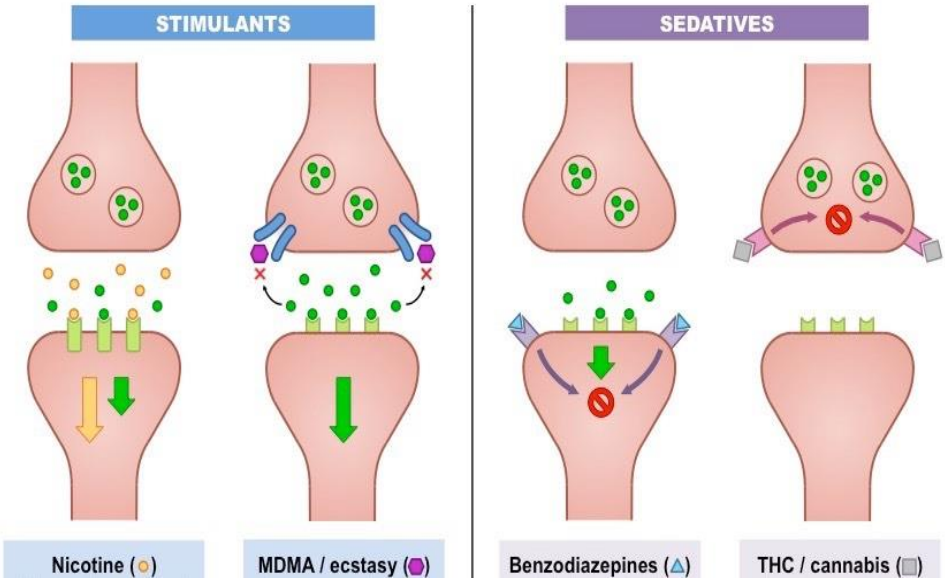
Neurotransmitters (e.g. acetylcholine)

Synaptic cleft

Calcium ion (Ca^{2+}) channels

Receptors on post-synaptic membrane

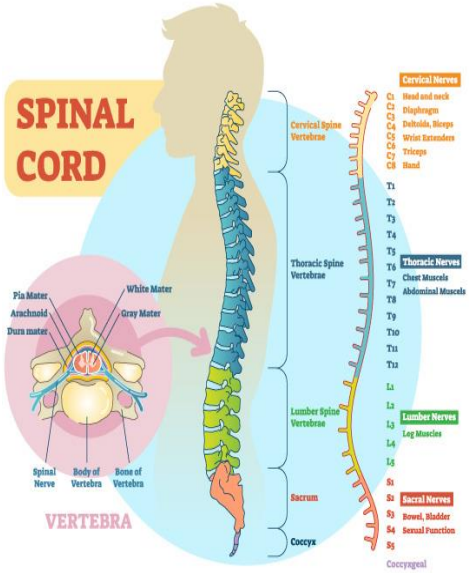
Describe the effects of chemicals on synaptic transmission



The musculoskeletal system

What is the purpose of the musculoskeletal system?

Describe what the spinal column is

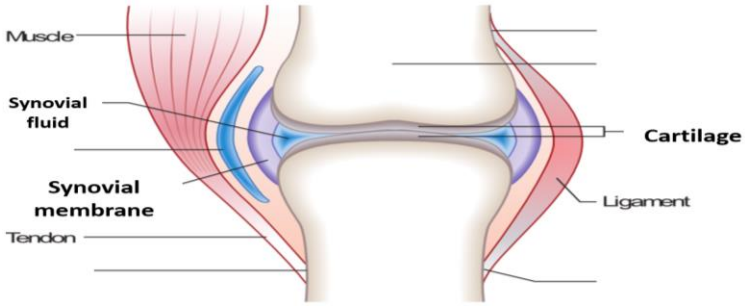


Joints

Name the 3 categories that joints can be classified by, giving an example for each.



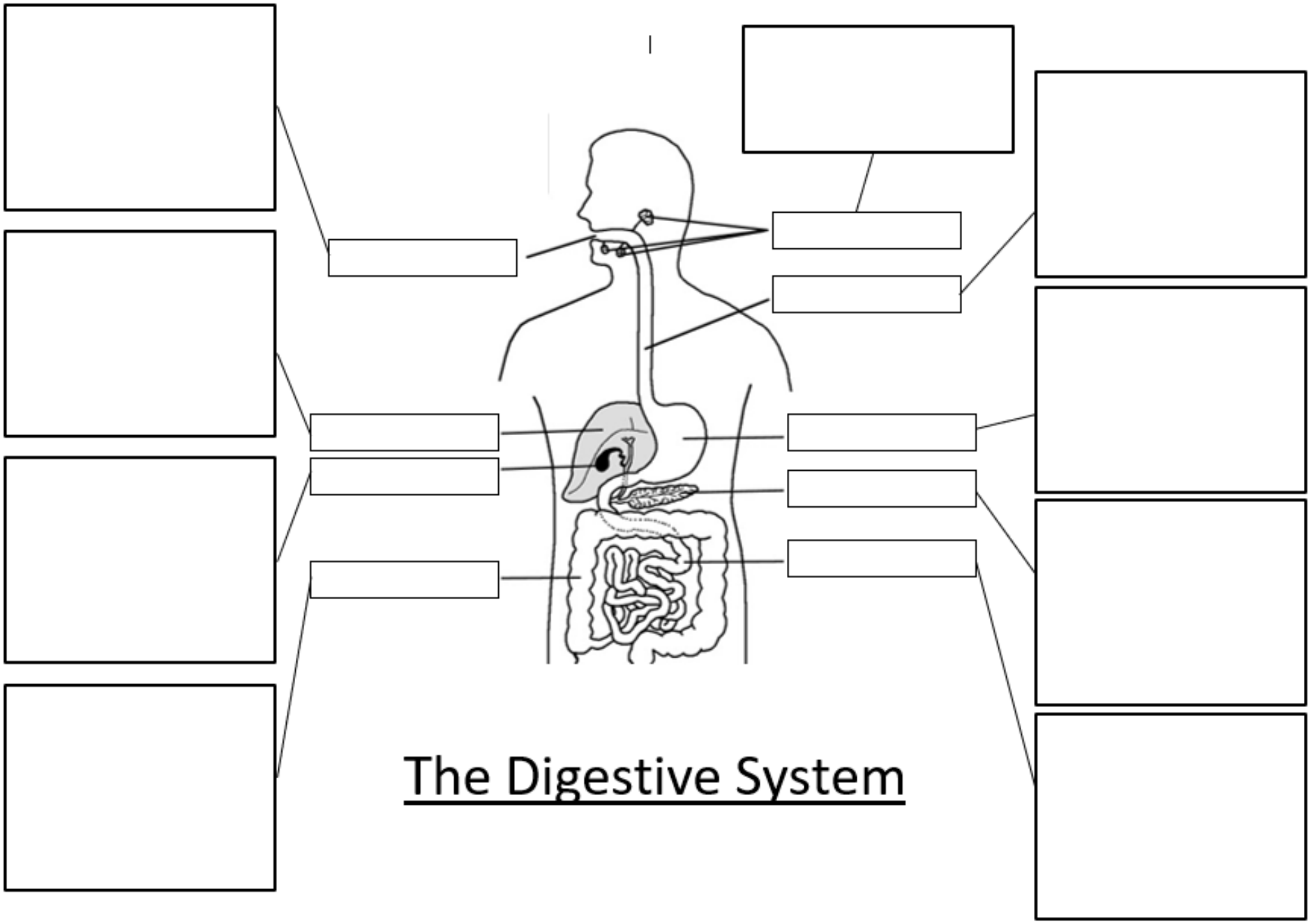
Describe the structure of a synovial joint



<u>Muscles.</u>

Muscles act in antagonists pairs. What does this mean?

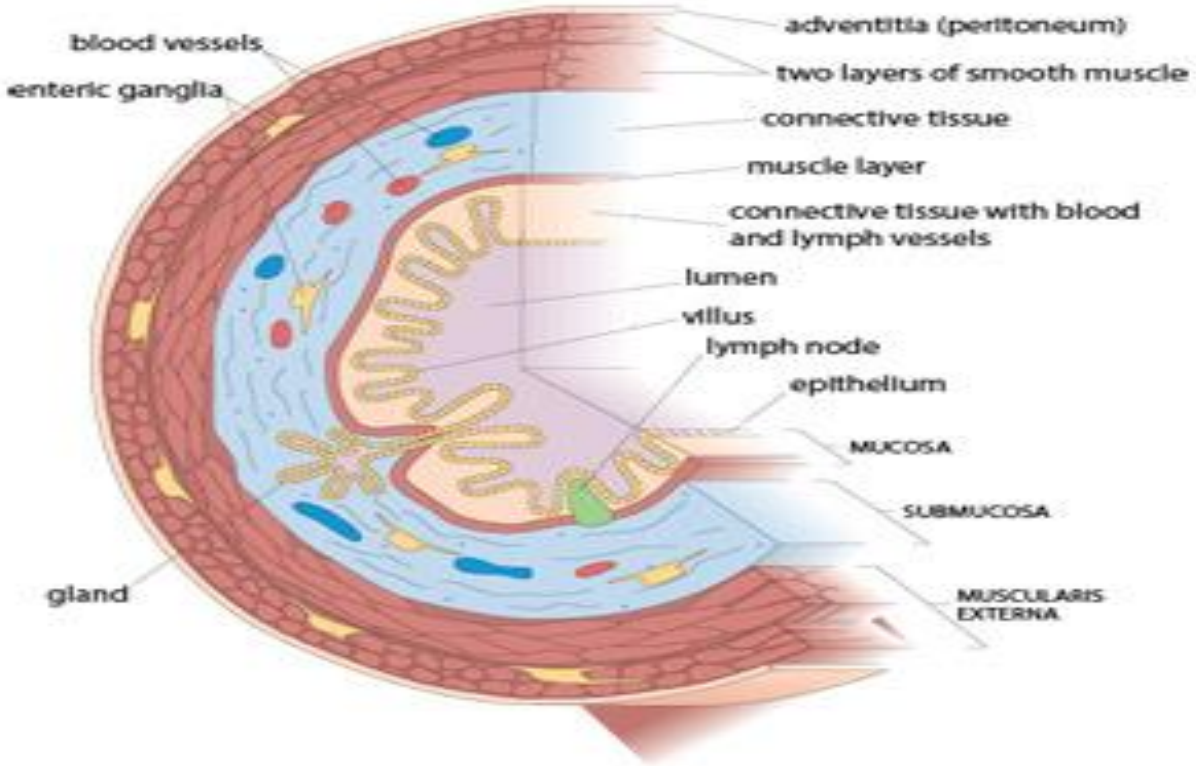
Describe the sliding filament theory of muscle contraction.



The Digestive System

The digestive system

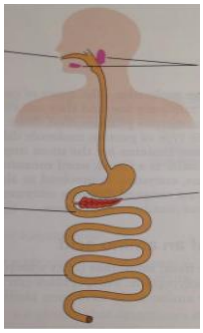
Layers of the gut walls and their relative proportions



What is the function of saliva during digestion?

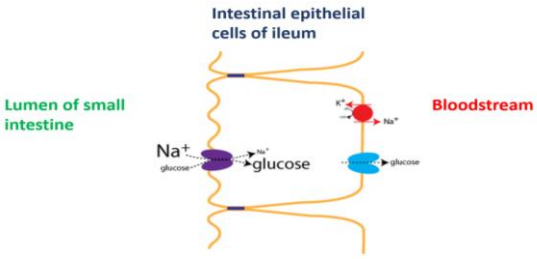
What is the function of mucus during digestion?

Describe how starch is fully digested into glucose. (3 marks)



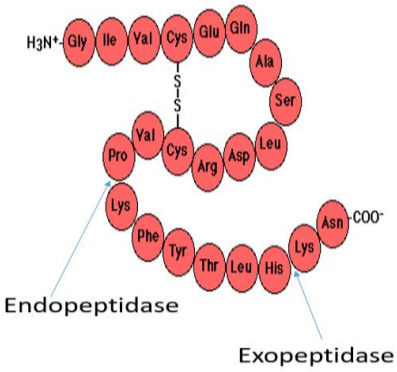
Describe how the disaccharides sucrose and lactose are digested. (2 marks)

Describe how glucose is absorbed into the blood from the ileum. (5 marks)



Digestion of proteins

Describe the chemical digestion of a protein (4)



Describe the how the endopeptidases pepsin and trypsin are activated.

Describe how glucose is absorbed by the epithelial cells of the ileum (small intestine). (5)

Lipid digestion and absorption

What are triglycerides made up of?

Where is bile produced?

Where is bile stored?

Where is bile secreted into?

Which organ produces the digestive enzymes e.g. lipase?

Where are the digestive enzymes secreted to?

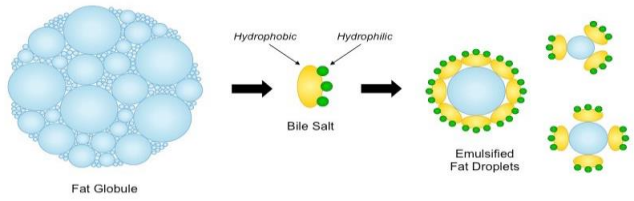
What is a monoglyceride?

What is a micelle?

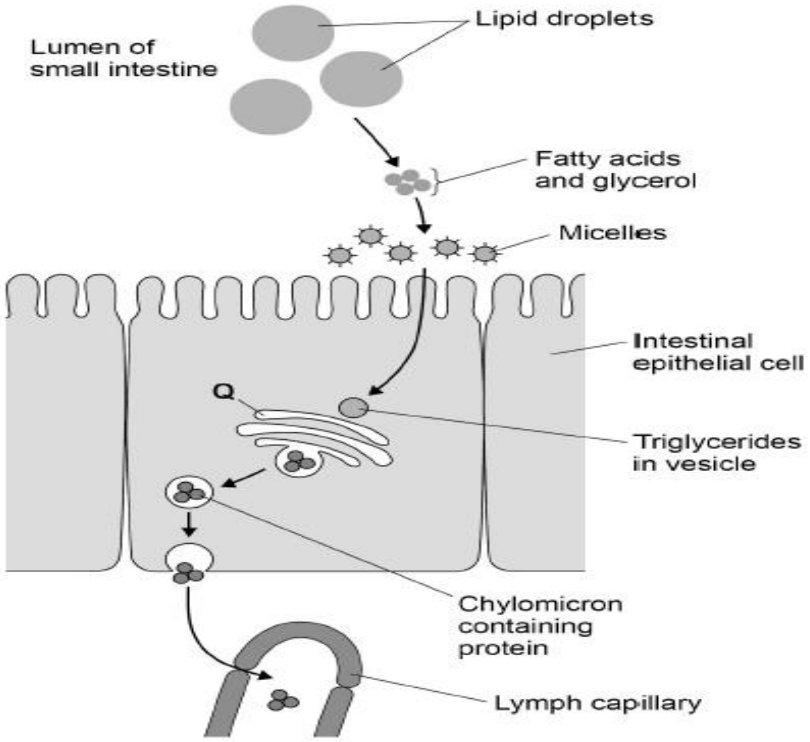
What is a chlylomicron?

What is the lacteal?

Describe the role of bile and lipase in the digestion of lipids.



Describe how the fatty acids and monoglycerides are absorbed into the lacteal (lymphatic capillary).



The cardiovascular system

The cardiac cycle wordfill:

1. Atrial systole

The ventricles are …… and the atria …….. This increases the ……..

and decreases the ……. in the atria, pushing the blood into the ventricles.

The tricuspid and bicuspid ……. are …….

2. Ventricular systole

The atria …….. and the ventricles ……..There is now more pressure in the

…… so the ……. and……. valves …… to prevent ….. …….

The pressure is also higher in the …… than in the …… and the ……

which forces the …… …… valves open as blood is forced into the

arteries.

3. Atrial and ventricular diastole

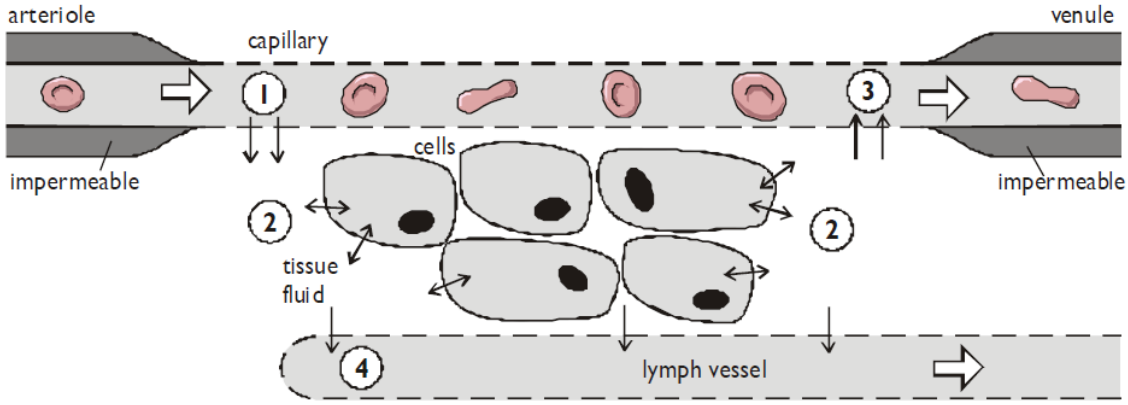
The atria and ventricles both……. The higher pressure in both the ……. and

……. force the ……. ……. ……. closed. Blood returns to the heart as the pressure in ……. and……. is greater than in the atria. As the

ventricles continue to relax, there is a higher pressure in the atria so the …… and

……. valves open and blood trickles into the …….

Formation of Tissue Fluid



Use the numbers – 1-5 to describe and explain what is happening at each number:

1.

2.

3.

4.

Highly Recommended Content

Unit 4 Research Questions

1.
   i) Describe each of these following routes for administration of medicines.
   ii) Give an example of a medicine, for each, which would be administered in this way.
   iii) Discuss the pros and cons for each route.

Routes for administration

Oral

Sublingual

Rectal

Topical

Intravenous

Intramuscular

Subcutaneous injection

2. Define:
a) An agonist
b) An antagonist

3. Define:
   a. Cancer.
   b. Primary cancers.
   c. Secondary cancers.
   d. Carcinoma.
   e. Sarcoma
   f. Leukaemia

g. Lymphoma
h. Melanoma

4. Discuss the treatment options for cancer:

a) Surgery
b) Chemotherapy (cytotoxic drugs)
c) Radiation therapy
d) Combination therapy
e) Blood transfusion
f) Targeted therapy
g) Immunotherapy
h) Photodynamic therapy