7.1 – RESPIRATORY SYSTEM

B3.1.1	Gas exchange as a vital function in all organisms
B3.1.2	Properties of gas-exchange surfaces
B3.1.3	Maintenance of concentration gradients at exchange surfaces in animals
B3.1.4	Adaptations of mammalian lungs for gas exchange
B3.1.5	Ventilation of the lungs
B3.1.6	Measurement of lung volumes

GAS EXCHANGE

State two challenges to maintaining sustainable gas exchanged faced by large multicellular organisms

1. _____

2. _____

Identify the properties of gas exchange surfaces

- S _____
- M _____
- A _____
- R _____
- T _____

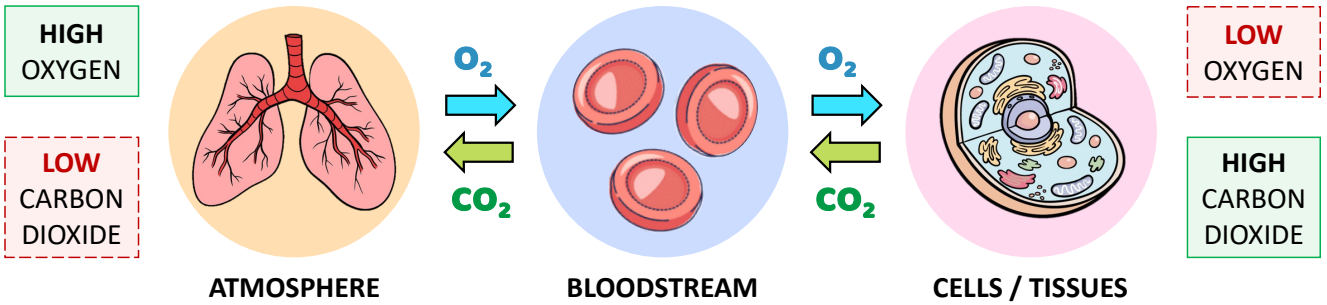
Describe how concentration gradients of respiratory gases are maintained at gas exchange surfaces

_____

_____

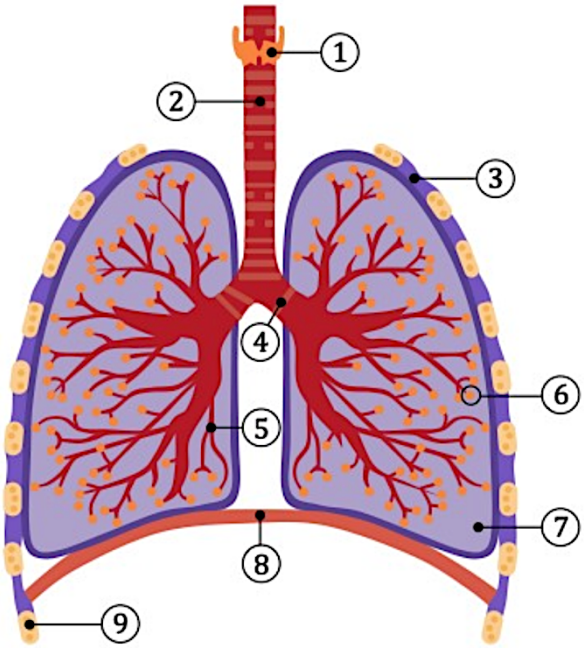
_____

_____



LUNGS

Label the parts of the human respiratory system



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

Differentiate between the structure and function of type I and type II pneumocytes

Type I: _____

Type II: _____

VENTILATION

Explain the mechanism of breathing, including the role of antagonistic muscles

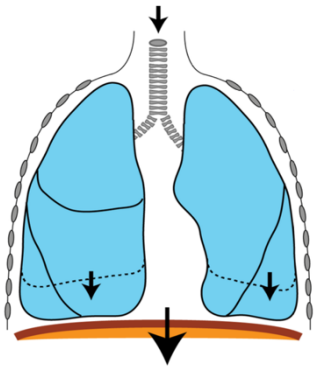
Inspiration / Inhalation:

_____

_____

_____

_____



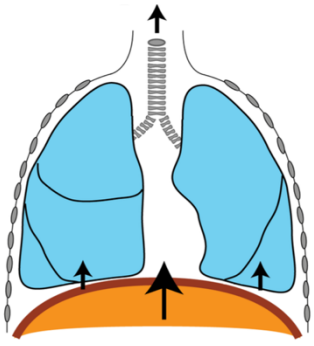
Expiration / Exhalation:

_____

_____

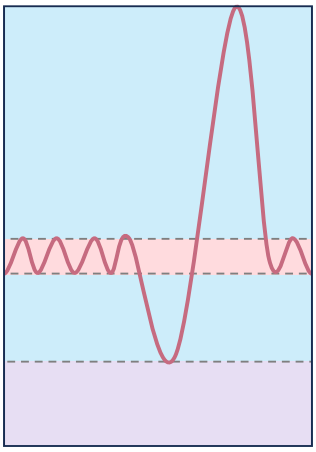
_____

_____



VENTILATION RATES

Define vital capacity, tidal volume and residual volume – and annotate these volumes on the diagram



_____

_____

_____

_____

_____

_____

Identify three factors that can influence the total lung capacity

1. _____

2. _____

3. _____

Explain how ventilation rate changes with moderate to vigorous exercise

_____

_____

_____

_____

_____

SPIROMETRY

Describe a method by which an individual could measure the inspiratory and expiratory reserves

_____

_____

_____

_____

_____

_____

7.2 – VASCULAR SYSTEM

B3.2.1	Adaptations of capillaries for exchange of materials between blood and the environment
B3.2.2	Structure of arteries and veins
B3.2.3	Adaptations of arteries for the transport of blood away from the heart
B3.2.4	Measurement of pulse rate
B3.2.5	Adaptations of veins for the return of blood to the heart
B3.2.6	Causes and consequences of occlusion of the coronary arteries

BLOOD COMPONENTS

Distinguish between the three types of blood cells

1. _____

2. _____

3. _____

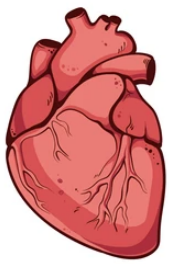
List materials that are transported around the body within the blood plasma

_____

_____

BLOOD FLOW

Describe the role of the heart in the movement of blood around the body



_____

_____

_____

Identify two methods for measuring pulse rate

1. _____

2. _____

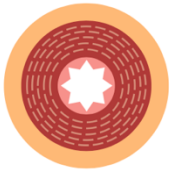
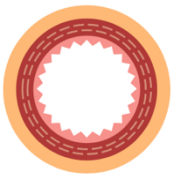
Explain how the composition of vessel walls supports pulse flow

_____

_____

BLOOD VESSELS

Compare the structure and function of arteries, capillaries and veins

	ARTERY	CAPILLARY	VEIN
			
Function			
Lumen Width			
Blood Pressure			
Valves			
Wall Structure			

CORONARY ARTERIES

Describe the causes and consequences of the occlusion of the coronary arteries

Causes:

_____

_____

_____

Consequences:

_____

_____

_____

7.3 – IMMUNE SYSTEM

C3.2.1	Pathogens as the cause of infectious diseases
C3.2.2	Skin and mucous membranes as a primary defence
C3.2.3	Sealing of cuts in skin by blood clotting
C3.2.4	Differences between the innate immune system and the adaptive immune system
C3.2.5	Infection control by phagocytes
C3.2.6	Lymphocytes as cells in the adaptive immune system that cooperate to produce antibodies
C3.2.7	Antigens as recognition molecules that trigger antibody production
C3.2.8	Activation of B-lymphocytes by helper T-lymphocytes
C3.2.9	Multiplication of activated B-lymphocytes to form clones of antibody-secreting plasma cells
C3.2.10	Immunity as a consequence of retaining memory cells
C3.2.11	Transmission of HIV in body fluids
C3.2.12	Infection of lymphocytes by HIV with AIDS as a consequence
C3.2.13	Antibiotics as chemicals that block processes occurring in bacteria but not in eukaryotic cells
C3.2.14	Evolution of resistance to several antibiotics in strains of pathogenic bacteria
C3.2.15	Zoonoses as infectious diseases that can transfer from other species to humans
C3.2.16	Vaccines and immunisation
C3.2.17	Herd immunity and the prevention of epidemics
C3.2.18	Evaluation of data related to the COVID-19 pandemic

PATHOGENS

Define pathogen and provide two specific examples of cellular versus acellular pathogens

_____

_____

Cellular: _____

Acellular: _____

LINES OF IMMUNE DEFENCE

Identify the three lines of defence against infectious diseases

1. _____

2. _____

3. _____

SURFACE BARRIERS

Contrast the skin and mucous membranes as barriers against infectious diseases

Skin	
Mucous Membrane	

Describe how clotting acts to maintain intact skin and provide non-specific protection against infection

Include: Platelets, clotting factors, thrombin, fibrinogen (soluble), fibrin (insoluble), clot

_____

_____

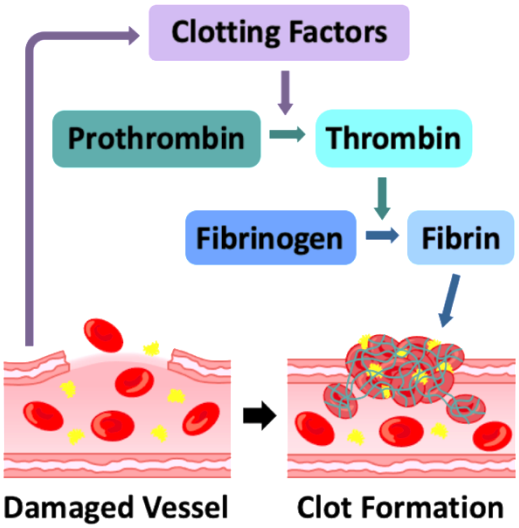
_____

_____

_____

_____

_____



PHAGOCYTOSIS

Outline how phagocytic leukocytes ingest pathogens and then present infectious material (antigens)

_____

_____

_____

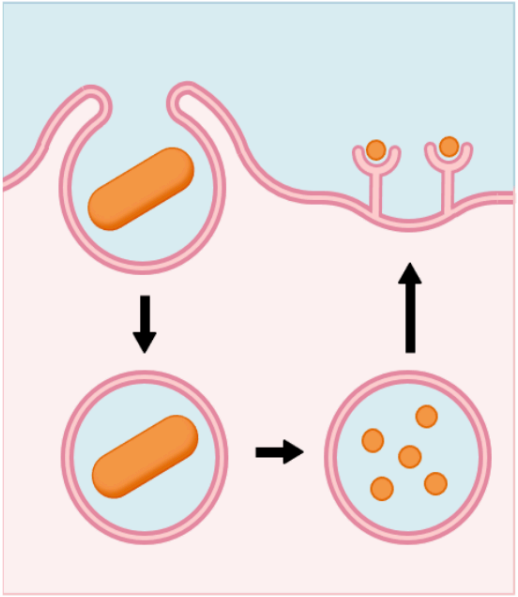
_____

_____

_____

_____

_____



INNATE VERSUS ADAPTIVE

Differentiate between the innate and adaptive immune responses

INNATE IMMUNITY	ADAPTIVE IMMUNITY

Explain the relationship between antigens and antibodies

_____

_____

_____

ANTIBODY PRODUCTION

Explain the production of antibodies as part of a body's adaptive immune response

Include: Antigen presenting cells, helper T cells, cytokines, B cells, plasma cells, memory cells

_____

_____

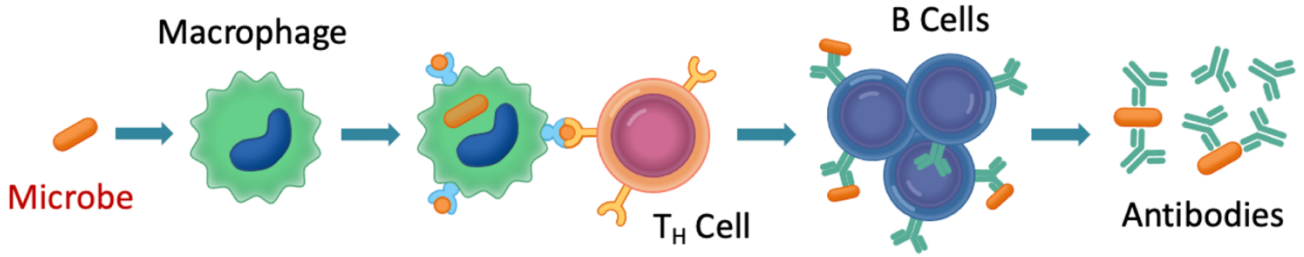
_____

_____

_____

_____

_____



ANTIBIOTICS

Explain why antibiotics are effective against bacteria, but not body cells or viruses

_____

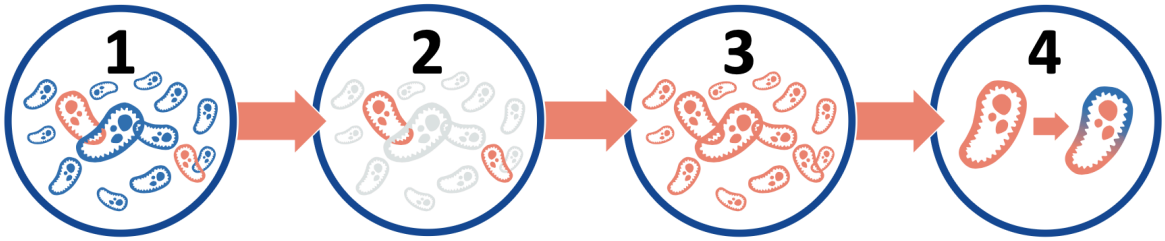
Outline how bacteria have evolved strains with resistance to certain antibiotics

_____

_____

_____

_____



Few resistant bacterial strains | *Antibiotic kills most bacteria* | *Resistant strains survive and grow* | *Resistance can be transferred*

IMMUNODEFICIENCY

Outline the effects of HIV on the immune system and how it is transmitted

Transmission:

_____

Cause and Effect:

_____

_____

_____

ZOONOSES

Outline examples of zoonotic diseases

	Mycobacterium bovis	Lyssavirus	JEV	SARS-CoV-2
Animal Source				
Disease				

IMMUNISATION

Describe the composition of a vaccine

_____

_____

Outline the process of vaccination

_____

_____

_____

_____

Explain herd immunity

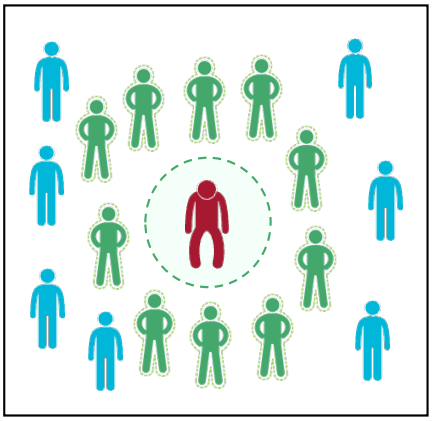
_____

_____

_____

_____

_____



OUTBREAKS

Distinguish between epidemics and pandemics

_____

_____

Calculate the vaccine efficiency (% change) and myocarditis incidence (% difference) for the two vaccines

Moderna Trial	Vaccine	Placebo
Participants	15,209	15,206
COVID Cases	55	744

Myocarditis (per million vaccines) = 181

Pfizer Trial	Vaccine	Placebo
Participants	21,720	21,728
COVID Cases	8	162

Myocarditis (per million vaccines) = 97

Vaccine Efficiency: _____

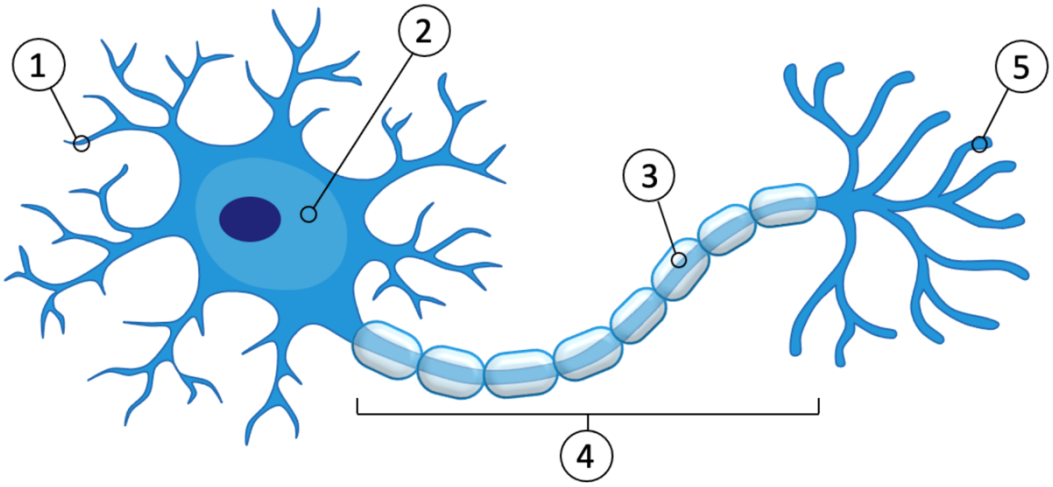
Comparative Myocarditis Incidence: _____

7.4 – NERVOUS SYSTEM

C2.2.1	Neurons as cells within the nervous system that carry electrical impulses
C2.2.2	Generation of the resting potential by pumping to establish and maintain concentration gradients of sodium and potassium ions
C2.2.3	Nerve impulses as action potentials that are propagated along nerve fibres
C2.2.4	Variation in the speed of nerve impulses
C2.2.5	Synapses as junctions between neurons and between neuron and effector cells
C2.2.6	Release of neurotransmitters from a presynaptic membrane
C2.2.7	Generation of an excitatory postsynaptic potential

NEURONS

Label a motor neuron (and identify the direction of an electrical impulse)



1. _____

2. _____

3. _____

4. _____

5. _____

Direction of impulse (circle): ⟵ or ⟶

RESTING POTENTIALS

Describe the generation of a resting potential by sodium-potassium pumps

_____

_____

_____

_____

_____

ACTION POTENTIALS

Describe the generation of an action potential in terms of depolarisation and repolarisation

_____

_____

_____

_____

_____

NERVE IMPULSES

Outline how nerve impulses are propagated by voltage-gated ion channels (via threshold potentials)

_____

_____

_____

_____

Describe two factors that can vary the speed of a nerve impulse

2. _____

3. _____

SYNAPTIC TRANSFER

Describe the transmission of a nerve signal between two neurons (i.e. across a synapse)

Include: Calcium channels, neurotransmitters, exocytosis, post-synaptic receptors, graded potentials

_____

_____

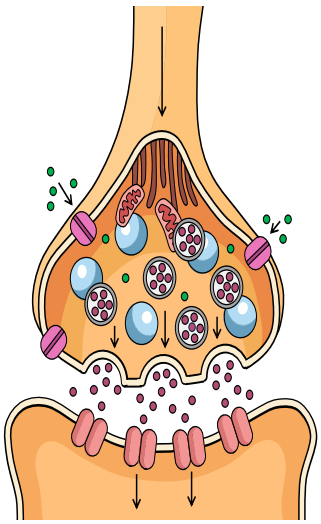
_____

_____

_____

_____

_____



7.5 – REPRODUCTIVE SYSTEM

D3.1.1	Differences between sexual and asexual reproduction
D3.1.2	Role of meiosis and fusion of gametes in the sexual life cycle
D3.1.3	Differences between male and female sexes in sexual reproduction
D3.1.4	Anatomy of the human male and female reproductive systems
D3.1.5	Changes during the ovarian and uterine cycles and their hormonal regulation
D3.1.6	Fertilisation in humans
D3.1.7	Use of hormones in *in vitro* fertilisation (IVF) treatment

TYPES OF REPRODUCTION

Compare the advantages and disadvantages of asexual reproduction versus sexual reproduction

Asexual	
Sexual	

Identify three specific examples of asexual reproduction

1. _____

2. _____

3. _____

SEXUAL LIFE CYCLE

Outline the role of mitosis and meiosis in the sexual life cycle

_____

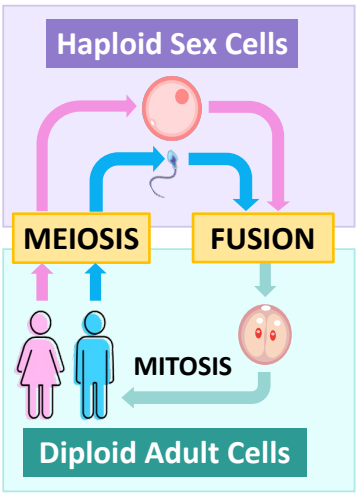
_____

_____

_____

_____

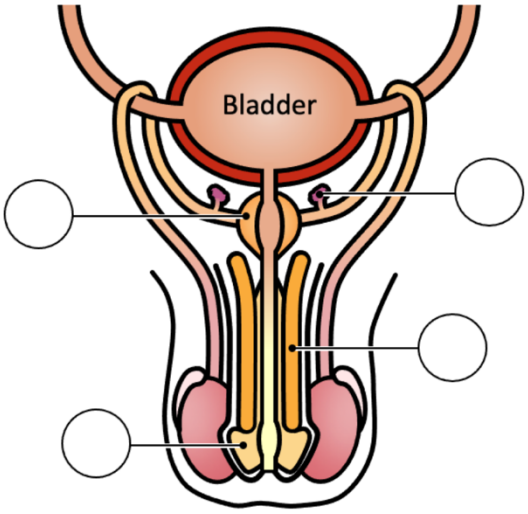
_____



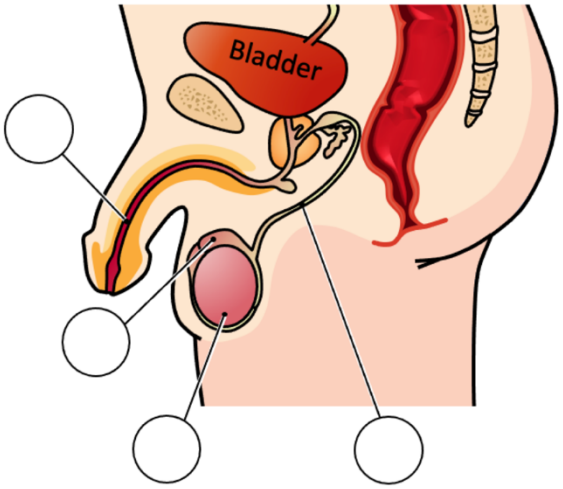
MALE REPRODUCTIVE SYSTEM

Annotate the diagram of the male reproductive system, describing the function of each component

FRONT VIEW



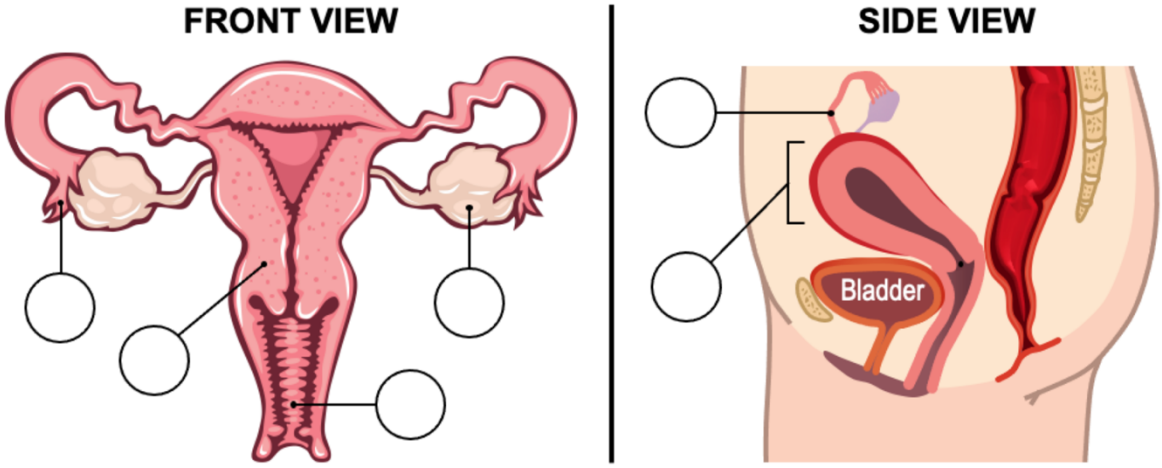
SIDE VIEW



#	Structure	Function
1	Testis	
2	Epididymis	
3	Vas Deferens	
4	Seminal Vesicle	
5	Prostate Gland	
6	Urethra	
7	Penis	
8	Erectile Tissue	

FEMALE REPRODUCTIVE SYSTEM

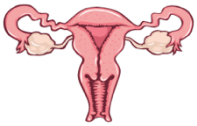
Annotate the diagram of the female reproductive system, describing the function of each component



#	Structure	Function
1	Ovary	
2	Fimbriae	
3	Oviduct	
4	Uterus	
5	Endometrium	
6	Vagina	

MENSTRUAL CYCLE

Identify the hormones involved in the menstrual cycle and describe their function

Endocrine Gland	Hormones	Function
 Anterior Pituitary		
 Ovaries		

Describe the events of the menstrual cycle (including the ovarian cycle, ovulation and the uterine cycle)

_____

_____

_____

_____

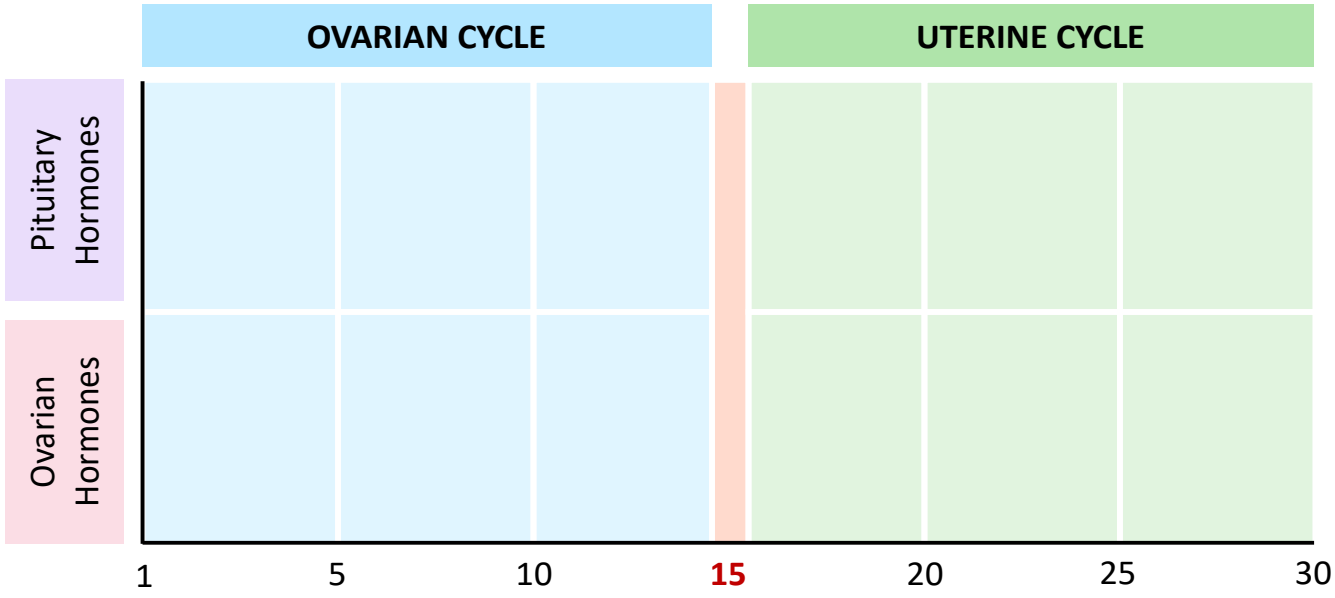
_____

_____

_____

_____

Annotate the diagram to show the hormonal changes that occur during a single menstrual cycle



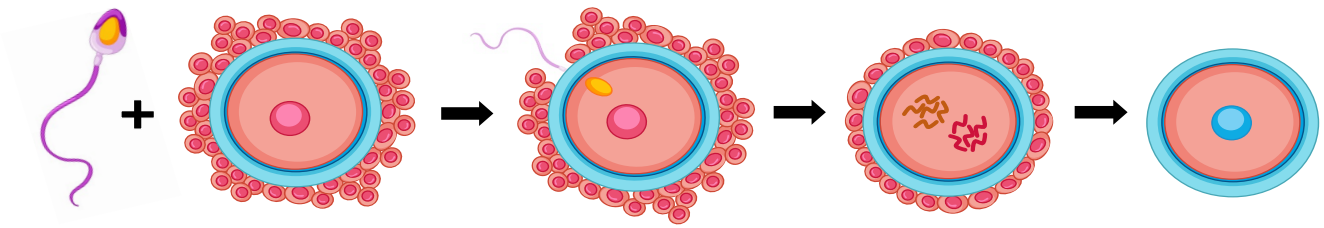
GAMETES

Compare the production of gametes in males and females

	MALE	FEMALE
Number produced (per meiotic division)		
Timing of production (over entire lifespan)		
Size and motility of gametes		

FERTILISATION

Describe the process of fertilisation in humans



IN VITRO FERTILISATION

Outline the artificial inducement of pregnancy via in vitro fertilisation (IVF)

7.6 – BLOOD SYSTEM (AHL)

B3.2.11 Release and reuptake of tissue fluid in capillaries

B3.2.12 Exchange of substances between tissue fluid and cells in tissues

B3.2.13 Drainage of excess tissue fluid into lymph ducts

B3.1.11 Adaptations of foetal and adult haemoglobin for the transport of oxygen

B3.1.12 Bohr shift

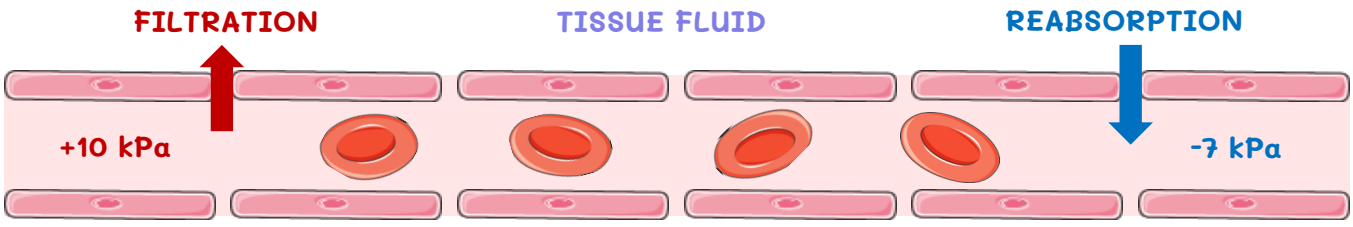
B3.1.13 Oxygen dissociation curves as a means of representing the affinity of haemoglobin for oxygen at different oxygen concentrations

FLUID EXCHANGE

Compare the composition of blood plasma and tissue fluid

BLOOD PLASMA	TISSUE FLUID

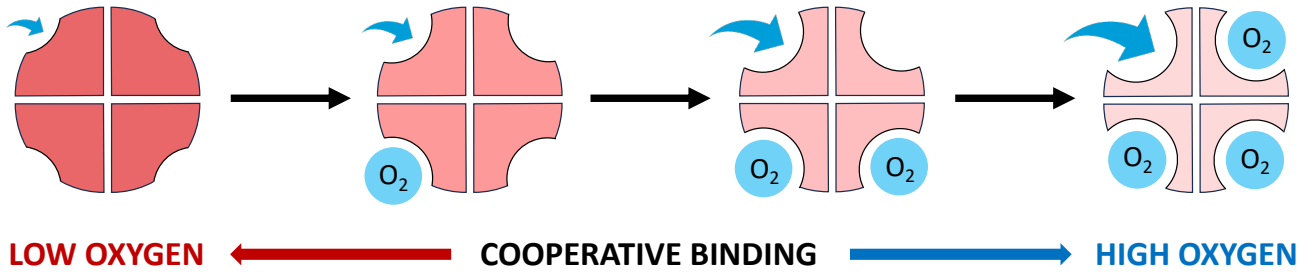
Describe the role of hydrostatic pressure and oncotic pressure in fluid exchange within the capillaries



Outline the role of the lymphatic system in the drainage of excess tissue fluid

HAEMOGLOBIN

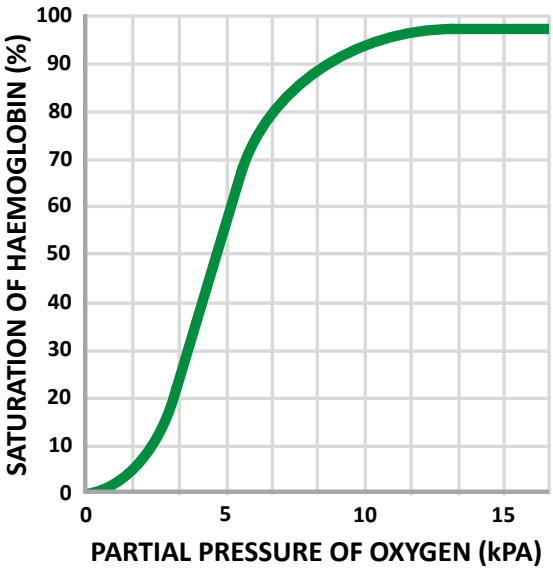
Outline cooperative binding (O_2) and allosteric binding (CO_2) in the transport of gases by haemoglobin



OXYGEN DISSOCIATION

Explain the dissociation curve for adult haemoglobin

Draw the expected dissociation curve for fetal haemoglobin



BOHR SHIFT

Explain how an increase in carbon dioxide causes increased oxygen dissociation (the Bohr shift)

7.7 – CARDIOVASCULAR SYSTEM (AHL)

B3.2.14	Differences between the single circulation of bony fish and the double circulation of mammals
B3.2.15	Adaptations of the mammalian heart for delivering pressurised blood to the arteries
B3.2.16	Stages in the cardiac cycle
D3.3.11	Changes in blood supply to organs in response to changes in activity

CIRCULATION

Outline the differences between single circulation systems and double circulation systems

_____

_____

_____

Describe the flow of blood around the body in a human

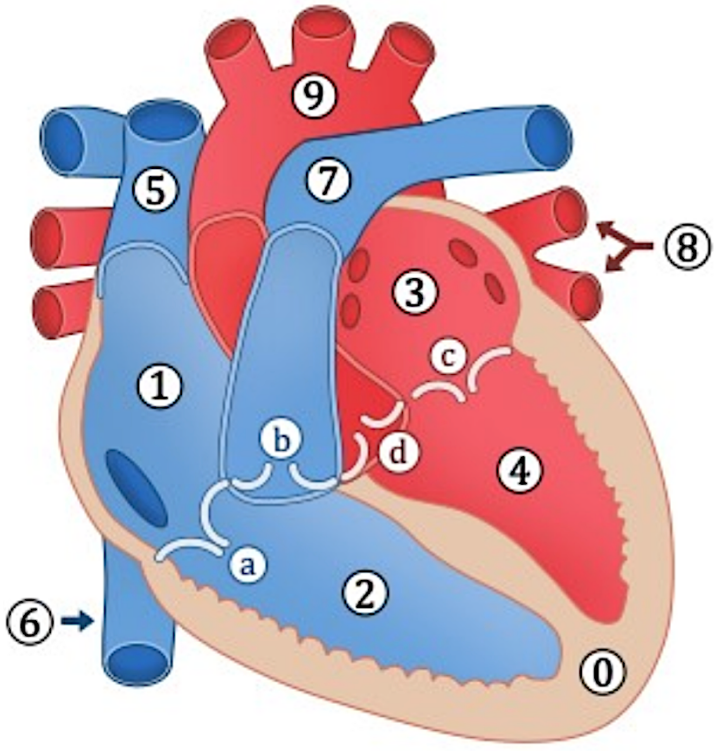
_____

_____

_____

THE HEART

Label the diagram of the human heart



Chambers:

1. _____ 2. _____

3. _____ 4. _____

Vessels:

5. _____ 6. _____

7. _____ 8. _____

9. _____ 0. _____

Valves:

a. _____ b. _____

c. _____ d. _____

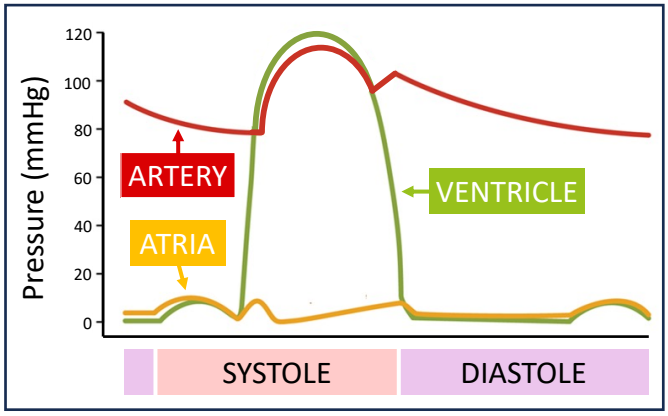
HEART BEAT

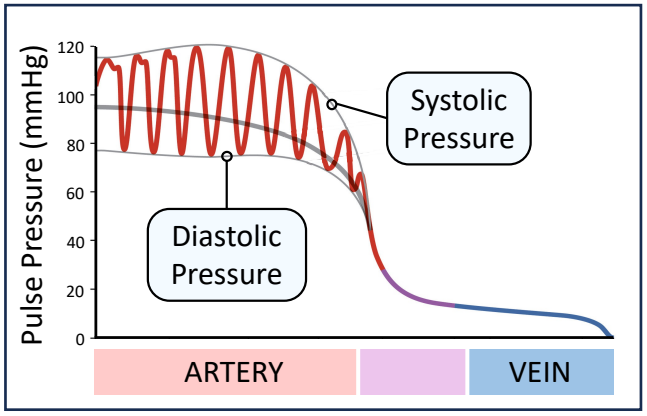
Outline the myogenic control of a single heart beat

Include: sinoatrial node (pacemaker), atrioventricular node, Bundle of His, Purkinje fibres

CARDIAC CYCLE

Outline the pressure changes in the heart and blood vessels during systole and diastole





BLOOD SUPPLY

State the changes to blood supply (more or less) during sleep, wakeful rest and vigorous activity

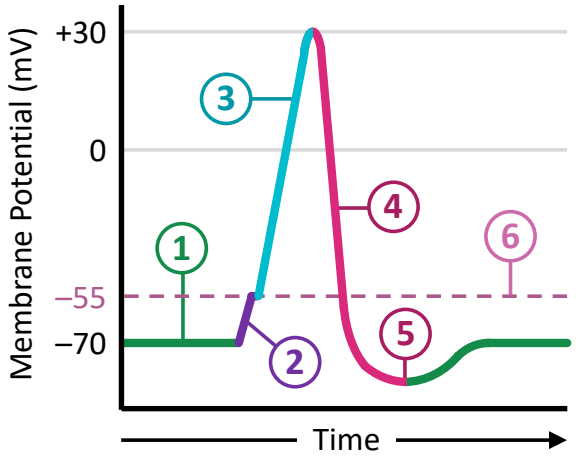
	Muscles	Gut	Brain	Kidneys
Sleep				
Wakeful Rest				
Vigorous Activity				

7.8 – NERVOUS SYSTEM (AHL)

C2.2.8	Depolarisation and repolarisation during action potentials
C2.2.9	Propagation of an action potential along a nerve fibre/axon as a result of local currents
C2.2.10	Oscilloscope traces showing resting potentials and action potentials
C2.2.11	Saltatory conduction in myelinated fibres to achieve faster impulses
C2.2.12	Effects of exogenous chemicals on synaptic transmission
C2.2.13	Inhibitory neurotransmitters and generation of inhibitory postsynaptic potentials
C2.2.14	Summation of effects of excitatory and inhibitory neurotransmitters in a postsynaptic neuron
C2.2.15	Perception of pain by neurons with free nerve endings in the skin
C2.2.16	Consciousness as a property that emerges from the interaction of individual neurons in a brain

OSCILLOSCOPE TRACE

Identify the parts of an action potential and describe what is meant by 'all or none'



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

All or None: _____

_____

SALTATORY CONDUCTION

Outline the role of the myelin sheath and nodes of Ranvier in saltatory conduction

_____

_____

_____

_____

_____

SUMMATION

Compare inhibitory post-synaptic potentials (IPSPs) and excitatory post-synaptic potentials (EPSPs)

IPSP	
EPSP	

Describe the summation of graded potentials

_____

_____

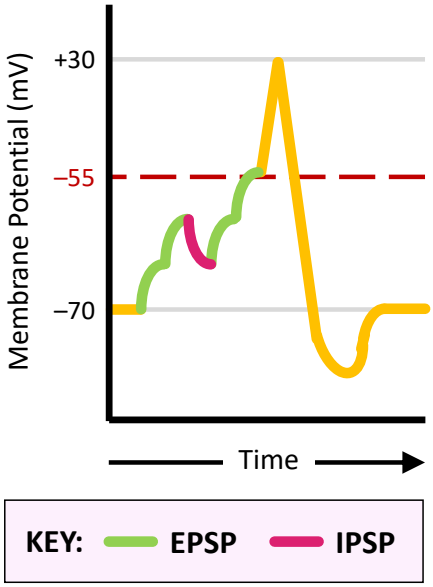
_____

_____

_____

_____

_____



PAIN PERCEPTION

List three stimuli that can trigger pain receptors (also called nocireceptors)

1. _____ 2. _____ 3. _____

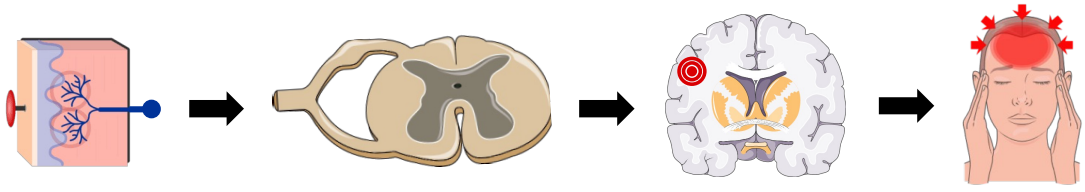
Outline the nerve pathway involved in the perception of pain

_____

_____

_____

_____



CONSCIOUSNESS

Describe how consciousness arises as an emergent property from the interaction of individual neurons

_____

_____

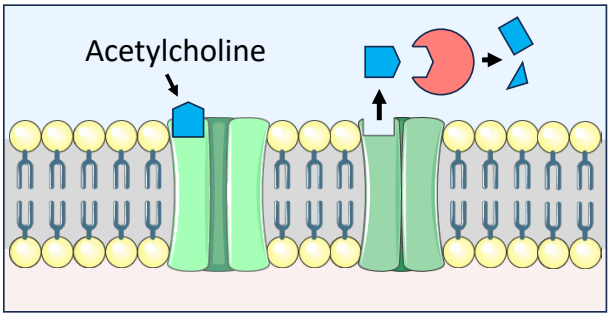
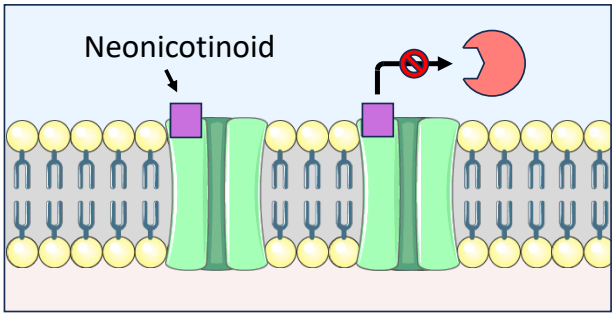
_____

_____

_____

DRUG INTERACTIONS

Outline the effect of neonicotinoid pesticides on the synaptic transmission of acetylcholine

Normal Acetylcholine Signalling	Neonicotinoid Pesticide Effect
	

Outline how cocaine interacts with the mesolimbic system to trigger a sensation of euphoria

_____

_____

_____

_____

_____

7.9 – REPRODUCTIVE SYSTEM (AHL)

D3.1.13	Control of the changes of puberty by gonadotropin-releasing hormone and steroid hormones
D3.1.14	Spermatogenesis and oogenesis in humans
D3.1.15	Mechanisms to prevent polyspermy
D3.1.16	Development of a blastocyst and implantation in the endometrium
D3.1.17	Pregnancy testing by detection of human chorionic gonadotropin secretion
D3.1.18	Role of the placenta in foetal development inside the uterus
D3.1.19	Hormonal control of pregnancy and childbirth
D3.1.20	Hormone replacement therapy and the risk of coronary heart disease

PUBERTY

Describe the role of gonadotropin-releasing hormone (GnRH) and the sex steroid hormones in puberty

GnRH:

_____

_____

_____

Testosterone:

_____

_____

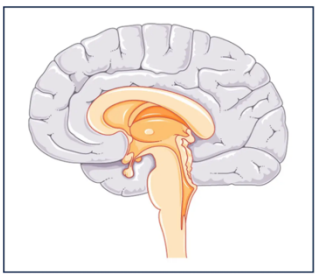
_____

Oestrogen:

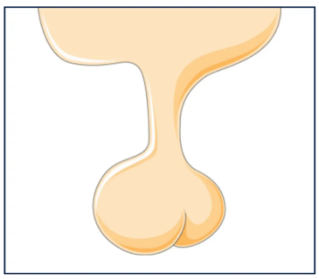
_____

_____

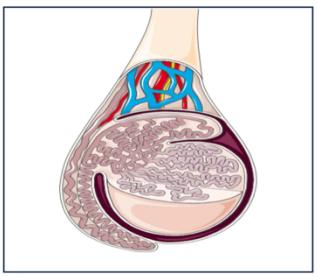
_____



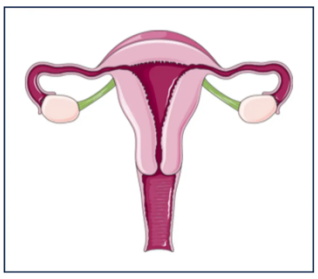
GnRH



FSH and LH



Testosterone



Oestrogen

GAMETOGENESIS

Compare spermatogenesis and oogenesis

Similarities:

_____

_____

_____

Differences:

	Spermatogenesis	Oogenesis
Location		
Gamete Size		
Cell Number		
Timing		

FERTILISATION

Describe the mechanisms that exist to prevent polyspermy

Acrosome Reaction by Spermatozoa:

_____

_____

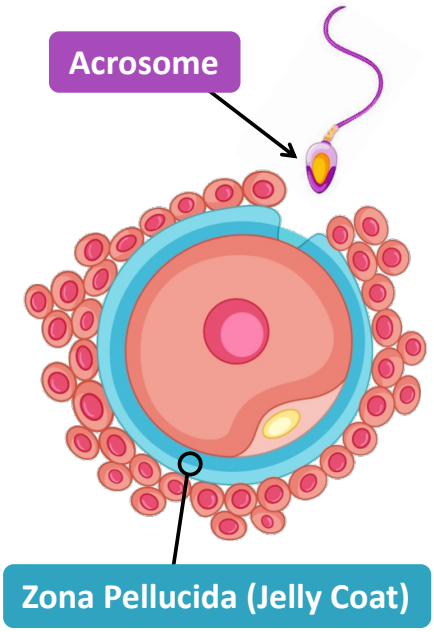
_____

Cortical Reaction by the Ovum:

_____

_____

_____



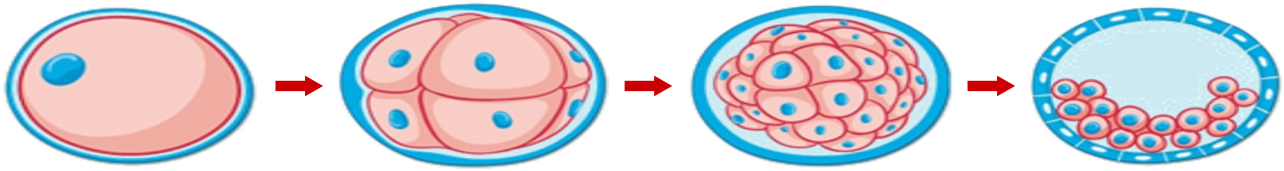
IMPLANTATION

Describe the development of an embryo and its implantation in the endometrium

_____

_____

_____



PREGNANCY TESTING

Outline the role of human chorionic gonadotropin (hCG) and monoclonal antibodies in pregnancy testing

_____

_____

_____

_____

_____

PLACENTA

Outline how the structure of the placenta allows a foetus to be retained to a later stage of development

_____

_____

Outline the role of the placenta in material exchange and hormonal control

Material Exchange:

Mother → Foetus: _____

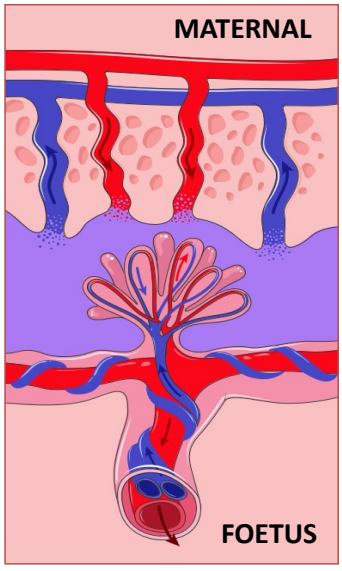
Foetus → Mother: _____

Hormonal Control:

_____

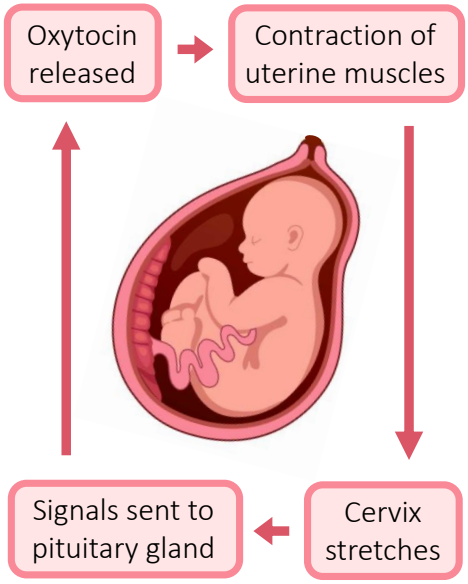
_____

_____



CHILDBIRTH

Describe child birth as a consequence of a positive feedback loop

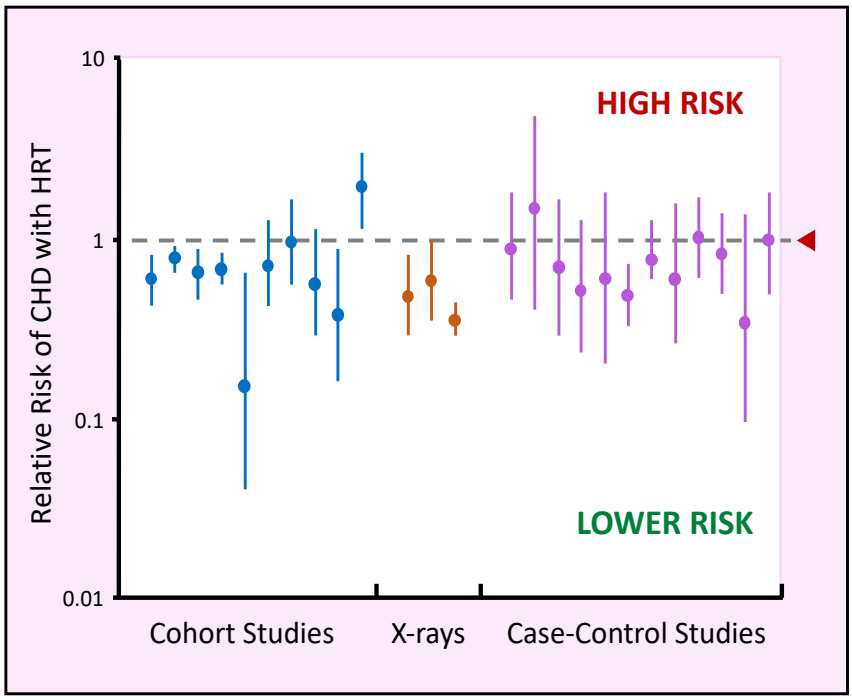


HRT AND CHD

Discuss the evidence for a correlation between hormone replacement therapy and coronary heart disease

Evidence For	Evidence Against

Evaluate the strength of the trends shown in the graph below



Arguments For:

Arguments Against:

7.10 – SKELETOMUSCULAR SYSTEM (AHL)

B3.3.1	Adaptations for movement as a universal feature of living organisms
B3.3.2	Sliding filament model of muscle contraction
B3.3.3	Role of the protein titin and antagonistic muscles in muscle relaxation
B3.3.4	Structure and function of motor units in skeletal muscle
B3.3.5	Roles of skeletons as anchorage for muscles and as levers
B3.3.6	Movement at a synovial joint
B3.3.7	Range of motion of a joint
B3.3.8	Internal and external intercostal muscles as an example of antagonistic muscle action
B3.3.9	Reasons for locomotion
B3.3.10	Adaptations for swimming in marine mammals

MOVEMENT

Distinguish between sessile and motile organisms (providing one example of each)

Sessile: _____

_____

Motile: _____

_____

Identify four reasons for locomotion

- F _____
- A _____
- S _____
- T _____

Outline adaptations for swimming in marine mammals

_____

_____

_____

_____

_____

SKELETONS

Describe the role of skeletons in movement and distinguish between exoskeletons and endoskeletons

_____

_____

_____

JOINTS

Outline the components of a human synovial hip joint

_____

_____

_____

_____

Describe a method by which range of motion (i.e. joint angles) can be measured in multiple dimensions

_____

MUSCLES

Describe how antagonistic muscle pairs facilitate movement, using the intercostal muscles as an example

_____

_____

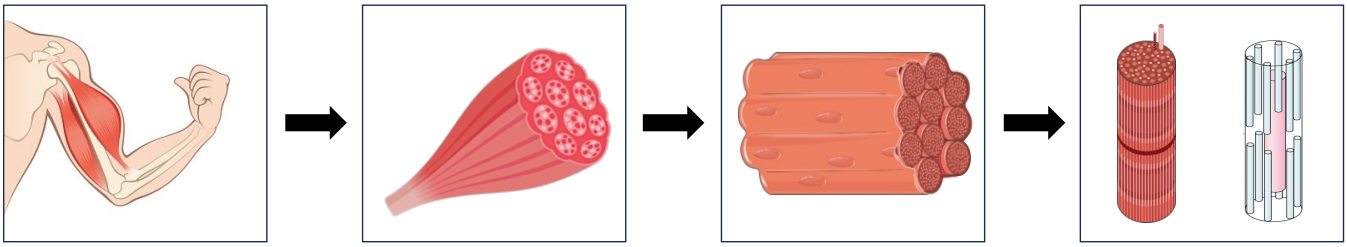
_____

Outline the structural organisation of a skeletal muscle into motor units

_____

_____

_____



SARCOMERE

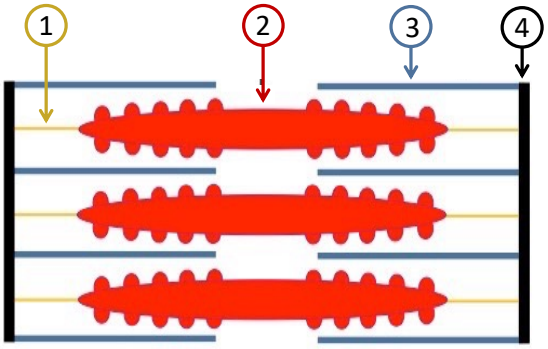
Label the components of a sarcomere

1. _____

2. _____

3. _____

4. _____



MUSCULAR CONTRACTION

Describe the contraction and relaxation of a skeletal muscle

1. Sarcolemma depolarisation

_____

_____

_____

2. Actin and myosin cross-bridge formation

_____

_____

_____

3. Sliding mechanism of the myofilaments

_____

_____

_____

4. Sarcomere shortening

_____

_____

5. Relaxation of the muscle fibre

_____

_____

7.11 – EXCRETORY SYSTEM (AHL)

D3.3.7	Role of the kidney in osmoregulation and excretion
D3.3.8	Role of the glomerulus, Bowman's capsule and proximal convoluted tubule in excretion
D3.3.9	Role of the loop of Henle
D3.3.10	Osmoregulation by water reabsorption in the collecting ducts

KIDNEYS

Describe the two main roles of the kidneys

1. _____

2. _____

Annotate the diagram of a human kidney

C. _____

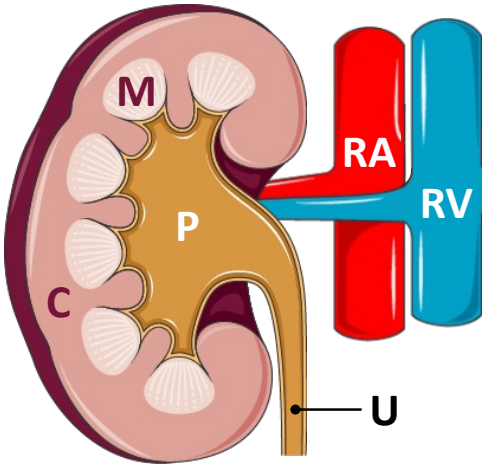
M. _____

P. _____

U. _____

RA: _____

RV: _____



NEPHRON

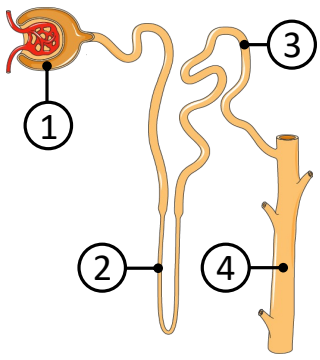
Identify the structural components of a nephron

1. _____

2. _____

3. _____

4. _____

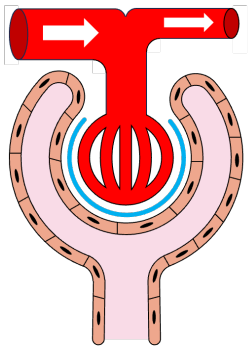


Identify the location of the different stages of urine formation

Ultrafiltration	
Selective Reabsorption	
Osmoregulation	

ULTRAFILTRATION

Describe the role of the glomerulus and the Bowman's capsule in ultrafiltration



_____

_____

_____

_____

SELECTIVE REABSORPTION

Describe the role of the convoluted tubules in selective reabsorption

_____

_____

_____

_____

OSMOREGULATION

Describe the role of the loop of Henle, vasa recta and collecting ducts in osmoregulation

_____

_____

_____

_____

_____

_____

URINE FORMATION

Compare the composition of blood, filtrate and urine

Blood	
Filtrate	
Urine	