Scheme of Work 2020-2021
Subject: Biology

Year Group: 13 Autumn term 2
Specification: A2 Biology

Lesson No	Topic & Objectives	Big Question – What will students learn?	Key Activities & Specialist Terminology (Do Now Task / Starter/Tasks/Plenary	Planned Assessment	Homework or flipped learning resources DODDLE resources	Lit Num SMSC Codes
1 **3.6.2.1 Nerve impulses**	The structure of a myelinated motor neurone. The establishment of a resting potential in terms of differential membrane permeability, electrochemical gradients and the movement of sodium ions and potassium ions. Changes in membrane permeability lead to depolarisatio	• Describe and explain the structure of a myelinated motor neurone. • Explain what is meant by a resting and an action potential. • Explain the events in establishing a resting potential. • Explain the events in generating an action potential. Explain what is meant by the all or nothing principle.	**Learning activities:** • back to back: provide labelled diagram of a myelinated motor neurone – pairs of students sit back to back and one student describes the structure to another who recreates it on paper • questioning to recap membrane structure and the role of proteins from section 3.2.3 • teacher explanation of resting potentials and action potentials and the all or nothing principle. Use interactive animation to check understanding • give cards showing stages involved in resting and action potential and get students to sequence them • provide an A3 oscilloscope trace showing time against axon membrane potential (with resting potential and action potential shown. Get students to match each description on the earlier card sort to the part of the graph • exam questions. **Skills developed by learning activities:**	**Specimen assessment material:** A-level Paper 2 (set 1) – Q4.1 and 4.3 **Past exam paper material:** BIOL5 June 2013 – Q10a BIOL5 June 2010 – Q3 HBIO4 June 2011 – Q3 HBIO4 Jan 2010 – Q5	**Flipped learning opportunity** PiXL Independence: Biology – Student Booklet KS5 – Coordination and Homeostasis 15.1 Worksheet sites.sinauer.com/neuroscience5e/animations02.01.html sites.sinauer.com/neuroscience5e/animations02.03.html highered.mheducation.com/sites/0072495855/student_view0/chapter14/animation__the_nerve_impulse.html outreach.mcb.harvard.edu/animations/actionpotential_short.swf	C1, Sp3,C3

	n and the generation of an action potential. The all-or-nothing principle.		• AO1 – development of understanding of motor neurone structure, resting potentials and action potentials AO2/AO3 – interpret scientific data and apply knowledge of the resting and action potentials to explain the data.		**Rich questions:** • How is a resting potential established? • How is the membrane potential reversed during an action potential? What is the all or nothing principle?	
2	The passage of an action potential along non-myelinated and myelinated axons, resulting in nerve impulses. Saltatory conduction affects the speed of conductance.	• Explain how action potentials pass along unmyelinated neurones. • Describe what nodes of Ranvier are. Describe how action potentials pass along myelinated neurones by saltatory conduction, and why this is faster than conductance along unmyelinated neurones.	**Learning activities:** • teacher explanation of how action potentials pass along an unmyelinated neurone by stimulating the depolarisation of the next region along the neurone • explain how myelinated neurones have nodes of Ranvier in the myelin sheath, and how action potentials pass between along nodes by saltatory conduction • exam questions. **Skills developed by learning activities:** AO1 – development of understanding of how action potentials pass along myelinated and unmyelinated neurones.	**Specimen assessment material:** A-level Paper 2 (set 1) – Q4.1 and 4.4	**<u>Flipped learning opportunities</u>** A2 9.1 sensory reception structure worksheet blackwellpublishing.com/patestas/animations/actionp.html **Rich questions:** • What are nodes of Ranvier? Why is conduction along myelinated neurones quicker than along unmyelinated ones?	C1, Sp3,C3
4	The nature and importance of the refractory period in producing	• Explain what is meant by the refractory period and why action potentials are prevented. • Explain the importance of the refractory period.	**Learning activities:** • teacher explanation of refractory periods and why they are important • provide data of an oscilloscope trace with the refractory period marked on. Ask students to work out the maximum number	**Past exam paper material:** BIOL5 June 2013 – Q4b HBIO4 June 2012 – Q7	**Rich questions:** • Give three reasons why the refractory period is important. Why are nerve impulses unidirectional?	C1, Sp3,C3

	discrete impulses and in limiting the frequency of impulse transmission.	• Apply knowledge of action potentials and refractory period to the context of exam questions.	of action potentials that could be generated per second • exam questions. **Skills developed by learning activities:** • AO1 – development of understanding of the refractory period and its importance AO2/AO3 – interpret scientific data and apply knowledge about refractory period in limiting the frequency of action potentials.	HBIO4 June 2010 – Q10		
5	Factors affecting the speed of conductance: myelination and saltatory conduction; axon diameter; temperature.	• Explain the factors which affect the speed of nerve impulse conductance. • Calculate an appropriate statistical test and interpret values in terms of probability and chance (eg mean speed of conductance at 2 different temperatures). • Apply knowledge to draw and explain conclusions/answer questions.	**Learning activities:** • highlighting exercise – what factors affect the speed of conductance? Accept feedback and discuss • students could undertake the BIO6T P14 ISA practical and exam. **Skills developed by learning activities:** • AO1 – knowledge of the factors affecting speed of conductance • AO2/AO3 – application of knowledge to practical results • AO3 – evaluation of the methodology and results of other people's investigations • MS 2.3/MS 2.4 – substitute numbers into an algebraic equation to convert distance fallen into reaction time • MS 1.2 – calculate the mean • MS 1.9 – select an appropriate statistical test (student's t-test) MS 1.4 – interpret stats test in terms of probability and chance, and whether to accept or reject H0.	BIO6T P14 ISA	aqa.org.uk	C1, Sp3,C3

6 **3.6.2.2 Synaptic transmission**	The detailed structure of a synapse. The sequence of events involved in transmission across a cholinergic synapse in sufficient detail to explain: • unidirectionality • temporal and spatial summation • inhibition by inhibitory synapses.	• Explain the functions of synapses. • Describe the detailed structure of a synapse. • Explain the sequence of events involved in transmission of an action potential from one neurone to another. • Explain why synaptic transmission is unidirectional. Explain temporal, spatial summation, and inhibition by inhibitory synapses	**Learning activities:** • teacher explanation of the functions of synapses between neurones • back to back: provide labelled diagram of a synapse – pairs of students sit back to back and one student describes the structure to another who draws it 'blind' • teacher explanation of the stages involved in transmission across a cholinergic synapse • card sort – sequence the stages • provide definitions of unidirectionality, temporal and spatial summation and inhibition by inhibitory synapses. Ask pupils to suggest how the structure of a synapse and the sequence events achieves each one • teacher explanation of summation, inhibition and unidirectionality • exam questions.	**Past exam paper material:** BIOL5 June 2013 – Q7a–7b BIOL5 June 2011 – Q2b HBIO4 Jan 2012 – Q1	highered.mheducation.com/sites/0072495855/student_view0/chapter14/animation__chemical_synapse__quiz_1_.html mind.ilstu.edu/flash/synapse_1.swf **Rich questions:** • Explain how the synapse structure and events involved in synaptic transmission allow for unidirectionality, spatial and temporal summation and inhibition by inihibitory synapses. • Why is it important that acetylcholinesterase hydrolyse acetylcholine? Explain the role played by ATP after synaptic transmission.	C1, Sp3,C3
7	The effects of specific drugs on a synapse. NB recall of names and modes of action of	Use information provided to predict and explain the effects of specific drugs on a synapse.	**Learning activities:** • stimulus: provide some drug names on cards and ask students to categorise them in a way they feel is appropriate, eg by legal classification, effect of drug etc	**Past exam paper material:** HBIO4 Jan 2011 – Q5 HBIO4 Jan 2010 – Q7a and 7c	outreach.mcb.harvard.edu/animations/synapse.swf biologymad.com/nervoussystem/synapses.htm	C1, Sp3,C3

	individual drugs are not expected		• introduce the idea that many drugs (both recreational and some medicinal) work by affecting synapses • provide information/data about some types of drugs (eg heroin, cocaine, atropine, curare), namely the characteristic effects of the drug, and the effect the drug has on synapses eg mimicking a neurotransmitter. Ask students to work in groups to explain the effect that the drug has.	BIOL5 June 2013 – Q7c	thirteen.org/closetohome/science/html/animations.html users.rcn.com/jkimball.ma.ultranet/BiologyPages/D/Drugs.html	
8	The detailed structure of a neuromuscular junction. A comparison of transmission across a cholinergic synapse and across a neuromuscular junction.	• Explain what a neuromuscular junction is. • Describe and explain the detailed structure of a neuromuscular junction. • Explain transmission across a neuromuscular junction by release of acetylcholine and compare this to synaptic transmission. • Explain how muscle fibres stimulated to contract by one motor neurone act as a motor unit.	**Learning activities:** • teacher introduction to what a neuromuscular junction is • provide students with a diagram of the structure of a neuromuscular junction and ask them to compare to a synapse • teacher explanation of transmission across a neuromuscular junction. Ask them to compare this to the transmission across a synapse • exam questions from Exampro. **Skills developed by learning activities:** AO1 – development of knowledge of neuromuscular junctions and transmission across neuromuscular junctions.	**Exampro:** BYA7 June 2004 – Q7	**Rich questions:** • How does an action potential arriving at a neuromuscular junction, trigger the release of acetylcholine? • What effect does acetylcholine have on the postsynaptic membrane? In what ways is the transmission across a neuromuscular junction similar to transmission across a (excitatory) cholinergic synapse?	C1, Sp3,C3
9	Muscles act in antagonistic pairs against an	• skeletal muscle, linked to the role of tendons and joints. • Explain how muscles which move bones that	**Learning activities:** • teacher introduction to skeletal muscle in terms of it moving bones at a joint. Emphasise that this is related to muscle contraction which pulls the bones	**Past exam paper material:** HBIO4 June 2012 – Q3a	wonderstruck.co.uk/files/KS3-Lesson-Plan-1-Muscles-and-Bones.pdf	C1, Sp3,C3

	incompressible skeleton.	form part of a joint work as antagonistic pairs. To produce movement as they contract, muscles work against/are attached to an incompressible skeleton/bones.	• students could produce working models of the arm, using balloons or elastic bands to represent the biceps and triceps. They could investigate what each one does as the arm raises or lowers • demonstration of antagonistic pairs by using forceps to pull on tendons in a dissected chicken leg (the pull of the forceps representing the muscle contraction) • teacher explanation that muscles can only generate force as they contract/shorten – they can only pull and not push • exam question. **Skills developed by learning activities:** AO1 – development of knowledge of antagonistic pairs of muscles.		**Rich questions:** • What are the three types of muscle in the body and what are their roles? • Muscles can pull as they contract, but they cannot push. What would happen to a bone if muscles did not work in antagonistic pairs? Evaluate this statement: 'in an antagonistic pair of muscles, one muscle contracts whilst the other relaxes'.	
10	Gross and microscopic structure of skeletal muscle. The ultrastructure of a myofibril.	• Describe the gross structure of skeletal muscles. • Explain what is meant by a myofibril. • Describe the microscopic structure of skeletal muscle. • Explain what is meant by a sarcomere. • Explain how actin and myosin are arranged within a myofibril to produce contraction of a sarcomere. • Interpret diagrams to identify I bands, A bands, the H zone and the Z line on a diagram.	**Learning activities:** • teacher explanation of the gross structure of skeletal muscle • students undertake microscopy of skeletal tissue. This using prepared slides of longitudinal and transverse sections of skeletal muscle. (It could also be done by them isolating and preparing slides of muscle fibres from the muscle on shin meat) • get them to draw observations • show low powered electron micrographs showing the detailed structure of a myofibril. Ask students to interpret and relate back to their observations • teacher explanation of the microscopic structure of skeletal muscle and the ultrastructure of a myofibril • exam questions.	**Past exam paper material:** HBIO4 Jan 2013 – Q9a–9b HBIO4 Jun 2012 – Q3b HBIO4 Jan 2011 – Q10a–10b HBIO4 June 2010 – Q4a–4b	cleapss.org.uk **Rich questions:** • What is a myofibril? • In which bands/zone would you find: a) Myosin? b) Actin? • How would you work out the length of one sarcomere? • Explain the presence of large amounts of mitochondria and endoplasmic reticulum in the sarcoplasm.	C1, Sp3,C3

			Skills developed by learning activities: • AO1 – development of knowledge and understanding of the structure of skeletal muscle, and the ultrastructure of myofibrils. • AO2 – application of knowledge to the context given in exam questions. AT d/At e – examine prepared slides of skeletal muscle, and make drawings, using an optical microscope.			
11	The roles of actin, myosin, calcium ions and ATP in myofibril contraction. The roles of calcium ions and tropomyosin in the cycle of actinomyosin bridge formation. The roles of ATP and phosphocreatine in muscle contraction.	• Recall how the release of acetylcholine across neuromuscular junctions, triggers the release of calcium ions. • Explain the importance of the release of calcium ions leading to a conformational change in tropomyosin. • Explain the sliding theory filament of myofibril contraction. • Explain the roles of key molecules myosin, actin, calcium and ATP in causing myofibril contraction. • Explain the role of phosphocreatine in muscle fibres.	**Learning activities:** • provide students with two string lines – one containing drawing pins and the other containing bungs attached periodically. Challenge them to make the string of bungs move along the bench without directly pulling it, and only pulling the string of pins a maximum of 5 cm. Ask them to write down how they did it in as much detail as possible • teacher explanation of sliding filament theory. Link into their explanation of the string lines • card sort – sequence the stages of myofibril contraction • teacher explanation of the role of phosphocreatine in regenerating ATP in some muscle fibres • exam questions. **Skills developed by learning activities:** AO1 **–** development of knowledge and understanding of the mechanism of myofibril contraction.	**Past exam paper material:** BIOL5 June 2012 – Q2 BIOL5 June 2013 – Q2a BIOL5 June 2010 – Q6 BIOL5 June 2011 – Q10b HBIO4 Jan 2012 – Q3 HBIO4 June 2013 – Q5 HBIO4 June 2010 – Q4c HBIO4 June 2011 – Q2 HBIO4 Jan 2010 – Q2	nuffieldfoundation.org/practical-biology/modelling-sliding-filament-hypothesis bcs.whfreeman.com/thelifewire/content/chp47/4702001.html blackwellpublishing.com/patestas/animations/myosin.html **Rich questions:** • Evaluate this statement: 'during contraction of a muscle, actin and myosin filaments contract and get shorter'. Explain the roles of tropomyosin, ATP and Ca2+ ions in muscle contraction.	C1, Sp3,C3

12	The structure, location and general properties of slow and fast skeletal muscle fibres.	• Describe the locations of slow and fast skeletal muscle fibres. • Describe differences in the structure of slow and fast skeletal muscle fibres. • Explain differences in the properties of slow and fast skeletal muscle fibres.	**Learning activities:** • jigsaw task: working in pairs, one student researches slow muscles and the other fast muscles, using information and resources provided eg websites, comprehensions, textbooks etc • accept feedback and reinforce using teacher explanation • students produce a summary table comparing and contrasting • exam questions. **Skills developed by learning activities:** • AO1 – development of knowledge relating to the structure, location and properties of slow and fast skeletal muscle • AO2 – application of knowledge to exam questions.	**Past exam paper material:** BIOL5 June 2013 – Q2b BIOL5 June 2010 – Q7 HBIO4 Jan 2013 – Q9c **Exampro:** BYA7 Jan 2004 – Q7	**Rich questions:** Provide students with statement cards and ask them to categorise them as relating to fast or slow muscle fibres.	C1, Sp3,C3
13 3.6.4 Homeostasis is the maintenance of a stable internal environment	**Homeostasis** **3.6.4.1 Principles of homeostasis and negative feedback** Homeostasis in mammals involves physiological control systems that maintain the	• Define what homeostasis is. • Explain why it is important that core temperature, blood pH, blood glucose concentration and blood water potential are maintained within restricted limits and the consequences of not doing so	**Learning activities:** • questioning to recall knowledge from GCSE. Lead this onto a definition of homeostasis • jigsaw task: in groups, students assign roles to gather information on the importance of one factor, eg temperature being maintained. They then each go to their respective information stations to research that factor (eg using websites, textbooks, videos etc.) • give students time to feedback and discuss • quiz: students work in teams to answer questions based on the knowledge they have accumulated (including data questions).	**Exampro:** Specimen paper Unit 5 – Q8 BYA6 June 2005 – Q2 BYB6 June 2005 – Q5 BYA6 Jan 2005 – Q3	**<u>Flipped learning opportunities</u>** 16.4_ Diabetes research task_Webquest **Rich questions:** • Explain how blood pH might fall and how the body would rectify this. • Explain the consequence to enzymes of a) a fall in body temperature	So5,Sp2 M2

	internal environment within restricted limits. The importance of maintaining a stable core temperature and stable blood pH in relation to enzyme activity. The importance of maintaining a stable blood glucose concentration in terms of availability of respiratory substrate and of the water potential of blood.		**Skills developed by learning activities:** • AO1 – development of knowledge relating to homeostasis and some of the key factors which the body maintains within restricted limits AO2/AO3 – application of knowledge to explain trends in data.		b) a rise in body temperature. • Suggest the effect on cells if blood sugar concentration were to rise, resulting in a fall in the water potential.	
14	Negative feedback restores systems to	• Explain what is meant by negative and positive feedback. • Explain the general stages involved in	**Learning activities:** • provide students with card statements of processes involved in a homeostatic mechanism covered at GCSE eg thermoregulation. Ask students to assemble	**Past exam paper material:** BIOL5 June 2013 – Q4a and 4c	wps.aw.com/bc_goodenough_boh_3/104/26720/6840414.cw/content/index.html	C1, Sp3,C3

	their original level. The possession of separate mechanisms involving negative feedback, controls departures in different directions from the original state, giving a greater degree of control.	negative feedback, and why these are used in homeostatic mechanisms. • Explain the benefit of having separate mechanisms for different departures from the original level. • Interpret information relating to examples of negative and positive feedback.	them into a flow diagram in a way they feel is logical. • teacher-led explanation of how homeostasis relies on negative feedback with support of animation examples. Go through the stages, and get students to construct a template for a model answer (departure from normal→receptor→ co-ordinator → effector→ response→ return to normal) • go back to the card sort on thermoregulation and ask what the benefit is of having separate mechanisms for departures in difference directions • ask students to suggest what positive feedback would entail. Show rest of the animation showing positive feedback in labour • exam questions.	HBIO4 Jan 2013 – Q1a HBIO4 Jan 2011 – Q6 **Exampro:** BYA6 June 2004 – Q9	**Rich questions:** • How do the principles of positive and negative feedback differ? What is the benefit of having separate negative feedback mechanisms controlling departures in different direction from the original state?	
15 **3.6.4.2 Control of blood glucose concentration**	The factors that influence blood glucose concentration	• Explain the factors which can influence blood glucose concentration. • Explain how hormones work to bring about a response. • Explain the role of the pancreas, specifically the α and β cells of the Islets of Langerhans, in regulating blood glucose concentration. • Explain what is meant by the terms glycogenesis, glycogenolysis and gluconeogenesis.	**Learning activities:** • questioning to assess recall from GCSE • teacher introduction to the action of hormones • provide information posters on the topics of: the actions of hormones; factors which influence blood glucose; the response to a reduction in blood glucose concentration; the response to an increase in blood glucose level. (NB These sheets should be an introduction to blood glucose regulation in the context of negative feedback and should be kept as overviews – the mechanisms of insulin/glucagon action will be explored in more detail in subsequent lessons) • accept feedback and reinforce	**Past exam paper material:** BIOL1 June 2013 – Q6 Specimen paper Unit 5 – Q3a and 3b	**Rich questions:** • What roles do the α cells of the Islets of Langerhans play in regulating blood glucose concentration? • What roles do the β cells of the Islets of Langerhans play in regulating blood glucose concentration? What factors influence blood glucose	So5,Sp2 M2

		Apply knowledge to explain the stages involved in negative feedback in response to changes in blood glucose concentration.	• students could produce negative feedback diagrams for blood glucose rise and fall • students could produce a concept map, with space to add to in further lessons. **Skills developed by learning activities:** AO1 – development of knowledge relating to negative feedback in the context of blood glucose regulation.		concentration and how do they influence it? • How do the hormones involved in bringing about adjustments to blood glucose concentration travel to their target organ?	
16	The action of insulin by: • attaching to receptors on the surfaces of target cells • controlling the uptake of glucose by regulating the inclusion of channel proteins in the surface membranes of	• Explain what triggers the release of insulin. • Explain how insulin acts at the cellular level to lower blood glucose concentration. Explain the role of the liver in glycogenesis	**Learning activities:** • questioning on the overview that students learnt previously • provide cards with statements on which students could categorise as would increase blood glucose concentration/ would decrease blood glucose concentration eg exercise, excitement, eating a bowl of pasta • teacher explanation of the action of insulin after it is released, and the role that this plays in promoting increased absorption, increased respiration, increased glycogenesis and increased conversion to fat • students add to their concept map which they began in previous lessons • students could interpret blood glucose concentration data relating to the impact of high GI and low GI foods • exam questions. **Skills developed by learning activities:**	**Past exam paper material:** HBIO4 Jan 2012 – Q10a HBIO4 June 2010 – Q11a HBIO4 Jan 2010 – Q3a **Exampro:** BYB4 Jan 2004 – Q4a	bcs.whfreeman.com/thelifewire/content/chp50/5002s.swf dnatube.com/video/8349/Animation-in-3D-of-the--Insulin-processes-mechanism **Rich questions:** • Which cells produce insulin? • What are the three actions which insulin binding to insulin receptors brings about? • Which cells are especially affected in terms of increasing the rate of glucose absorption?	C1, Sp3,C3

	target cells • activating enzymes involved in the conversion of glucose to glycogen. The role of the liver in glycogenesis.		AO1 – development of knowledge relating to the mechanisms of action by insulin, and how it results in a decrease in blood glucose concentration.		What role does the liver play?	
17	The action of glucagon by: • attaching to receptors on the surfaces of target cells • activating enzymes involved in the conversion of glycogen to glucose	• Explain what triggers the release of glucagon. • Explain how glucagon acts at the cellular level to raise blood glucose concentration Explain the role of the liver in glycogenolysis and gluconeogenesis	**Learning activities:** • questioning on the overview that students learnt previously • teacher explanation of the action of glucagon on liver cells after it is released, in terms of promoting conversion of glycogen, amino acids and glycerol into glucose • students add to their concept map which they began in previous lessons • exam questions. **Skills developed by learning activities:** AO1 – development of knowledge relating to the mechanisms of action by glucagon, and how it results in an increase in blood glucose concentration.	**Past exam paper material:** BIOL5 June 2010 – Q8 HBIO4 June 2013 – Q9bii	bcs.whfreeman.com/thelifewire/content/chp50/5002s.swf **Rich questions:** • When is glucagon released? • Which cells produce glucagon? Which cells are the only cells that have glucagon receptors?	So5,Sp2 M2

	• activating enzymes involved in the conversion of glycerol and amino acids into glucose. The role of the liver in glycogenolysis and gluconeogenesis.					
18	The role of adrenaline by: • attaching to receptors on the surfaces of target cells • activating enzymes involved in the conversion of glycogen	• Explain what triggers the release of adrenaline. • Explain how adrenaline acts at the cellular level to control blood glucose concentration. • Explain the second messenger model related to adrenaline and glucagon action. • Describe the role of adenylate cyclase, cyclic AMP and protein kinase in the second message model.	**Learning activities:** • provide students with the opportunity to generate questions on the processes discussed so far • think, pair, share: when would adrenaline be released? Based on your answer what effect would you predict it to have and why? • teacher explanation of the role of adrenaline in binding to receptors and activating enzymes in the liver to breakdown glycogen to glucose • think, pair, share: both glucagon and adrenaline involve activating cellular enzymes to breakdown glycogen to glucose, yet both bind to cell surface receptors outside the cell. Suggest how they activate enzymes inside the cell	**Past exam paper material:** BIOL5 June 2012 – Q6a	highered.mheducation.com/sites/0072507470/student_view0/chapter17/animation__second_messenger__camp.html **Rich questions:** • When is adrenaline released? Suggest how the binding of glucagon and adrenaline to liver cell surface receptors is able to activate enzymes inside the cells of the liver.	So5,Sp2 M2

	to glucose. The second messenger model of adrenaline and glucagon action, involving adenylate cyclase, cAMP and protein kinase.		• teacher explanation of the second messenger model • students complete their concept map. **Skills developed by learning activities:** • AO1 – development of knowledge relating to the mechanism of action by adrenaline and the second messenger model AO2 – application of knowledge to think-pair-share tasks.			
19	The causes of types I and II diabetes and their control by insulin and/or manipulation of the diet.	• Explain the causes of type I and II diabetes. • Explain how type 1 and type 2 diabetes can be controlled. • Apply knowledge of blood sugar regulation and diabetes to interpret data. • Evaluate the positions of health advisers and the food industry in relation to the increased incidence of type II diabetes.	**Learning activities:** • think, pair, share: provide students with data from a glucose tolerance test for a diabetic and non-diabetic and ask them to suggest an explanation • students can use the web to research types I and II diabetes (causes and methods of control) and produce an information pamphlet or presentation • teacher explanation to reinforce key messages • section B of the BIO6T Q13 ISA • exam questions • show data on the increasing incidence of type II diabetes • students could be provided with some stimulus material and then conduct a class debate on the increasing incidence of type II diabetes, taking on the roles of health advisers and representatives of food companies.	**Past exam paper material:** HBIO4 Jan 2012 – Q10b–10f HBIO4 June 2013 – Q9a–9bi HBIO4 June 2010 – Q11b–11g HBIO4 June 2011 – Q6 HBIO4 Jan 2010 – Q3b HBIO4 June 2013 – Q8 BIO6T – Q13 ISA Section B	**Rich questions:** • Explain the causes of types I and II diabetes. • Why do diabetics have to manage their carbohydrate intake? • Why do diabetics have to be mindful about how much exercise they do? What are the arguments for and against the banning of advertising for certain types of food and drink in order to lower the incidence of type II diabetes?	So5,Sp2 M2

			Skills developed by learning activities: • AO1 – development of knowledge relating to types I and II diabetes, in terms of causes and control • AO2/AO3 – interpretation of experimentally derived data in exam questions and from the glucose tolerance test, and application of knowledge to explain/evaluate the data and evaluate societal arguments around particular types of food/drink MS 1.10 – understand standard deviation in the context of diabetes studies contained within suggested exam questions.			
20	**Required practical 11:** Production of a dilution series of a glucose solution and use of colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown 'urine' sample.	• Apply knowledge of diabetes and biochemical tests, to design an experiment to identify the concentration of glucose in a 'urine' sample. • Explain how to use colorimetry of known concentrations, alongside calibration curves to identify unknown concentrations. • Explain the usefulness of calibration curves or standards.	**Learning activities:** • show students some fake urine samples (water and yellow food dye) and tell them that at least one is from a diabetic (contains glucose) • provide opportunity for students to work in small groups to design a method for identifying the concentration of glucose in urine samples using the knowledge they have from unit 3.1 • accept feedback to jointly arrive at a method • students then conduct the practical • students plot a calibration curve and read off the value for the unknown urine sample. **Skills developed by learning activities:** • AO2 – application of knowledge of biochemical tests, colorimetry and calibration curves	Marking of accuracy of concentration determined by reading from calibration curve.	cleapss.org.uk **Rich question:** Why can glucose concentration in urine be used as a means of diagnosing diabetes?	Sp7,Sp2

			• AT b and c – production of a dilution series from a stock glucose concentration. Use colorimetric techniques to produce a • calibration curve • PS 1.1/1.2 – apply knowledge to solve problems in a practical context • MS 0.2 – convert concentrations between standard and ordinary form • PS 4.1 – use colorimetry/calibration curves PS 3.1/MS 1.3/3.2 – plot a calibration curve and read off an unknown concentration.			

21 3.6.4.3 Control of blood water potential	The structure of the nephron and its role in: • the formation of glomerular filtrate • reabsorption of glucose and water by the proximal convoluted tubule • maintaining a gradient of sodium ions in the medulla by the loop of Henle reabsorption of water by the distal convoluted tubule and collecting ducts.	• Describe the structure of a nephron. • Explain the process of ultrafiltration and where it occurs. • Explain the process of selective reabsorption, where it occurs along a nephron and the transport processes involved. • Explain the adaptations of cells of the proximal convoluted tubule. • Explain the importance of maintaining a sodium ion gradient in the medulla, and how this is achieved. • Explain the reabsorption of water from the distal convoluted tubule and collecting ducts.	**Learning activities:** • questioning to assess recall from GCSE • think, pair, share: provide data showing the concentrations of molecules/ions in the blood plasma and the glomerular filtrate. Ask pupils to suggest an explanation. • introduce the concept of a nephron, as well as the medulla and cortex of the kidney • provide a series of information stations for students to circulate round (videos, animations, suitable webpages, textbooks, comprehensions) • in groups, provide an unlabelled diagram of a nephron and ask students to work in pairs to use their knowledge to label and explain what is happening at different places • teacher explanation/reinforcement of the process of ultrafiltration and selective reabsorption • exam question **Skills developed by learning activities:** • AO1 – development of knowledge/understanding relating to the structure of a nephron, and the events which occur at different points along the nephron AO2/AO3 – interpretation of data and application of knowledge to explain it.	**Specimen assessment material:** A-level Paper 2 (set 1) – Q7.4 **Exampro:** BYB4 Jan 2008 – Q2 BYB4 June 2004 – Q6 BYB4 June 2006 – Q5	bcs.whfreeman.com/thelifewire/content/chp51/5101s.swf **Rich questions:** • Explain what causes some molecules to be filtered into the filtrate and others not. • Which molecules are selective reabsorbed? By which processes does this occur? Explain the countercurrent multiplier mechanism and why it is important for water reabsorption.	C1, Sp3,C3

22	Osmoregulation as control of the water potential of the blood. The roles of the hypothalamus, posterior pituitary and ADH in osmoregulation.	• Explain the role of the hypothalamus and posterior pituitary gland in osmoregulation. • Explain the responses which are brought about by the release of ADH. • Apply knowledge to explain the stages involved in negative feedback in response to changes in blood water potential.	**Learning activities:** • think, pair, share: provide data about water gains and losses. Provide scenarios and ask students what would happen within the body as a result eg 'it is a hot day and you sweat more than normal' • ask students to suggest how the body could adjust the water losses to balance out changes to water gains • teacher explanation of ADH and its role in osmoregulation. Explain the action of ADH on the kidneys • students could produce negative feedback diagrams for when blood has a lower water potential than normal and a higher water potential than normal • exam question. **Skills developed by learning activities:** • AO1 – development of knowledge relating to negative feedback in the context of osmoregulation and the role of ADH. • AO2/AO3 – interpretation of data and application of knowledge to think-pair-share tasks. MS 1.3 – interpret pie charts.	**Specimen assessment material:** A-level Paper 2 (set 1) – Q7.1 to 7.3 **Past exam paper material:** BYB4 June 2008 – Q5	**Rich questions:** • Where are osmoreceptors located? • Where is ADH released from? What effect does ADH have on the distal convoluted tubule and collecting duct (in the medulla)? What happens as a consequence of this?	C1, Sp3,C3
