APPLIED

WJEC Level 3 Diploma in

MEDICAL SCIENCE

SAMPLE ASSESSMENT MATERIALS - External

Teaching from 2016

CONTENTS

WJEC LEVEL 3

Diploma in Medical Science

Resource Folder (Pre-release Article)

*For use with **unit 1 Human health and disease** examination*

Specimen

The following article is adapted from content found on the diabetes.org.uk website.

What is Diabetes?

Diabetes is a common life-long condition. There are 3.2 million people diagnosed with diabetes in the UK and an estimated 630 000 people who have diabetes, but don't know it.

Diabetes is a condition where the concentration of glucose in the blood is too high because the body cannot process it properly. There are two main types of diabetes: Type 1 diabetes and Type 2 diabetes.

What is type 1 diabetes?

Type 1 diabetes develops when the insulin-producing cells in the body have been destroyed and the body is unable to produce any insulin.

Type 1 diabetes accounts for about 10% of all adults with diabetes and is treated by daily insulin doses – taken either by injections or via insulin pump. It is also recommended to follow a healthy diet and take regular physical activity. Type 1 diabetes can develop at any age but usually appears before the age of 40, and especially in childhood. It is the most common type of diabetes found in childhood.

As a result of the diabetes the body can't use glucose to provide energy and tries to get it from elsewhere and starts to break down stores of fat and protein instead. This can cause weight loss. Because the body doesn't use the glucose it ends up passing into the urine. Nobody knows for sure why these insulin-producing cells have been destroyed, but the most likely cause is the body having an abnormal reaction to the cells. This may be triggered by a virus or other infection.

What is type 2 diabetes?

Type 2 diabetes develops when the insulin-producing cells in the body are unable to produce enough insulin, or when the insulin that is produced does not work properly.

Type 2 diabetes usually appears in people over the age of 40, though in some ethnic groups, who are at greater risk, it often appears from the age of 25. It is also increasingly becoming more common in children, adolescents and young people of all ethnicities. Type 2 diabetes accounts for between 85 and 95 per cent of all people with diabetes and is treated with a healthy diet and increased physical activity.

In addition to this, medication and/or insulin are often required.

Prevalence

In 2013, the prevalence of diabetes in the adult population across the UK was as follows:

Country	Prevalence	Number of people
England	6.0%	2 703 044
Northern Ireland	5.3%	79 072
Scotland	5.2%	252 599
Wales	6.7%	173 299

Distribution of diabetes by age group in England and Wales, and Scotland is given below:

Age	Prevalence (England and Wales)	Prevalence (Scotland)
0 – 9	0.22%	0.26%
10 – 19	0.99%	1.23%
20 – 29	1.69%	2.09%
30 – 39	3.83%	3.55%
40 – 49	10.69%	9.69%
50 – 59	18.95%	18.97%
60 – 69	26.05%	26.46%
70 – 79	24.14%	24.67%
80+	13.42%	13.07%

Financial Costs

It is currently estimated that about £10 billion per year is spent by the NHS on diabetes. 10 per cent of the NHS budget is spent on diabetes.

Diabetes risk factors

About 90 % of people with diabetes have Type 2 diabetes. It can come on slowly, usually over the age of 40. The signs may not be obvious, or there may be no signs at all, therefore it might be up to 10 years before some patients learn that they have it.

Risk factors include:

- being overweight or having a high Body Mass Index
- being from an African-Caribbean, Black African, Chinese or South Asian background and over 25
- being from another ethnic background and over 40
- having a parent, brother or sister with diabetes
- ever had high blood pressure, a heart attack or a stroke
- a history of polycystic ovaries or gestational diabetes
- suffering from schizophrenia, bipolar illness or depression, or taking anti-psychotic medication

Testing

There are a range of tests which will need to be done to monitor health and diabetes. Some of these, such as blood glucose levels, can be done by the patient themselves. Others will be done by healthcare professionals. Tests include:

- blood glucose levels
- urine testing
- HbA1c (glycated haemoglobin) and fructosamine
- blood pressure
- blood lipids

Blood glucose levels

As part of the day-to-day routine, testing blood glucose concentration can help with necessary lifestyle and treatment choices as well as help to monitor for symptoms of hypo- or hyperglycaemia. Home blood glucose testing gives an accurate picture of blood glucose level at the time of the test. It involves pricking the side of the finger and putting a drop of blood on a testing strip.

Blood glucose targets

Children with Type 1 diabetes

- Before meals: 4–8mmol/l
- Two hours after meals: less than 10mmol/l

Adults with Type 1 diabetes

- Before meals: 4–7mmol/l
- Two hours after meals: less than 9mmol/l

Type 2 diabetes

- Before meals: 4–7mmol/l
- Two hours after meals: less than 8.5mmol/l

How to test blood glucose levels

The finger is pricked at the side and blood transferred to a test strip. Blood glucose levels should then be logged daily.

Urine testing

Urine testing involves holding a test strip under a stream of urine for a few seconds and comparing the colour change on the strip, after a set amount of time, with the chart on the strip container. Patients that have been advised to test their urine for glucose should test in the morning before breakfast. Tests done at this time should be negative.

HbA1c (Glycated haemoglobin) and fructosamine
At least once a year, the doctor should check a patient's long-term diabetes control by taking a blood sample from the arm.

The most common test is the HbA1c test, which indicates blood glucose levels for the previous two to three months. The HbA1c measures the amount of glucose that is being carried by the red blood cells in the body. For most adults with diabetes, the HbA1c target is below 48 mmol/mol, since evidence shows that this can reduce the risk of developing complications, such as nerve damage, eye disease, kidney disease and heart disease.

Fructosamine test
If the red blood cells are affected by, for example, anaemia, sickle cell anaemia or thalassaemia (all of which involve a lack of or abnormal type of haemoglobin) then a doctor may carry out a blood test for fructosamine. Fructosamine gives an average result for the previous 14 to 21 days.

Blood pressure
For someone without diabetes the blood pressure should be no higher than 140/85 but for a diabetic blood pressure should be no higher than 130/80.

Blood cholesterol and triglycerides
Some cholesterol in the blood, HDL (high density lipoprotein), can actually protect against heart disease. Low levels of this protective HDL cholesterol increase the risk of cardiovascular disease (CVD). However, LDL (low density lipoprotein) cholesterol is the bad form of cholesterol in the blood. It is high levels of this type that is linked with an increased risk of heart disease. Triglycerides are another type of fat in the blood. Raised LDL and raised triglycerides give an increased risk of CVD. For diabetes patients:

- total cholesterol level should be below 4.0 mmol/l
- LDL levels should be less than 2.0 mmol/l
- HDL levels should be 1.0mmol/l or above in men and 1.2mmol/l or above in women
- triglyceride levels should be 1.7mmol/l or less

Diabetes complications
People living with diabetes may have to deal with short-term or long-term complications as a result of their condition.

Short-term complications include hypoglycaemia, diabetic ketoacidosis (DKA), and hyperosmolar hyperglycaemic state (HHS).

Long-term complications include how diabetes affects the eyes (retinopathy), heart (cardiovascular disease), kidneys (nephropathy), and nerves and feet (neuropathy).
Hypoglycaemia (hypo)

Hypoglycaemia means ‘low blood glucose levels’ – less than 4 mmol/l. This is too low to provide enough energy for the body’s activities.

Symptoms
Hypos can come on quickly and everyone has different symptoms, but common ones are: feeling shaky, sweating, hunger, tiredness, blurred vision, lack of concentration, headaches, feeling tearful, stroppy or moody, going pale.

There's no rule as to why they happen, but some things make it more likely: excess insulin, delayed or missed meal or snack, not enough carbohydrate, unplanned physical activity, and drinking large quantities of alcohol or alcohol without food. Sometimes there just is no obvious cause.

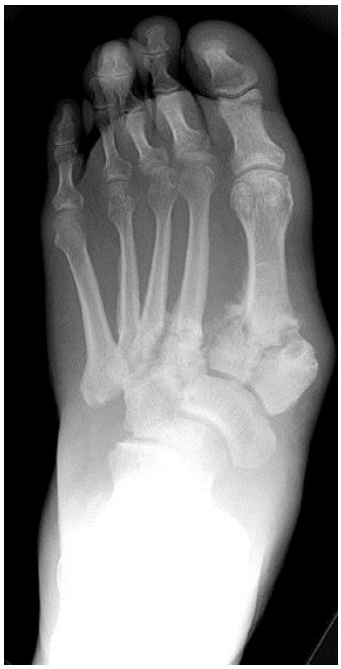
Hyperglycaemia (hyper)
At the other end of the scale is hyperglycaemia or hypers. This happens when blood glucose levels are too high – usually above 7mmol/l before a meal and above 8.5mmol/l two hours after a meal.

A patient may have missed a dose of medication, eaten more carbohydrate than the body and/or medication can cope with, be stressed, be unwell from an infection, over-treated a hypo.

Feet
People with diabetes are at much greater risk of developing problems with their feet, due to the damage raised blood sugars can cause to sensation and circulation. If left untreated, these problems can cause foot ulcers and infections and, at worst, may lead to amputations. However, most foot problems are preventable with good, regular foot care.

The high blood sugar levels associated with diabetes can affect the circulation and damage the sensory, motor or autonomic nerves in the body. Nerve damage is known as neuropathy, and the feet are often the first part of the body to be affected.

Sensory neuropathy



This affects the nerves that carry messages from the skin, bones and muscles to the brain and affects how we feel temperature, pain and other sensations. It is the most common form of neuropathy, mainly occurring in nerves in the feet and legs, and can lead to a loss of feeling and a failure to sense pain. This could mean that patients might develop a blister or minor burn without realising it, which, if not treated properly, could become infected or develop into an ulcer.

Charcot joint is a rare complication of people with diabetes who have severe neuropathy. It happens when an injury to the foot causes a broken bone, which may go unnoticed because of the existing neuropathy. The bone then heals abnormally, causing the foot to become deformed and misshapen. Treatment includes immobilizing the foot in a plaster cast and in some cases surgery.

Motor neuropathy
This affects the nerves responsible for sending messages to the muscles about movements, such as walking. Damage to these nerves leads to weakness and wasting of the muscles that receive messages from the affected nerves. If the nerves supplying the feet are affected it could cause the feet to alter shape. The toes may become clawed (curled) as the arch/instep becomes more pronounced or the arch may 'fall' causing flat feet. This can cause the bones in the foot to fracture (break) when stressed.

Autonomic neuropathy

Autonomic neuropathy affects nerves that carry information to organs and glands. They help to control some functions without consciously directing them, such as stomach emptying, bowel control, heart beating and sexual organs working. Damage to these nerves may affect the sweat glands, reducing secretions and making the skin dry and inelastic. If not looked after the skin may crack and become sore and prone to infection.

Other problems associated with autonomic neuropathy include gastroparesis, loss of bladder control, leading to incontinence, irregular heart beat and impotence.

Poor circulation

Diabetes may also affect the circulation by causing atherosclerosis. This can affect all the major blood vessels, especially those supplying the feet. Without a good blood supply, patients may have problems with cuts and sores, as the feet will be less able to heal well. Patients may also suffer from cramp and pain in the legs and/or feet as a result of poor circulation. High blood pressure, a high fat content in the diet and, in particular, smoking, all increase the risk of poor circulation.

Cardiovascular disease

People with diabetes have a higher chance of developing cardiovascular disease.

Blood vessels are damaged by high blood glucose levels, high blood pressure, smoking or high levels of cholesterol. So, it is important for people with diabetes to manage these levels by making lifestyle changes such as eating a healthy diet, taking part in regular activity, weight loss if overweight and stopping smoking.

Eyes (retinopathy)

Diabetic retinopathy is damage to the retina and is a complication that can affect people with diabetes. It is the most common cause of blindness among people of working age in the UK.

The delicate network of blood vessels that supply the retina with blood are damaged by high blood glucose and high blood pressure. When those blood vessels become blocked, leaky or grow haphazardly, the retina becomes damaged and is unable to work properly.

Kidneys (nephropathy)

Kidney disease (nephropathy) is when the kidneys start to fail. Kidney disease is much more common in people with diabetes or high blood pressure, and is most common in people who have had diabetes for over 20 years. About one in three people with diabetes might go on to develop kidney disease, although, as treatments improve, fewer people are affected.

The kidneys regulate the amount of fluid and various salts in the body, helping to control blood pressure. They also release several hormones.

As kidney disease progresses, the kidneys become less efficient and the person can become very ill. This happens as a result of the build-up of waste products in the blood, which the body cannot get rid of.

Kidney disease is caused by damage to small blood vessels, making the kidneys work less efficiently. Keeping blood glucose levels as near normal as possible can greatly reduce the risk of kidney disease developing as well as other diabetes complications. It is also very important to keep blood pressure controlled.

As part of the annual health care review patients should have a blood and urine test. The urine will be checked for tiny particles of protein, called 'microalbumin'. These appear during the first stages of kidney disease, as the kidneys become 'leaky' and lose protein. At this stage, kidney disease can often be treated successfully, so this test is very important. The blood test will measure urea, creatine, and estimated glomerular function (eGFR) showing how well the kidneys are working.

Diabetic ketoacidosis (DKA)

Consistently high blood glucose levels can lead to a condition called diabetic ketoacidosis (DKA). This happens when a severe lack of insulin means the body cannot use glucose for energy, and the body starts to break down other body tissue as an alternative energy source. Ketones are the by-product of this process. Ketones are poisonous chemicals which build up and, if left unchecked, will cause the body to become acidic – hence the name 'acidosis'.

Hyperosmolar Hyperglycaemic State (HHS)

Hyperosmolar Hyperglycaemic State (HHS) occurs in people with Type 2 diabetes who experience very high blood glucose levels (often over 40mmol/l). It can develop over a course of weeks through a combination of illness (e.g. infection) and dehydration.

Stopping diabetes medication during illness (e.g. because of swallowing difficulties or nausea) can contribute, but blood glucose often rises despite the usual diabetes medication due to the effect of other hormones the body produces during illness.

HHS is a potentially life-threatening emergency. It does not usually lead to the presence of ketones in the urine, as occurs in diabetic ketoacidosis (DKA). Ketones develop when the blood glucose level is high due to lack of insulin which is needed to allow glucose to enter the cells for energy. Because people with Type 2 diabetes may still be producing some insulin, ketones may not be created.

Candidate Name	Centre Number	Candidate Number

WJEC Level 3 Diploma in Medical Science

Specimen External Assessment

AM/PM xxxday xx June 20xx

Unit 1: Human Health and Disease (2 hours)

	For Examiner's use only	
Question	**Maximum Mark**	**Mark Awarded**
1-6	**25**	
7	**16**	
8	**6**	
9	**9**	
10	**12**	
11	**7**	
12	**8**	
13	**7**	
Total	**90**	

Instructions to candidates

Answer all questions.

Write your answers in the spaces provided in this booklet.

Information for candidates

The total mark for the paper is **90** marks.

You are reminded of the necessity of good English and orderly presentation of your answers.

The number of marks is given in brackets at the end of each question or part question.

Questions in section A are based on the pre-release article.

You will need the resource folder that contains the pre-release article.

You will need a calculator and ruler for this exam.

You should show your working to calculations.

Section A

1. State **three** risk factors for diabetes. [1]

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2. Explain the difference between type 1 and type 2 diabetes. [2]

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3. *(a)* Describe the role of the pancreas in regulating blood glucose in a healthy person. [2]

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(b) Describe the role of the liver in regulating blood glucose in a healthy person. [4]

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4. Glucose is present in the urine of Diabetics. There are two isomers of glucose, alpha (α) glucose and beta (β) glucose. Describe how the two isomers of glucose differ from each other. *(Any diagrams must be fully annotated.* [2]

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5. In diabetics, blood pressure should not be above 130/80.

(a) Describe what is meant by the term '130/80' [2]

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(b) Describe how a GP would measure a patient's blood pressure [3]

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(c) Kidney disease is a complication of diabetes that occurs due to high blood pressure. Suggest why high blood pressure is particularly damaging to the kidneys. [2]

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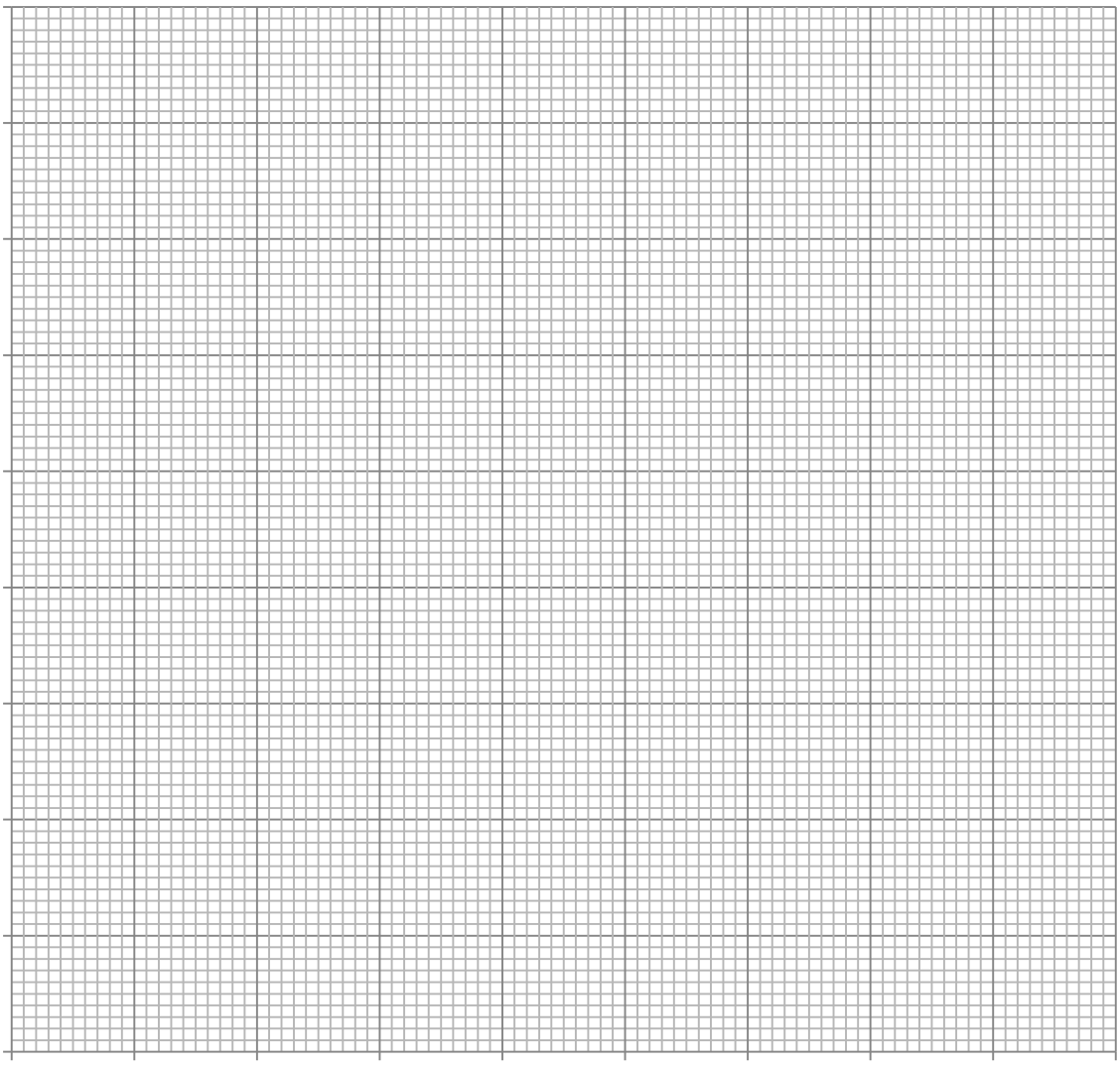
6. *(a)* Plot the data for distribution of diabetes in England and Wales by age group on the graph paper below. [4]

Age	**Prevalence (England and Wales)**	**Prevalence (Scotland)**
0 – 9	0.22%	0.26%
10 – 19	0.99%	1.23%
20 – 29	1.69%	2.09%
30 – 39	3.83%	3.55%
40 – 49	10.69%	9.69%
50 – 59	18.95%	18.97%
60 – 69	26.05%	26.46%
70 – 79	24.14%	24.67%
80+	13.42%	13.07%



(b) Calculate the percentage difference in the distribution of diabetes between 10-19 years and 40-49 years in England and Wales. [2]

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(c) Suggest why this pattern of distribution occurs. [2]

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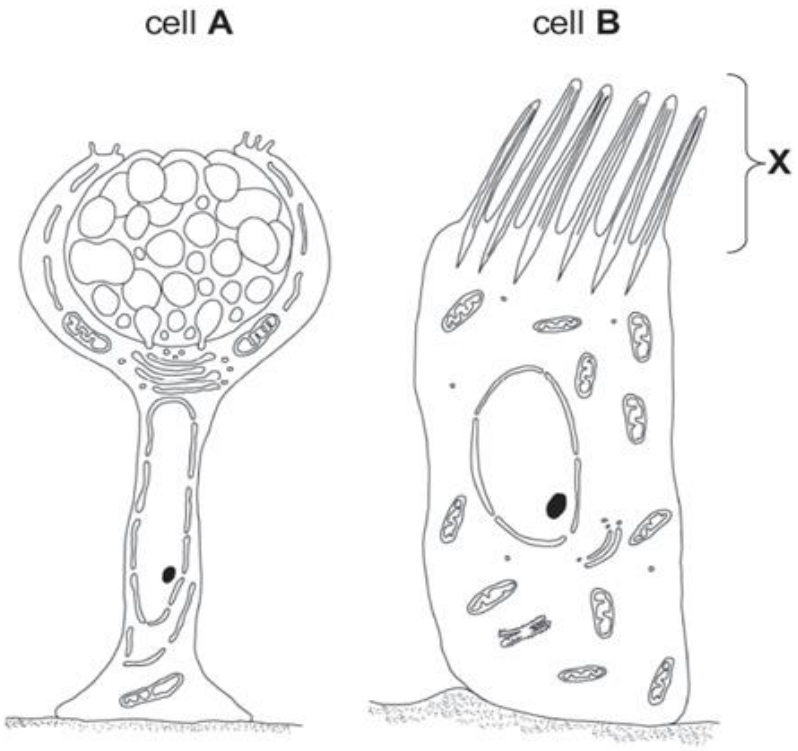
Section B

7. The diagram below shows two cells found in the human respiratory system



(a) Cell **A** produces mucus. State **two** reasons why mucus is present in the respiratory system. [2]

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(b) State in which part of the respiratory system cell **B** is found. [1]

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(c) Which cell (**A** or **B**) would be most metabolically active? Explain your answer. [2]

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(d) Suggest how the structures in cell A show that mucous contains a high concentration of glycoprotein. [1]

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(e) (i) The function of the structures in region **X** is affected by tar from cigarettes. How will this affect the respiratory system? [1]

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(ii) State what equipment is used to monitor the lung capacity of smokers [1]

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(f) A study invited smokers to participate in a discussion into their opinions on quitting smoking. Posters were used to invite members of the local community who smoked to participate and a snowballing approach used to support recruitment.

Face-to-face interviews revealed that smokers who self-identified as highly motivated to quit, actually expressed low motivation during discussions.

(i) Describe the difference in the type of data collected by qualitative and quantitative methods. Explain which type of method was used to collect data in this case. [4]

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(ii) Explain what is meant by a 'snowballing approach'. What are the limitations of this method? [4]

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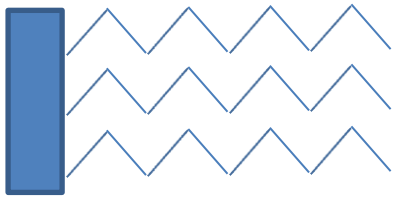
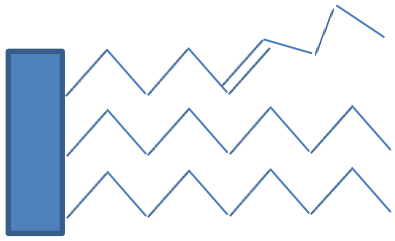
8. The diagram below shows the structure of four lipid and lipid-based molecules in the human body.

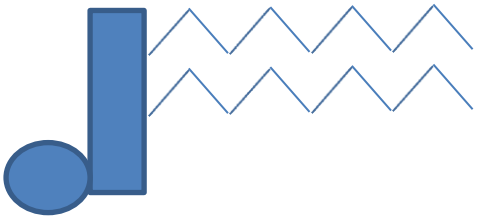
A



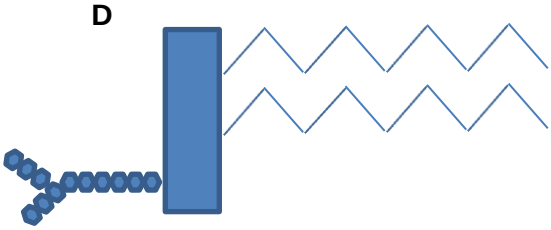
B



C



D



(a) Identify molecules **A**, **B**, **C** and **D** [2]

A ……..

B ……..

C ……..

D ……..

(b) Explain how the structural differences in **A** and **B** contribute to their different physical properties. [1]

……

……

(c) State a function of **C** and **D** in the human body. [2]

C……

D……

(d) Suggest why we are encouraged to decrease our consumption of **A** compared to **B**. [1]

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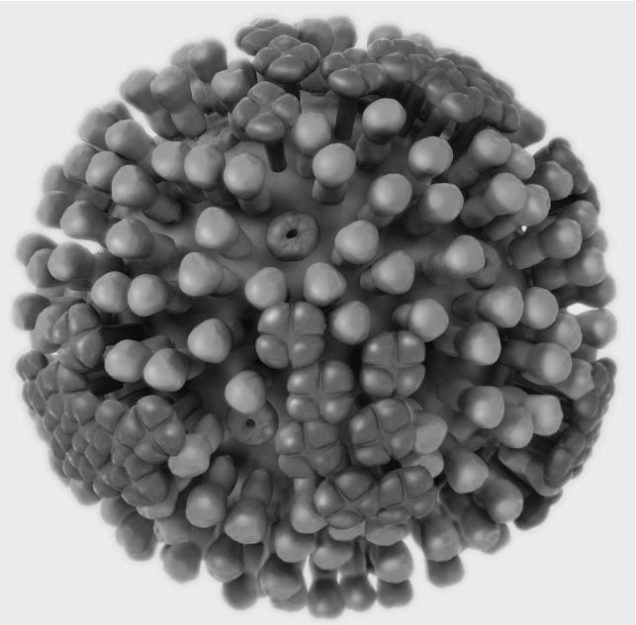
9. The diagram below shows the structure of the influenza virus.



(a) Describe how viruses such as influenza replicate. [4]

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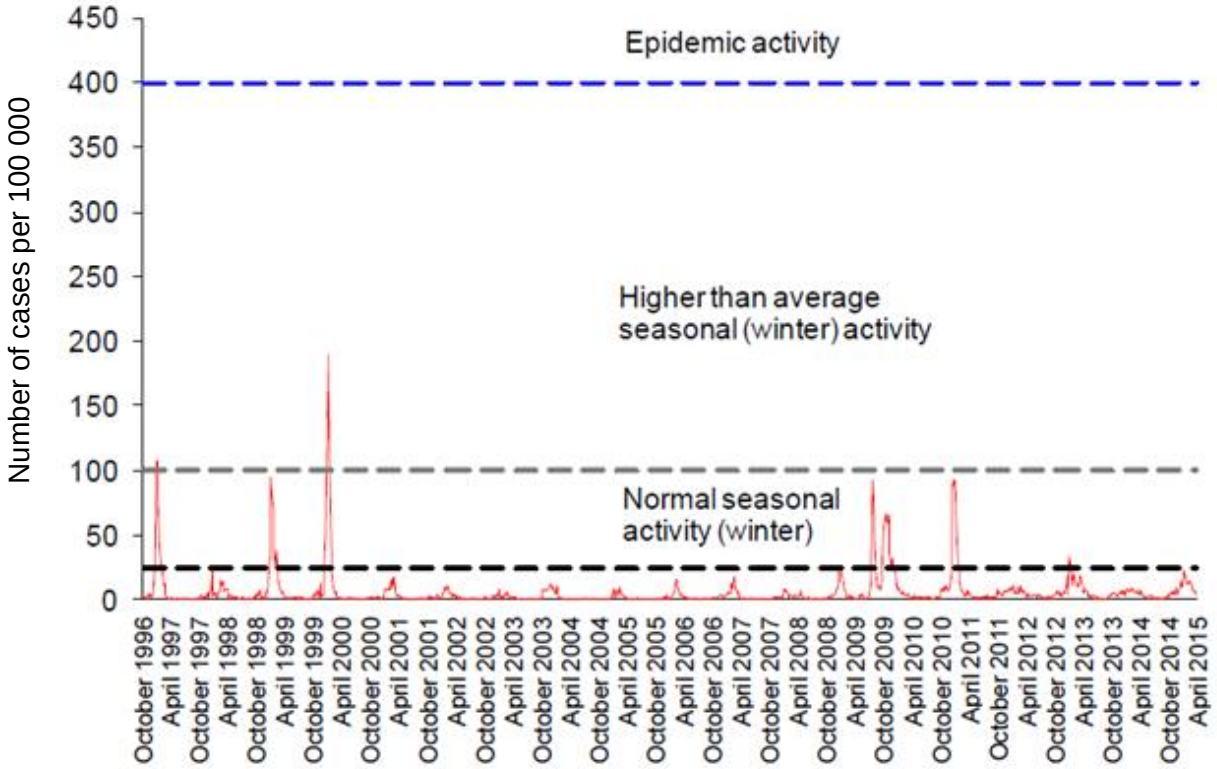
The chart below shows the number of influenza cases in Wales between October 1996 and April 2015.



(b) (i) Describe the pattern shown in the chart. [2]

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(ii) Suggest why the number of cases of influenza appears to be unchanged despite the availability of a vaccine. [1]

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(iii) During the winter of 2010, there was a public campaign to promote awareness of the importance of good hygiene to prevent the spread of a particularly severe form of influenza known as 'swine flu'. Use the evidence in the chart to evaluate whether this campaign was successful. [2]

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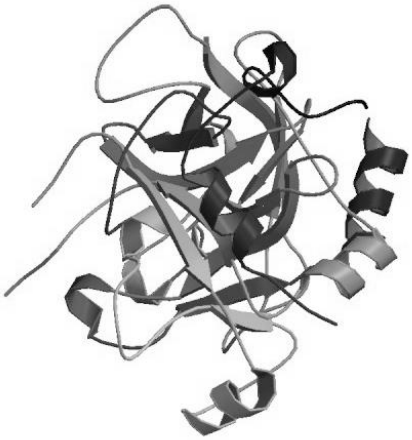
10. The enzyme, thrombin is important in blood plasma. It catalyses the conversion of fibrinogen to fibrin during the blood clotting process.



(a) Describe the structure of thrombin. [4]

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(b) Explain how the structure of the enzyme thrombin allows it to catalyse the conversion of fibrinogen to fibrin. [3]

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(c) (i) Heparin is a drug which prevents blood clotting. Suggest how heparin brings about its effect. [1]

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(ii) In an experiment, the effect of heparin concentration on clotting time was investigated. On the axes below, sketch the expected result of this investigation. [2]

(iii) Protamine sulfate can reverse the effects of heparin by binding to the heparin molecule so that it no longer has its effect. Suggest how protamine sulfate reverses the effect of heparin. [2]

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11. Haemophilia is caused by a sex linked gene**.**

(a) What is meant by the term *'sex linkage'*? [1]

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(b) Complete the following genetic diagram to show how parents who did not suffer from haemophilia, could have a son with haemophilia but also other children who did not suffer from haemophilia. Use the symbols $\mathbf{X^H}$ for the normal allele and $\mathbf{X^h}$ for the allele which causes haemophilia. [4]

Phenotype of parents	Normal male	Normal female
Genotype of parents	……	……
Genotype of gametes	…… ……	…… ……

Genotype of offspring	……	……	……	……
Phenotype of offspring	……	……	……	……

(c) What is the probability of the couple having a daughter with haemophilia? [1]

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(d) What is the probability of the couple having another son with haemophilia? [1]

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12. Catrin was studying the electrical activity of the heart as part of her Medical Science course. She learnt that the heart muscle was myogenic and that the electrical excitation spread in a particular route, to ensure that the chambers contract in the correct sequence.

(a) State what is meant by the term *myogenic*. [1]

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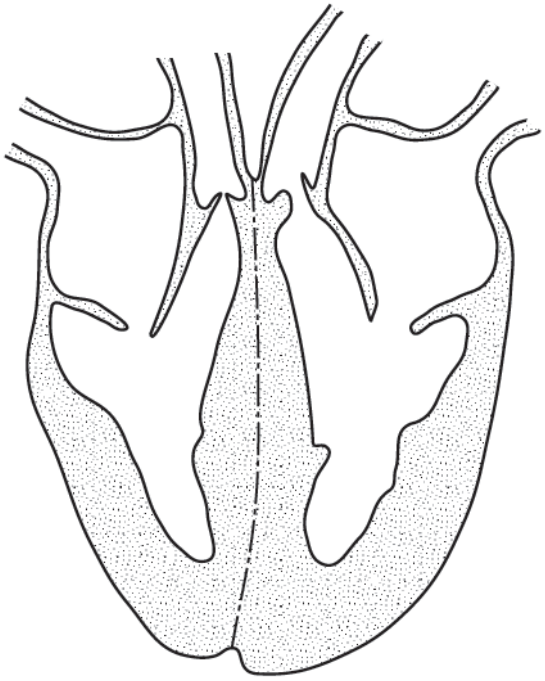
(b) (i) Catrin studied the role of the Atrio-Ventricular Node, Purkinje (Purkyne) tissue and Sino-Atrial Node. On the diagram below, show the position of these **three** structures. [3]



(c) The atrio-ventricular septum is a thin layer of tissue between the outer walls of the atria and ventricles. Explain the role of the atrio-ventricular septum. [1]

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(d) Name the equipment used to determine the electrical activity of the heart. [1]

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(e) In Britain, about 10 000 people a year are fitted with an artificial pacemaker to treat an abnormally slow heartbeat.

(i) What is the medical term given to a heart beat of less than 60 beats per minute? [1]

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(ii) What region mentioned in part *(b)* is mimicked by an artificial pacemaker? [1]

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13. Phagocytes are specialised white blood cells that defend the body from bacterial pathogens such as *Mycobacterium tuberculosis.* Describe the process by which pathogens such as *Mycobacterium tuberculosis* are destroyed by phagocytes. [7]

Question Number			Answer	Marks	LO1	LO2	LO3	LO4	Unit 2	Unit 3
1			• Overweight/high BMI • Large waist • African-Caribbean, Black African, Chinese or South Asian background and over 25 • Other ethnic background and over 40 • Parent or sibling with diabetes • Have high blood pressure • Polycystic ovaries / gestational diabetes • Schizophrenia/bipolar/depression/taking antipsychotic drugs (3 points for 1 mark)	1			1			
2			• Type 1: insulin-producing cells in the body have been destroyed • Type 2: insulin-producing cells in the body are unable to produce enough insulin / insulin that is produced does not work properly	2			2			
3	a		• Pancreas produces insulin to decrease blood glucose/when blood glucose is high • Pancreas produces glucagon to increase blood glucose/when blood glucose is low	2		2				
	b		When blood glucose levels are low: • Liver converts glycogen to glucose / glycogenolysis • Liver converts {non-carbohydrate substances/amino acids/glycerol} to glucose / gluconeogenesis When blood glucose levels are high: • Liver stores glucose as glycogen / glycogenesis • Liver converts glucose to fat • Liver uses the glucose for respiration (2 points for low, 2 points for high)	4		4				

4			• α glucose: H on C1 above the ring, OH below • β glucose: OH on C1 above the ring, H below	2	2					
5	a		• the maximum arterial pressure (occurring during contraction of the left ventricle of the heart) is 130 mm/Hg • The minimum arterial pressure (due to relaxation of the ventricles) is 80 mmHg	2					2	
	b		• The cuff is inflated/ pumped- up around upper arm to prevent blood flow • cuff is deflated until blood flow begins - this gives systolic pressure • cuff loosened further until free blood flow - this gives diastolic pressure	3					3	
	c	i	• Damages {capillary network / small blood vessels} • {Filtration of blood/ultrafiltration} is less efficient	2		2				
6	a		Axes + scale (1) Plot (2)	3				3		
	b		difference = 10.69-0.99 = 9.7 % difference = 9.7/0.99 x 100 = 979.8 %	2				2		
	c		• Before 40 low numbers as cases due to Type 1 diabetes • After 40 High number as cases due to type 1 and type 2 diabetes	2			2			
Total Section A				25	2	8	5	5	5	0

Question Number			Answer	Marks	LO1	LO2	LO3	LO4	Unit2	Unit 3
7	a		Lubrication Protection	2		2				
	b		Trachea	1		1				
	c		B – more mitochondria more respiration/ATP (marks for reason)	2	2					
	d		Extensive golgi apparatus / Golgi used in protein modification	1	1					
	e	i	lack of mucous clearance / infection/cough	1			1			
		ii	Spirometer / peak flow meter	1					1	
	f	i	• quantitative methods - generates measureable data / data that can be transformed into useable statistics (1) • qualitative methods – has no measurement statistics / uses words to explore meaning (1) • Qualitative method used (1) • best method to gain an understanding of underlying reasons / opinions / motivations. (1) *or* • Or qualitative methods use interviews (etc) to find underlying reasons / opinions / motivations	4						4
		ii	• Snowballing is a non-probability sampling technique (1) • where existing subjects recruit future subjects from friendships/ acquaintances (1) Limitations (2) Two of: • Danger of bias • First participants will have strong impact on sample • Not random sample so may not be representative	4						4

8	a		A: Saturated triglyceride B: Unsaturated triglyceride C: Phospholipid D: Glycolipid (1 mark per correct pair)	2	2					
	b		A – no C=C double bonds – solid at room temp/lower mp Or B – has C=C double bonds – liquid at room temp/higher mp	1	1					
	c		C membranes D cellular recognition	2	2					
	d		A – saturated fat linked to CHD (or reverse argument)	1			1			
9	a		• Virus attaches itself to host cell • Injects genetic material into host cell • Viral DNA incorporates into host cell • Host cell replicates the viral {genome/DNA/RNA} • Newly-created viruses and released from the host cell • Cell breaks apart/dies (any 4 points in correct sequence)	4			4			
	b	i	• Number of cases low {in summer months / Apr-Oct} • Number of cases high {in winter months / Oct-Apr}	2				2		
		ii	High mutation rate of influenza virus	1			1			
		iii	Yes • Cases of flu did not reach epidemic level • Numbers decreased in spring to normal (marks for reasoning)	2				2		

10	a		• Primary structure/sequence of amino acids • Folded into secondary structure / Alpha helix and beta pleated sheet • Held by H Bonds • Folding of secondary structure to form tertiary structure • Held by H bonds, ionic bonds, disulphide bridges • 3D structure enables formation of active site (any 4 points)	4	4					
	b		• {Substrate/fibrinogen} binds to active site / forms E-S complex • Formation of fibrin as product • {Substrate/fibrinogen} is specific / active site is complementary • Correct reference to {lock and key/induced fit model}	3	3					
	c	i	Inhibitor of thrombin (ignore ref to competitive/non-competitive)	1	1					
		ii	• Appropriate line - As conc of Heparin increases, clotting time increases • Axes correctly labelled	2				2		
		iii	(Heparin-protamine) sulfate complex is a different shape (heparin-protamine sulfate) complex is no longer complementary to (active site/allosteric site of) thrombin Substrate/fibrinogen can now bind (any 2 points)	2	2					

<table>
<tr><td>11</td><td>a</td><td></td><td>(Genes) on the {X/ Y} chromosomes / (genes) on sex chromosomes, not on the autosomes</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td><td></td></tr>
<tr><td></td><td>b</td><td></td><td><table>
<tr><td>Parents</td><td colspan="2">X^HY</td><td colspan="2">X^HX^h</td></tr>
<tr><td>Gametes</td><td>X^H</td><td>Y</td><td>X^H</td><td>X^h</td></tr>
<tr><td>Offspring</td><td>X^HX^H</td><td>X^HX^h</td><td>X^HY</td><td>X^HY</td></tr>
<tr><td></td><td>Normal Female</td><td>Normal / Carrier Female</td><td>Normal Male</td><td>Haemophilliac / Affected Male</td></tr>
</table>1 mark per correct row</td><td>4</td><td></td><td></td><td>4</td><td></td><td></td><td></td></tr>
<tr><td></td><td>c</td><td></td><td>None</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td><td></td></tr>
<tr><td></td><td>d</td><td></td><td>0.25 / 25%</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>12</td><td>a</td><td></td><td>Excitation produced spontaneously, without requiring stimulation from nerve cells</td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>SAN, AVN, Purkinje fibres labelled in correct region (Purkinje fibres across both sides)</td><td>3</td><td></td><td>3</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>c</td><td></td><td>• Insulation
• Prevents direct transfer of wave of excitation to ventricles
• Prevents atria and ventricles from contracting at the same time
• Causes contraction of ventricles from base
(any one)</td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>d</td><td></td><td>ECG</td><td>1</td><td></td><td></td><td></td><td></td><td>1</td><td></td></tr>
<tr><td></td><td>e</td><td>i</td><td>Bradychardia</td><td>1</td><td></td><td></td><td></td><td></td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>SAN</td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td></tr>
</table>

13			• (Bacterial pathogens /tuberculosis) initially attach to receptors on surface of phagocyte • Pathogen is engulfed by phagocyte / surrounded by cytoplasm • By phagocytosis • Formation of {phagocytic vesicle / phagocytic vacuole / phagosome} • Lysosomes fuse with vesicle • {Enzymes/lysins/hydrogen peroxide / free radicles} are released from the lysosomes • {Digest/break down} pathogen • Into {amino acids/sugars/glucose/fatty acids/glycerol} • Break down products are absorbed by cells (any 7)	7		3	4			
Total B				65	18	12	18	6	3	8
Total (unit)				90	20	20	23	11	8	8

WJEC Level 3 Diploma in Medical Science

Unit 1 Human Health and Disease

External Assessment: documentation

Year	*specimen*
Examiner	
Reviser	

Specification link

SECTION A (pre-release section)

LO	1				2		3				4				Unit link	
AC	1.1	1.2	1.3	1.4	2.1	2.2	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	2	3
Question																
1								1								
2										2						
3 a						2										
b					4											
4	2															
5 a															2	
b															3	
c i						2										
6 a												3				
b												2				
c										2						
Total	2				4	4		1		4		5			5	
	2				8		5				5				5	0
Total															25	
Allowed range for Section A															22-25	

SECTION B

LO	1				2		3				4				Unit link	
AC	1.1	1.2	1.3	1.4	2.1	2.2	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	2	3
Question																
7 a						2										
b					1											
c		2														
d		1														
e i										1						
e ii															1	
f i																4
f ii																4
8 a	2															
b	1															
c	2															
d							1									
9 a									4							
b i												2				
ii									1							
iii													2			
10 a	4															
b	3															
c i	1															
c ii												2				
c iii	2															
11 a										1						
b										4						
c										1						
d										1						
12 a					1											
b					3											
c						1										
d															1	
e i															1	
ii					1											
13						3			4							
Total B	15	3			6	6	1		9	8		4	2		3	8
	18				12		18				6				3	8
																65
Total A	2				4	4		1		4		5			5	
Total	20				20		23				11				8	8
Allowed range	18-23				18-23		18-23				10-15				8-13	8-13
														Total	90	

WJEC Level 3 Diploma in Medical Science

Unit 1 Human Health and Disease

Coverage

	Specimen	2017	2018	2019	All AC covered in last three years?	2020	2021	2022	All AC covered in last three years?	2023
Section A marks in range 22-25 marks	25									
LO1 marks in range 18-23	20									
LO2 marks in range 18-23	20									
LO3 marks in range 18-23	23									
LO4 marks in range 10-15	11									
Unit 2 marks in the range 8-13	8									
Unit 3 marks in the range 8-13	8									
Extended response	✓									
Principal Examiner										
Reviser										

WJEC Level 3 Diploma Medical Science

Unit 1 Human Health and Disease

Assessment criteria: annual coverage

LO	**1**				**2**		**3**				**4**				**Unit 2**	**Unit 3**	**Verified**	
AC / Year	**1.1**	**1.2**	**1.3**	**1.4**	**2.1**	**2.2**	**3.1**	**3.2**	**3.3**	**3.4**	**4.1**	**4.2**	**4.3**	**4.4**			Principal Examiner	Reviser
Specimen	17	3			10	10	1	1	9	12		9	2		8	8		
2017																		
2018																		
2019																		
2020																		
2021																		
2022																		
2023																		

WJEC LEVEL 3 Diploma in Medical Science

MODEL ASSIGNMENT

UNIT 5: Clinical laboratory techniques

Activity 1 – Use of Clinical Laboratory Techniques

Activity 2 – Selection of Clinical laboratory techniques and Data Analysis

Index

Activity 1:

The clinical pathology laboratory in Briansville hospital carries out hundreds of clinical tests every day.

Urine samples have been sent to the laboratory from patients with suspected infections.

You will carry out clinical laboratory tests on these urine samples and inform clinicians of the outcome of your tests.

You will need to test the urine samples to find out the following:

- if the patient has abnormal glucose levels in their urine using a suitable testing method
- count number of cells in the urine samples using a haemocytometer
- whether the patient has a bacterial infection by growing any bacterial colonies from the test samples and dilution plating.

You are required to plan, carry out and report the results of the tests.

Task 1: Plan your investigation
Plan to carry out appropriate clinical tests on the urine samples you are provided with. These should be the biochemical, microscopic and microbiological tests outlines above.

Task 2: Carry out your investigation
Follow your plan from task 1. Record any modifications to your plan as you carry out your investigations.

Task 3: Record results in laboratory notebook
Record all of your results in your laboratory notebook. These should include the biochemical, microbiological and microscopic properties of the sample. You should also record any other relevant observations. Ensure that all raw data and calculations are recorded in a legible manner.

Task 4: Summary
Summarise your findings in a format suitable for a GP to deliver to their patients. Your summary should be in a concise format but show all relevant information.
(*You are not required to diagnose the patient in your report)*

LEARNER SUMMARY SHEET

Task Number	**Evidence** *This is the evidence that will be produced*	**Assessment Criteria** *You **must** make sure your work covers the following assessment criteria.*	**Controls** *This tells you the rules that your teacher must keep, when you complete the tasks.*
Task 1 Plan	Written plan	AC2.1	**Time** 60 minutes. **Resources**: Access to appropriate ICT software; access to class notes **NOT** allowed. **Supervision** You will be supervised throughout **Collaboration** Individual task **Feedback** You can**not** be given feedback on the work you produce until it has been marked
Task 2 Carry out	Raw data in laboratory notebook Observation record	AC2.2	**Time** 120 minutes(split as required) **Resources**: Access to appropriate ICT software; access to class notes **NOT** allowed. **Supervision** You will be supervised throughout **Collaboration** Individual task **Feedback** You can**not** be given feedback on the work you produce until it has been marked
Task 3 Record in laboratory notebook	Laboratory notebook	AC2.3	**Time** 60 minutes. **Resources**: Access to appropriate ICT software; access to class notes **NOT** allowed. **Supervision** You will be supervised throughout **Collaboration** Individual task **Feedback** You can**not** be given feedback on the work you produce until it has been marked
Task 4 Summary	Written summary	AC3.4	**Time** 30 minutes. **Resources**: Access to appropriate ICT software; access to class notes **NOT** allowed. **Supervision** You will be supervised throughout **Collaboration** Individual task **Feedback** You can**not** be given feedback on the work you produce until it has been marked

WJEC Level 3

Diploma in Medical Science

Observation Record

To be completed by assessor as part of the evidence for task 2

Unit 5: Clinical Laboratory Techniques

Learner's Name:		
AC2.2 assess biological samples using clinical tests		
Assessment Commentary Preparation of equipment Use of equipment		
Mark Awarded AC2.2		
Assessor	**Signature**	**Date**

Technical Guidance: Procedures

Activity 1 Urine Investigation

Different candidates in the same class should be given different 'urine' samples.

Candidates should be given at least 3 samples that allow them to test for glucose content using the Benedict's test (or other suitable test), study bacterial growth by growing bacterial samples on agar plates, and count cell numbers using a haemocytometer.

Substitute urine samples can be prepared by a variety of methods, however a common method would be to prepare cold tea as a substitute for urine.

Samples should contain the following:

- glucose
- bacteria
- cell samples that are visible under light microscope (e.g. yeast)

There is no requirement to test more samples/markers than indicated.

Activity 2: Test Selection

Elin has found out that she is pregnant. Her midwife has advised her that a number a number of tests are offered during pregnancy to monitor the condition of mother and baby. Tests are offered to detect the following problems:

- gestational diabetes
- bacterial infection
- anaemia
- inherited diseases

The results of a blood test taken at her 12 week scan are given below:

Table 2.1 Glucose testing using known glucose concentrations

Glucose concentration (mmol dm^{-3})	**Absorbance (490 nm)**		
0	0	0	0
2	0.265	0.256	0.241
4	0.462	0.471	0.454
6	0.612	0.631	0.599
8	0.865	0.874	0.852
10	0.951	0.998	0.987
Patient sample (unknown)	0.846	0.864	0.871

Table 2.2 Haemoglobin testing using known concentrations

Haemoglobin concentration (gdm^{-3})	**Absorbance (570 nm)**		
0	0	0	0
20	0.082	0.091	0.078
40	0.156	0.175	0.166
60	0.245	0.254	0.239
80	0.346	0.352	0.351
100	0.431	0.426	0.435
120	0.521	0.532	0.518
140	0.601	0.607	0.598
160	0.685	0.684	0.692
180	0.769	0.758	0.753
Patient sample (unknown)	0.378	0.379	0.374

Table 2.3 Other parameters tested

Test	Result
Sodium ions	140 mmol dm^{-3}
Potassium ions	4 mmol dm^{-3}
Calcium ions	1.29 mmol dm^{-3}
Zinc ions	18 mmol dm^{-3}
Urea	200 mg dm^{-3}
Triglycerides	121 mg dm^{-3}
Cholesterol	114 mg dm^{-3}
Red blood cell count	3.5×10^{12} dm^{-3}
White blood cell count	600×10^{9} dm^{-3}
Platelet count	250×10^{9} dm^{-3}
Albumin	35 mg dm^{-3}
Creatinine	0.7 mg dm^{-3}
Total Protein	85 mg dm^{-3}

Task 1: **Choice of techniques**

Produce a leaflet that can be given to pregnant women by midwives. The leaflet should describe the principles and purpose of the tests that are carried out during pregnancy.

Task 2: Analysis of results

Tables 2.1, 2.2 and 2.3 give the results from Elin's twelve week blood test. Interpret the data from Elin's blood test given in tables 2.1, 2.2 and 2.3. You should use both graphs and numerical methods.

You will need access to the *'reference ranges for some common blood tests'* data sheet

LEARNER SUMMARY SHEET

Task Number	**Evidence** *This is the evidence that will be produced*	**Assessment Criteria** *You **must** make sure your work covers the following assessment criteria.*	**Controls** *This tells you the rules that your teacher must keep, when you complete the tasks.*
Task 1 **Choice of techniques**	Report	AC 1.1, AC1.2, 3.4	**Time** 60 minutes. **Resources**: Access to appropriate ICT software; access to class notes **NOT** allowed. **Supervision** You will be supervised throughout **Collaboration** Individual task **Feedback** You can**not** be given feedback on the work you produce until it has been marked
Task 2 **Analysis of data**	Report	AC3.1, AC 3.2, AC3.3	**Time** 30 minutes. **Resources**: Access to appropriate ICT software; access to class notes **NOT** allowed. Table of reference ranges for some common blood tests should be supplied. **Supervision** You will be supervised throughout **Collaboration** Individual task **Feedback** You can**not** be given feedback on the work you produce until it has been marked

Reference ranges for some common blood tests

Test	Adult Male	Adult Female
Glucose (Fasting)	4.5 – 6.1 mmol dm^{-3}	4.5 – 6.1 mmol dm^{-3}
Sodium ions	133 – 147 mmol dm^{-3}	133 – 147 mmol dm^{-3}
Potassium ions	3.5 – 5.0 mmol dm^{-3}	3.5 – 5.0 mmol dm^{-3}
Calcium ions	1.15 – 1.29 mmol dm^{-3}	1.15 – 1.29 mmol dm^{-3}
RED BLOOD CELLS		
Haemoglobin	140 – 180 g dm^{-3}	115 – 160 g dm^{-3}
Red Cell count	$4.5 – 6.5 \times 10^{12}$ dm^{-3}	$3.8 – 5.8 \times 10^{12}$ dm^{-3}
White blood cell count	$4 – 11 \times 10^{9}$ dm^{-3}	$4 – 11 \times 10^{9}$ dm^{-3}
Platelet count	$150 – 400 \times 10^{9}$ dm^{-3}	$150 – 400 \times 10^{9}$ dm^{-3}

Managing the assessment

Time

6 hours

The time suggested for each task, as set out in the Learner Summary Table, takes account of the contribution of the task to the overall assessment requirements. There can be no changes to the total time available for controlled assessment, as set out in this model assignment. Centres can, however, amend the suggested time available for each task.

Resources

Learners must have access to the assignment brief, Learner Summary Table, list of reference ranges for some common blood tests and any necessary equipment.

Collaboration

Group work is not allowed for the assessment.

Supervision

Learners must be supervised by an assessor whilst completing the activities. Centres must have in place systems to ensure learners cannot access evidence they have been developing outside of supervised activities.

Authentication

Supervision is in place to ensure the authenticity of evidence produced for summative assessment. Assessors should not provide input or guidance to learners during the controlled assessment time. This includes providing formative feedback on the evidence being produced. Assessors can provide guidance on the requirements of the task and remind learners of the performance bands and how they can be interpreted.

Learners can review and redraft evidence independently within the time controls for the assessment.

Learners must sign a declaration to confirm that all evidence submitted for moderation is their own work and that any sources used have been acknowledged.

Assessors must sign a declaration to confirm that evidence submitted was completed under the controlled conditions set out in the model assignments.

Marking

This assessment will be marked by WJEC. The work must be submitted for marking in the summer of the academic year in which the assessment is set. The date for submission of external assessment can be found in the WJEC Examination Timetable published for each academic year on the WJEC website.

WJEC will use the performance bands found in unit 5 of the specification.

Accepted changes

Activity one

No changes are permitted to this activity.

Activity two

No changes are permitted to this activity.

WJEC Level 3 Diploma in Medical Science

MARK RECORD SHEET

UNIT 5 ***Clinical Laboratory Techniques***

Centre Name: …… **Centre Number:** ……

Candidate's Name: …… **Candidate Number:** ……

I confirm that the evidence submitted for assessment has been produced by me without any assistance beyond that allowed.

Candidate's Signature: …… **Date: ...../……../20……**

I confirm that the evidence submitted by the learner has been produced under the controlled conditions set out in the qualification specification and model assignment.

Assessor's Signature: …… **Name (printed): …….. Date: ...../……../20……**

WJEC Level 3 Diploma in Medical Science

EXTERNAL ASSESSMENT: MARK RECORD SHEET

UNIT 5: Clinical Laboratory Techniques

Centre Name: …….. **Centre No.** ……..…

Candidate Name: …… **Candidate No**. ……

Assessment criteria	Evidence Page number(s)	Activity 1	Activity 2	Unit mark
AC1.1				
AC1.2				
AC2.1				
AC2.2				
AC2.3				
AC3.1				
AC3.2				
AC3.3				
AC3.4				
			TOTAL	**/80**

(MARK RECORD SHEET P2 of 2)

Assessment Grid

AC	**Activity** 1				**Activity** 2	
	1	**2**	**3**	**4**	**1**	**2**
AC1.1					✓	
AC1.2					✓	
AC2.1	✓					
AC2.2		✓				
AC2.3			✓			
AC3.1						✓
AC3.2						✓
AC3.3				✓		✓
AC3.4				✓	✓	

WJEC LEVEL 3

Diploma in Medical Science

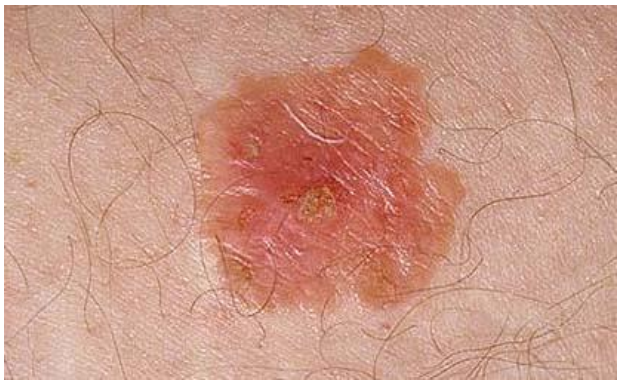
Resource Folder (Medical conditions)

*For use with **unit 6 Medical Case Study** examination*

Specimen

Medical Case Study information – for release in late April, prior to examination

Melanoma



Melanoma is a type of skin cancer that can spread to other organs in the body. Melanoma is the 5th most common cancer in the UK with around 13000 new cases of melanoma diagnosed each year.

More than a quarter of cases are diagnosed in people under 50, which is unusual compared to most other types of cancer. It is also becoming more common in the UK over time, and thought to be caused by increased exposure to UV light from the sun and sunbeds.

More than 2000 people die every year in the UK from melanoma.

In most cases, melanomas have an irregular shape and more than one colour. They may also be larger than normal moles and can sometimes be itchy or bleed.

Melanoma happens when some cells in the skin begin to develop abnormally. It is thought that exposure to ultraviolet (UV) light from natural or artificial sources may be partly responsible.

Diagnosing melanoma

In most cases, a suspicious mole will be surgically removed and studied to see if it is cancerous. This is known as a biopsy. Patients may also have a test to check if melanoma has spread elsewhere in the body. This is known as a sentinel node biopsy.

Treating melanoma

The main treatment for melanoma is surgery, although the method of treatment will depend on circumstances.

If melanoma is diagnosed and treated at an early stage, surgery is usually successful. If melanoma isn't diagnosed until an advanced stage, treatment is mainly used to slow the spread of the cancer and reduce symptoms. This usually involves medicines, such as chemotherapy.

Drug treatments for melanoma include:

- Dabrafenib mesilate
- Dactinomycin
- Vindesine
- Ipilimumab

Hay fever (Allergic Rhinitis)

Hay fever is a common allergic condition that affects up to one in five people at some point in their life. It is estimated that there are more than 14 million people with hay fever in the UK. Hay fever is more likely if there is a family history of allergies, particularly asthma or eczema. Indeed, hay fever can make asthma symptoms much worse during the summer months.

Symptoms of hay fever are caused when a person has an allergic reaction to pollen and include sneezing, a runny nose and itchy eyes. The pollen contains proteins that can cause the nose, eyes, throat and sinuses to become swollen, irritated and inflamed.

Hay fever symptoms are likely to be worse if the pollen count is high. The pollen count is the number of grains of pollen in one cubic metre of air.

Treatment

There is currently no cure for hay fever but most people are able to relieve symptoms with treatment, at least to a certain extent.

In an ideal world, the most effective way to control hay fever would be to avoid exposure to pollen. However, it is very difficult to avoid pollen, particularly during the summer months.

Treatment options for hay fever include antihistamines, and corticosteroids (steroids).

For persistent and severe hay fever there is also a type of treatment called immunotherapy where patients are exposed to small amounts of pollen over time to build up a resistance to its allergic effects. However, this can take many months or even years to be effective.

Hay fever can cause a blocked nose. A decongestant, in the form of a nasal spray, can relieve this. Decongestants reduce the swelling of the blood vessels in your nose, which opens your nasal passage and makes breathing easier.

Eye drops are available to treat hay fever symptoms that affect the eyes, such as redness, itchiness and watering (allergic conjunctivitis). These drops contain antihistamine to reduce the inflammation in the eyes, which will relieve the symptoms.

Complications

Hay fever does not pose a serious threat to health but it can have a negative impact on quality of life. Another common complication of hay fever is inflammation of the sinuses (sinusitis). Children in particular may also develop a middle ear infection (otitis media) as a result of hay fever.

Allergy testing

A GP may refer a patient to an immunologist for an allergy test if they have hay fever symptoms all year round (persistent allergic rhinitis), or symptoms that are not responding to treatment. Other substances could be causing the allergy, such as house-dust mites.

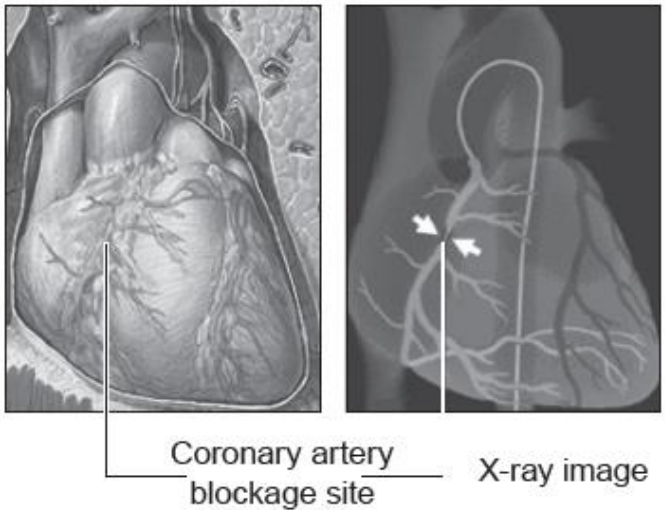
Coronary heart disease

Coronary heart disease (CHD) is the UK's biggest killer, causing around 82,000 deaths each year. About one in five men and one in eight women die from the disease. In the UK, there are an estimated 2.7million people living with the condition and 2 million people affected by angina (the most common symptom of coronary heart disease).

Symptoms of CHD include angina, heart attack and heart failure.

Causes of heart disease

Coronary heart disease (CHD) is usually caused by a build-up of fatty deposits on the walls of the arteries around the heart (coronary arteries). The fatty deposits, called atheroma, are made up of cholesterol and other waste substances. The build-up of atheroma on the walls of the coronary arteries makes the arteries narrower and restricts the flow of blood to the heart. This process is called atherosclerosis



Diagnosing coronary heart disease

If a doctor feels a patient is at risk of CHD, they may ask about the patient's medical and family history, their lifestyle and take a blood test.

Further tests may be needed to confirm a diagnosis of CHD, including an electrocardiogram (ECG), X-ray, blood tests for cardiac enzymes and troponin, echocardiogram, MRI scan, a CT scan and coronary angiography.

Treating coronary heart disease

There are a number of ways to treat CHD:

- Lifestyle changes can reduce the risk of further episodes.
- Medicines such as Beta blockers, Statins, Nitrates or anti-clotting drugs
- Procedures and surgery such as coronary angioplasty, coronary artery bypass graft or transplant.

WJEC Level 3 Diploma in Medical Science

Specimen External Assessment

AM/PM xxxday xx

Medical Case Study (1 hour 30 minutes)

	For Examiner's use only	
Question	**Maximum Mark**	**Mark Awarded**
1-6	**25**	
7-10	**25**	
11-14	**25**	
Total	**75**	

Instructions to candidates

Answer all questions.

Write your answers in the spaces provided in this booklet.

Information for candidates

The total mark for the paper is **75** marks.

You are reminded of the necessity of good English and orderly presentation of your answers.

The number of marks is given in brackets at the end of each question or part question.

Questions in section A are based on the pre-release article.

You will need the resource folder that contains the pre-release article.

You will need a calculator and ruler for this exam.

You should show your working to calculations.

Case Study 1 – Melanoma

Helen was diagnosed with malignant melanoma after a routine check on a mole.

"I had a mole on the side of my knee that was about 1cm across. It was a bit rough and uneven, and when I saw my GP about something else, I mentioned that I wanted it removed as I didn't like the look of it. I wasn't worried about it, but I used to feel a bit self-conscious if I wore a skirt that wasn't long enough to cover it.

At the hospital, the doctor suggested I could have a procedure where the top of the mole is shaved off under local anaesthetic. No one seemed to think there was a risk of cancer, but the doctor went ahead with the procedure because of the mole's position. After the procedure, a sample was sent off for a routine check. Two weeks later, I had a message asking me to return to hospital.

I was quite naive really and I didn't think about why I was going back. But when I went into the clinic, I was told I had malignant melanoma and needed an operation to remove it.

I was totally shocked by the results. I hadn't considered that anything like this could happen, and the fact that nobody else had thought there was cause for concern made the results even more shocking. I'm fair-skinned with red hair, but I never thought I'd be at risk, as I've never been really badly sunburnt and I've never used sunbeds.

It all happened very quickly. Two weeks after I received the results, I was given a sentinel node biopsy to see if the cancer had spread to other parts of my body. This was followed by an operation to remove the melanoma. Initially, they thought I'd need a skin graft, but luckily they managed to stitch up the 5cm incision instead.

It took about a month to get back to normal again. After the operation, I had to keep a splint on my leg for 10 days, to keep my leg straight and give the wound a chance to heal. It was difficult waiting for the results, as it was hard not to worry that the cancer had spread. However, I was very lucky. The melanoma was self-contained.

I have to have check-ups every three months for the first two years after the operation. I'll then have them every six months for three more years. The nurse examines my skin and gland areas, and I also check myself at home for any changes to my skin and moles.

From spring onwards I wear moisturiser with a sunblock in, and during the summer I avoid the sun from 11am to 3pm. I'm careful not to spend too much time in the sun. I don't want to risk getting burnt and doing any more damage to my skin."

Figure 1. Malignant Melanoma Incidence Rates per 100,000 population, by Sex, UK, 1993-2011.

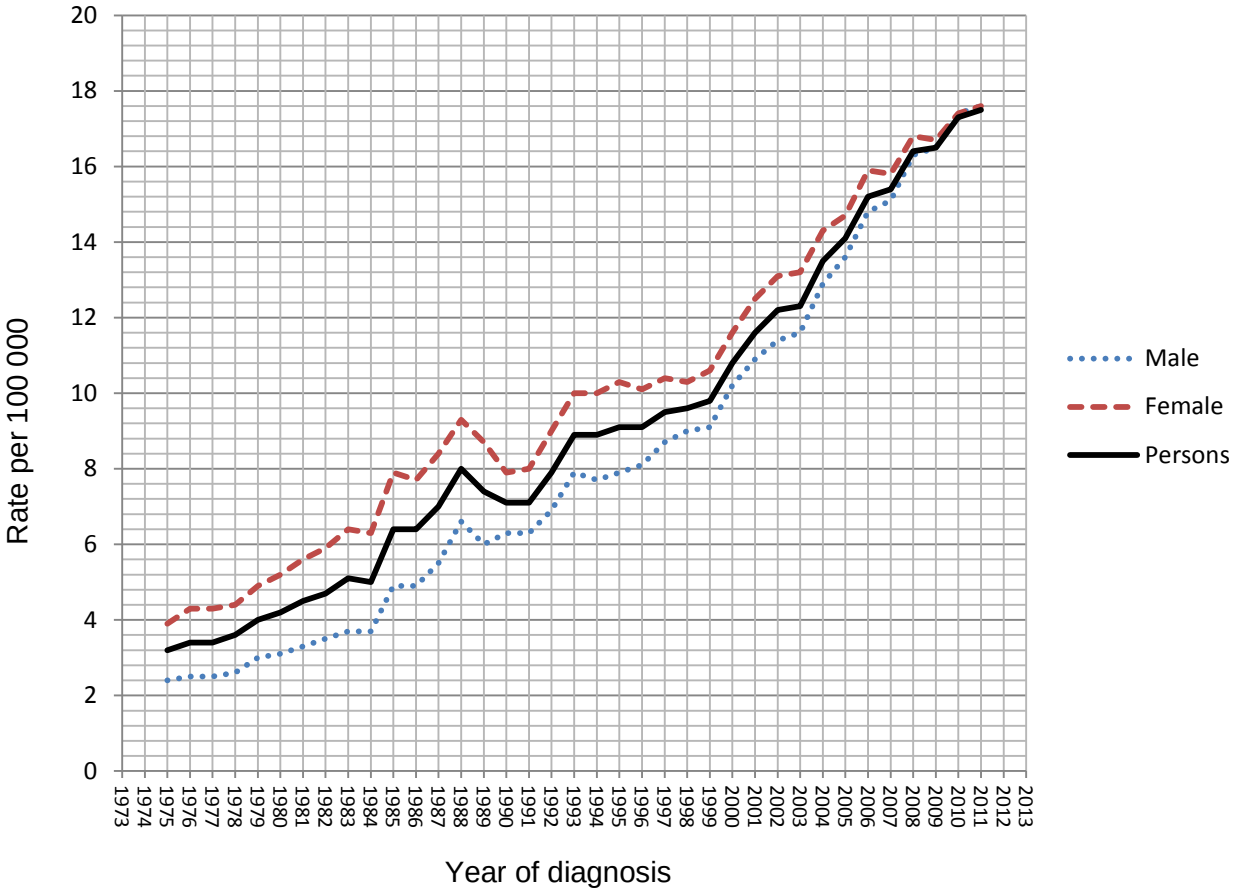
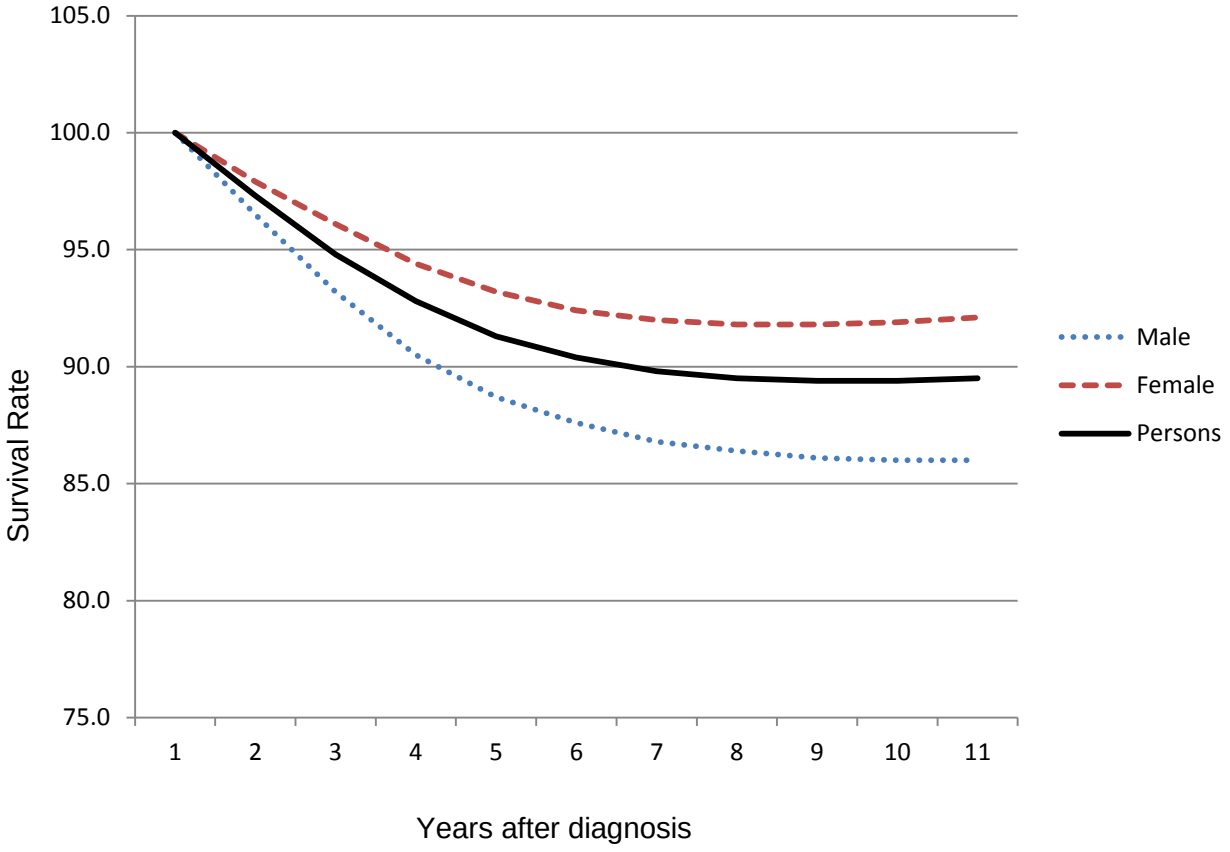


Figure 2. Survival up to Ten Years after Diagnosis, Adults (Aged 15-99), England and Wales.



1. Diagnosis of myeloma involves taking a biopsy of the affected area. Describe how biopsy samples are processed after excision from the patient. [4]

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2. *(a)* Describe the trend in the number of cases of melanoma in males and females between 1975 and 2011 (Figure 1). [2]

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(b) Suggest why there is an increase in the number of cases of melanoma. [1]

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(c) The estimated cost per patient for the diagnosis and treatment of melanoma is £2179. The population of the UK is 70 million. Estimate the UK cost of diagnosis and treatment of melanoma in 2011. [2]

Answer…….

3. *(a)* Compare the survival rates for males and females for the ten years after treatment for myeloma (Figure 2). [2]

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(b) Suggest the length of time that myeloma patients should receive regular check-ups following removal of the malignant tissue. [1]

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4. In the case study Helen has to wear moisturiser containing sunblock. Explain why this is necessary. [2]

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5. *(a)* Dactinomycin is a drug used in cancer chemotherapy that damages the DNA of Cancer cells. How does damage to this DNA help to cure the symptoms of cancer? [3]

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(b) State **two** other therapeutic approaches to treat cancer. [2]

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6. A side effect of Dactinomycin is a drop in white blood cell, red blood cell and platelet number. Explain how a decreased number of these blood components will affect the patient. [6]

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Case Study 2 – Hayfever

Sarah Price, tried a number of different treatments before she found the right one for her.

"When I first got hay fever, I already had asthma and I just thought my symptoms were connected to this. My head and nose felt very congested. My eyes would feel very sore, red and itchy, especially when I was near flowers. It was during a routine check with my GP that my hay fever was diagnosed.

My symptoms tend to flare up from February until September. Hay fever can make my asthma worse and I used to have problems sleeping too. It's like trying to go to sleep with a bad cold. Luckily, the medication I take has helped me get to sleep.

I take antihistamines prescribed by my doctor regularly throughout the hay fever season. These are non-drowsy so they don't affect my day-to-day life. I also use eye drops. I find that this treatment helps a lot. It doesn't get rid of my symptoms completely, but it makes them manageable.

I've also had to make a few lifestyle changes. I now avoid cutting the grass. If I really have to, I do it late in the evening when pollen counts are lower. I always keep my windows shut too. I try not to sit outside when pollen counts are high in the morning and late afternoon. Taking medication before the hay fever season starts has really helped as well.

My advice to anyone with hay fever is to try a different antihistamine if the one prescribed isn't effective. I tried several antihistamines before I found one that really helped my symptoms. Don't feel shy about going back to your doctor and asking for a different one if your symptoms aren't relieved."

Figure 3. Pollen release at different times of year

Figure 4 Association of asthma and hay fever. Data based upon a survey of children aged 4-17 attending 30 different schools in Eire. The schools were randomly selected. The population was almost entirely Caucasian.

	Suffer with hay fever	*Without asthma*	*Total number*
suffer from asthma	111	197	308
without asthma	213	2174	2387
total number	324	2371	2695

7. State what species has the most prolonged period of pollen release (Figure 3) and explain why this species is not the most problematic pollen species. [2]

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8. *(a)* Antihistamines and corticosteroids are used to treat hay fever. Explain how these treatments work. [4]

Antihistamines……

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Corticosteroids……

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(b) Immunotherapy is a potential treatment for hay fever. Suggest two reasons why immunotherapy is used infrequently. [2]

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(c) Explain why hay fever treatments, particularly Antihistamines are often taken prophylactically, before symptoms start. [2]

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(d) Describe **two** other measures, besides drug treatment that hay fever sufferers should take to minimise symptoms. [2]

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9. Asthma is a condition linked with hay fever. Describe how asthma is **diagnosed** and **monitored**. [5]

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10. A researcher plans to collect data to find out whether there is a correlation between childhood asthma and hay fever.

(a) Explain what is meant by hypothesis testing. [2]

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(b) Suggest a null hypothesis for this research. [1]

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(c) A questionnaire will be sent to the parents of the children. Suggest suitable questions, written as they will appear on a questionnaire, which could be used to collect quantitative data to test this hypothesis. [2]

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(d) Examine the data collected in **Figure 4** from research carried out in Eire. The researcher proposes to use the chi square test to their null hypothesis. Explain whether this is a suitable test. [3]

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Case study 3 – Coronary Heart Disease

After a heart attack, 36-year-old Rhian Williams was too scared to pick up her 18-month-old baby. Rehabilitation helped her move on with her life.

It was the usual rush in the Williams household as Rhian raced around getting her four children ready for school. But as she strode into the living room to summon her eldest, she was suddenly stopped in her tracks by a sharp pain in her chest.

"My heart was racing, the pain was awful, and I had pins and needles in my lower jaw and down both arms," she says. "I sat down on the sofa hoping the pain would stop, but it didn't. I knew something was very wrong. I was on my own with the kids, so I got my eldest to bring me the phone. I called my mother-in-law and my father and told them I didn't feel very well. My dad was over in 10 minutes. He took one look at me and called an ambulance."

In the ambulance, paramedics gave her an electrocardiogram (ECG) to test the electrical activity in her heart. She was then given an aspirin to chew. Once she got to the hospital, doctors gave her a drug to dissolve any clots in her blood that might have caused the heart attack.

"I knew it was serious, but I didn't guess how serious," she remembers. "When I got to the hospital, it was madness. Everyone was rushing around, hooking me up to machines. It didn't take the doctor long to tell me I'd suffered a heart attack. It didn't quite sink in until my mother-in-law got to the hospital and I had to tell her what had happened to me."

Rhian stayed in hospital for a week. On the sixth day, she began to experience pins and needles in her left arm. Doctors were concerned that she might be having another heart attack. As a precaution, she was given another ECG and sent for an angiogram, a procedure that checks the arteries for blockages. The angiogram was clear and she didn't have another attack. The cause of her original attack is still unknown.

Back at home, she realised how much the experience had shaken her. "I was frightened to do anything. I was nervous about going up the stairs, and I was too scared to pick up my 18-month-old daughter in case I had another heart attack," she says.

"Then I was sent for rehabilitation, which really helped. We learned about healthy eating and exercise, but a big part of it was finding the confidence to carry on with our lives. The nurses reassured me that I could live a perfectly normal life again and they were right. By the end of the six-week course, I'd got my confidence back."

Two years on, Rhian still takes several drugs every day, including aspirin and a statin, to help prevent another attack. She sees a consultant once a year. But so far she hasn't had another heart attack. "It was a very frightening experience, but I came through it," she says. "I'd urge anyone who's had one to make the most of rehabilitation and use all the help they can get. It certainly helped me to move on."

Figure 5 Prescriptions used in the prevention and treatment of CHD, England 1981 to 2011

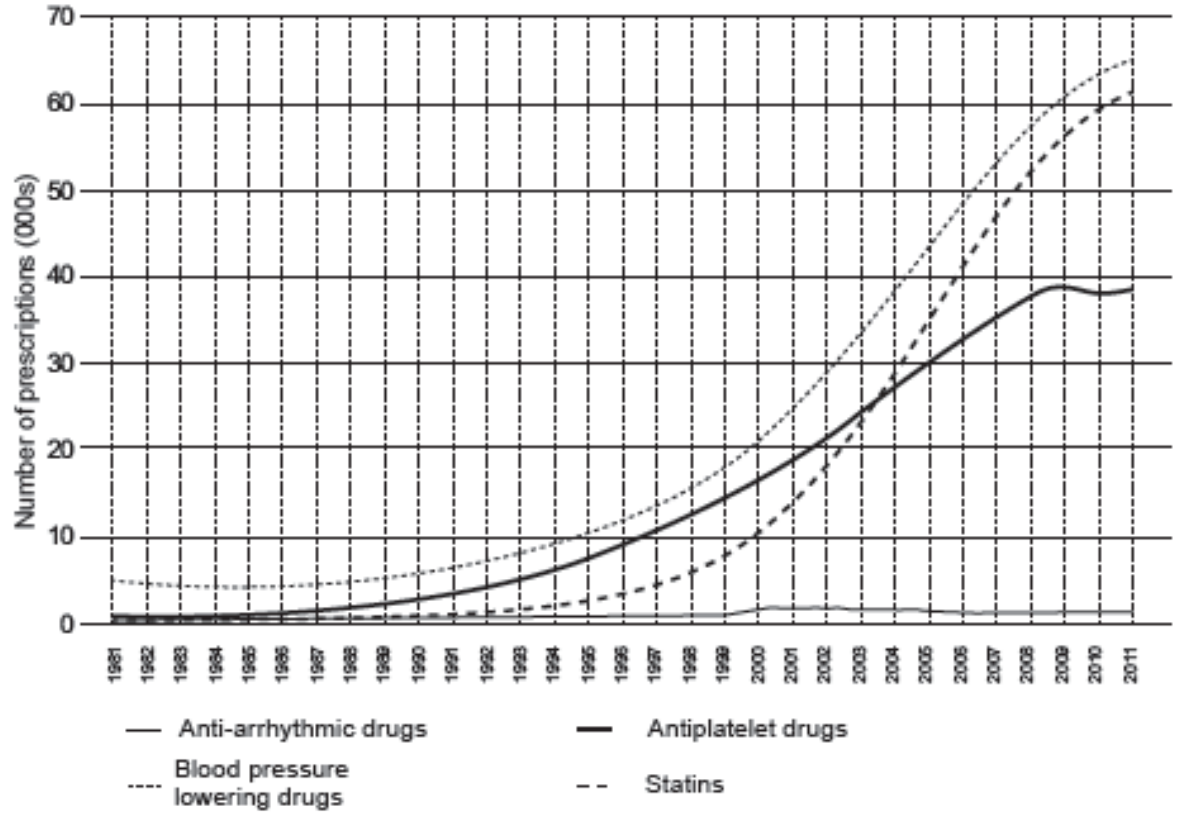
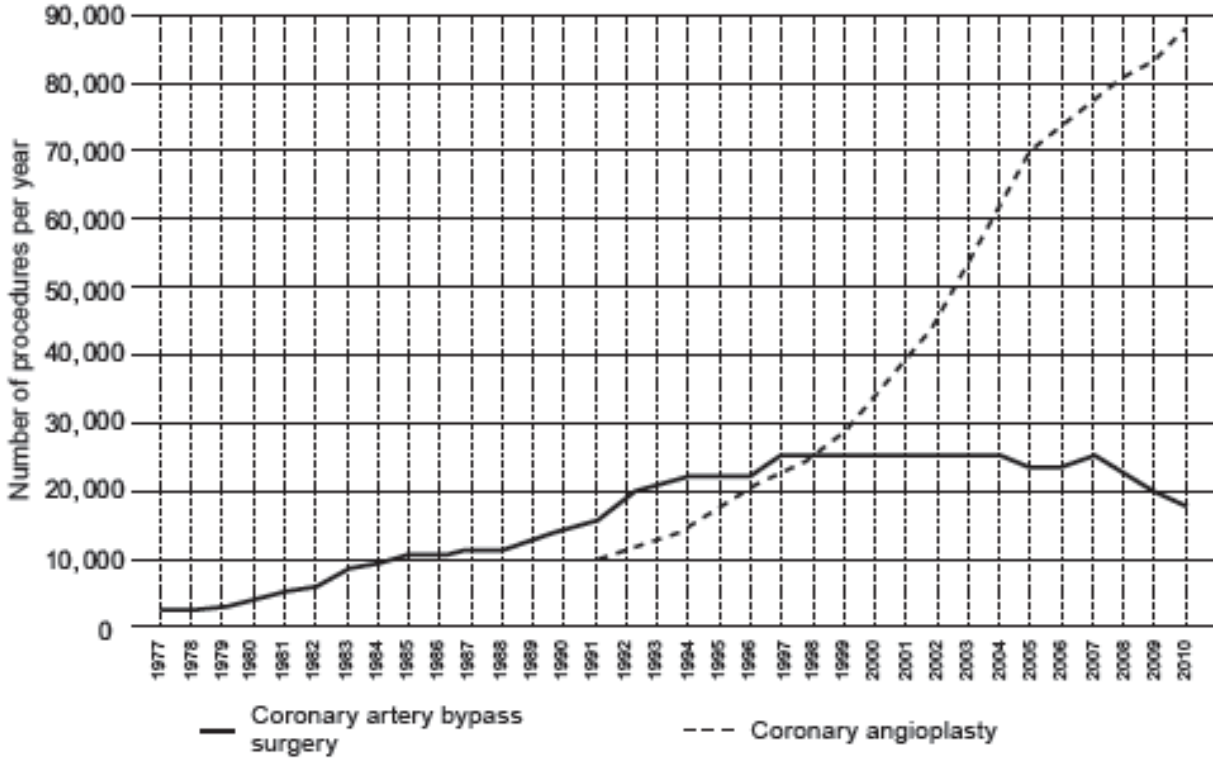


Figure 6 Number of coronary artery bypass and coronary angioplasty operations per year United Kingdom 1977 to 2010



The above graphs are taken from BHF website.

11. *(a)* State the function of the coronary arteries. [2]

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(b) Give **one** reason why a patient experiences chest pain when the coronary arteries become partially blocked. [1]

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(c) Give **one reason** why coronary veins are less likely to be affected by atheroma than coronary arteries. [1]

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(*d*) Explain how a Nitrate spray can relieve chest pain. [2]

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12. Please refer to the figures 5 and 6 to answer this question.

(a) Describe the trend in prescription of blood pressure lowering drugs and statins since 1981. [1]

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(b) Compare the trend for the number of coronary bypass operations and coronary angioplasty since 2007. [2]

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(c) Give **two** reasons for the observed trend in coronary bypass operations. [2]

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13. Explain why blood pressure lowering drugs and antiplatelet drugs are prescribed to sufferers of coronary heart disease. [4]

blood pressure lowering drugs: ……

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antiplatelet drugs:……

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14. Two tests for cardiac heart disease are ECG, and ELISA assay of a protein called Troponin that is released by heart muscle. Describe how these tests are carried out and explain how they indicate a patient is suffering from Coronary Heart disease. [10]

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Mark Scheme unit 6

Question			Answer	mark	LO1	LO2	LO 3	LO 4	LO 5
Case Study 1 - Melanoma									
1			• Specimen described by pathologist/clinician • Specimen cut • Infiltrate with alcohol (to remove water) • Impregnate with paraffin wax • Embed in molten wax • Allow to solidify • Cut into thin sections • Mount on slide • View under microscope (any 4 in correct order)	4					4
2	a		• {Male and females / total} cases increasing • Male cases now equivalent to female/male increased more than female	2	2				
	b		• Increased exposure to uv from sun/sunbeds/ozone effect	1	1				
	c		• Number of cases in UK = 17.5 x 10 x 70 = 12 250 (1) • Cost = 12 250 x £2179 = £26 692 750 (1) (accept £26-27 million)	2	2				
3	a		• male survival lower than females • both rates stabilise/plateau after 7 years	2				2	
	b		• 5 – 7 years	1				1	
4			• Protect from UV • Prevent from further damage	2	2				
5	a		• (Damage to DNA) stops/alters DNA replication • No cell division • No protein synthesis • Cancer cells die (any 3 points)	3	3				
	b		• surgery • radiation therapy • immunotherapy • photodynamic therapy	2				2	

6			*Red blood cells* • Decreased oxygen carriage • Lethargy / breathlessness/ blue-coloured skin/ tachycardia/ Wheezing *White blood cells* • Less able to {engulf bacteria/destroy bacteria/produce antibodies} • Increased susceptibility to infection/fever Platelets • Decreased ability to clot • Easy or excessive bruising / Superficial bleeding into the skin / Prolonged bleeding from cuts / Bleeding from your gums or nose / fatigue	6	6				
7			Nettle • Others have nearly as long a release period • But a longer peak period (Marks for reasoning - *accept in the context of a given example from the chart)*	2	2				
8	a		*Antihistamines* • The chemical histamine is released from mast cells and basophils when you are exposed to allergens. • Antihistamines block the release of histamine • Prevent the allergic response to improve hay fever symptoms. *Corticosteroids* • Corticosteroids have an anti-inflammatory effect • reduce inflammation and swelling brought on by pollen to prevent symptoms (2 for each)	4				4	
	b		• Takes a long time to take effect • Often unsuccessful	2				2	
	c		• Prevent symptoms starting • Avoids issues that arise due to varying pollen levels	2				2	

	d		• avoid being out-doors when pollen levels are high • close windows and doors • shower regularly • avoid cutting grass *(any2)*	2	2				
9			• Spirometry • Measures the volume of air breathed out in the first second of exhalation / forced expiratory volume in one second / FEV_1 • and total amount of air breathed out / forced vital capacity / FVC • Peak Flow • measures peak <u>expiratory</u> flow / how fast you blow air out of lungs in one breath	5		5			
10	a		Up to 2 marks for definition/outline of what is meant by hypothesis testing, e.g. a hypothesis is a testable, predictive statement/proposition specifying the relationships between events or variables.)	2			2		
	b		There is **no** correlation between childhood asthma and hay fever.	1			1		
	c		*Two questions which allow collection of suitable quantitative data e.g.* *Does your child suffer from asthma? Y / N* *Does your child suffer from hay fever? Y / N* Questions are clear and ambiguous allowing collection of suitable data (2) Suitable questions are stated but without clear means of capturing data (1)	2			2		
	d		Test is suitable (1) since: ▪ the sampling method is random sampling ▪ data is collected in categories / frequency data is collected ▪ the number of sample observations in each level of the variable is greater than 5. *(any two reasons)*	3			3		

Case Study 3 - CHD									
11	a		• Transport oxygen and nutrients • to heart muscle	2	2				
	b		• less oxygen in blood to cardiac muscle	1	1				
	c		• Veins have wider lumen so less likely to be blocked/ veins carry blood back to the heart at low pressure so less likely to deposit material	1	1				
	d		• Nitrate {dilate /widen} arteries • to increase blood flow	2				2	
12	a		increases	1				1	
	b		• Coronary bypass decreases • angioplasty increases	2				2	
	c		• More drug intervention so less coronary bypass • increased awareness of causes of CHD so less coronary bypass operations • PCIs increase so less coronary bypass *(any 2 of 3)*	2				2	
13			blood pressure lowering drugs – • decrease stress on artery walls • so decrease damage • patient is less susceptible to formation of atheroma/plaques *(any 2 of 3)* antiplatelet drugs • reduce blood clot formation • less susceptible to blockage of coronary arteries	4				4	

14			ELISA • Immobilize (anti-troponin) antibody (on multiwall plate) • Pass test solution over immobilized antibodies • block unbound sites • If troponin is present it will bind to the antibody • A second antibody with enzyme attached is added • this binds to first antibody – troponin complex • Add substrate for enzyme • Colour change produced • increase colour – more troponin • more troponin – more damage to the heart *(6 points max*) ECG • ECG follows electrical activity of nerves and muscles in the heart • P, QRS and T waves are used • Waves are picked up as electrical echoes from the heart • ECG leads are connected to the skin in vertical and horizontal planes across the body • ECG gives a 3D picture of hearts electrical activity • Allows the detection of arrhythmias caused by damage to the heart muscle (*4 points max*)	10		4			6
Total				75	24	9	8	24	10

WJEC Level 3 Diploma in Medical Science

Unit 6 Medical Case Study

External Assessment: documentation

Year	*specimen*
Examiner	
Reviser	

Specification link

CASE STUDY 1

LO / Question	1	2	3	4	5
1					4
2 a	2				
b	1				
c	2				
3 a				2	
b				1	
4	2				
5 a	3				
b				2	
6	6				
Total	16	0	0	5	4
				Total (Case study 1)	25

CASE STUDY 2

LO Question	1	2	3	4	5
7	2				
8 a				4	
b				2	
c				2	
d	2				
9		5			
10 a			2		
b			2		
c			1		
d			3		
Total	4	5	8	8	0
				Total (Case study 2)	25

CASE STUDY 3

LO Question	1	2	3	4	5
11 a	2				
b	1				
c	1				
d				2	
12 a				1	
b				2	
c				2	
13				4	
14		4			6
Total	4	4	0	11	6
				Total (Case study 3)	25
Total	24	9	8	24	10
Allowed Range	20-25	8-12	8-12	20-25	8-12
				Total	**75**

WJEC Level 3 Diploma / Extended Diploma in Medical Science

Unit 6 Medical Case Study

Coverage

	Specimen	2017	2018	2019	All AC covered in last three years?	2020	2021	2022	All AC covered in last three years?	2023
LO1 marks in range 20-25	24									
LO2 marks in range 8-12	9									
LO3 marks in range 8-12	8									
LO4 marks in range 20-25	24									
LO5 marks in the range 8-12	10									
Extended response	✓									
Principal Examiner										
Reviser										