

Surname	Centre Number	Candidate Number
First name(s)		4



LEVEL 3 CERTIFICATE / DIPLOMA

4463U10-1



S23-4463U10-1

MONDAY, 22 MAY 2023 – MORNING

MEDICAL SCIENCE

UNIT 1: Human Health and Disease

2 hours

Section A

Section B

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1–7.	24	
8.	3	
9.	7	
10.	5	
11.	16	
12.	19	
13.	10	
14.	6	
Total	90	

4463U101
01

ADDITIONAL MATERIALS

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

You will need a calculator and ruler for this examination.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The total number of marks for this paper is 90.

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

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

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

Workings for calculations should be shown.



JUN234463U10101

SECTION AAnswer **all** questions.

1. State **three** symptoms of migraine. [1]

1.
2.
3.

2. Females are more likely to suffer from migraines. Explain why females are more likely to be affected by migraines. [3]

.....

.....

.....

.....

.....

3. A migraine can cause changes to the nervous system and blood vessels to the brain. This will affect brain activity.

- (a) (i) Name a test that records brain activity. [1]

.....

- (ii) Describe how this test is performed. [2]

.....

.....

.....

- (b) Name another condition that can be diagnosed using the test given in 3(a)(i). [1]

.....



4. (a) State how a person's vision can be affected by migraine. [1]

.....

(b) (i) Name **one** test that can be performed to test a person's vision. [1]

.....

(ii) Describe how this test is carried out. [1]

.....

.....

.....



5. Use the information from **Figure 1** and **Figure 2** to answer this question.

- (a) Give **two** ways that a person's employment can lead to them suffering from migraines. [2]

1.

.....

2.

.....

- (b) A plant-based diet is believed to have both advantages and disadvantages for migraine sufferers.

Suggest how a plant-based diet could be an advantage and a disadvantage to migraine sufferers. [2]

Advantage:

.....

Disadvantage:

.....

- (c) Other than a plant-based diet, state **three** lifestyle changes that a person could make to reduce the frequency of their migraines. [1]

1.

2.

3.



6. Use the information from **Figure 3** to answer this question.

- (a) In 2019, the number of people aged 15–69 years old in the UK was 46 million.

Calculate the estimated number of people that were suffering from migraines in the UK in 2019. Give your answer in standard form. [3]

number of people = ...

- (b) The direct cost of migraines in England is £1 billion. Explain why the indirect cost of migraines is much higher at £8.8 billion. [2]

.....

.....

.....

7. Not all treatments for migraines are effective. Suggest a **different** reason why a person would be reluctant to undergo a course of treatment using the following methods:

- (a) medication such as painkillers or triptans [1]

.....

.....

- (b) acupuncture [1]

.....

.....

- (c) transcranial magnetic stimulation (TMS) [1]

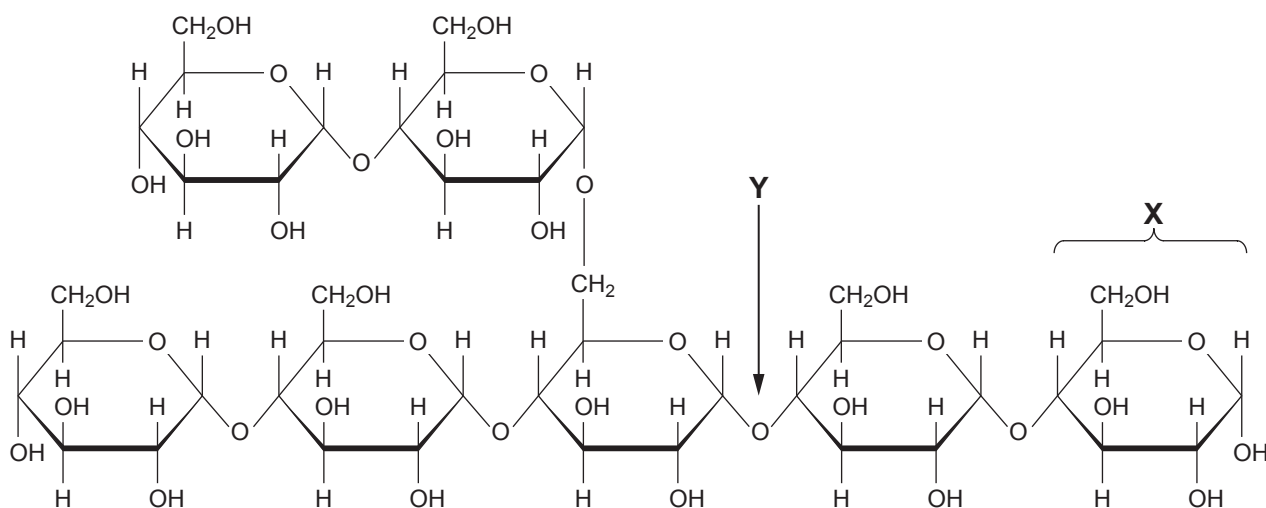
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.....



SECTION BAnswer **all** questions.

8. An example of a polysaccharide found in humans is shown below.



- (a) Name this polysaccharide. [1]

.....

- (b) Name the monomer labelled **X**. [1]

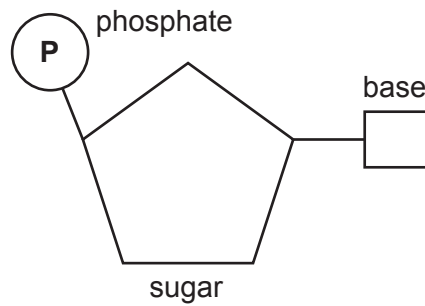
.....

- (c) Name the bond labelled **Y**. [1]

.....



9. The diagram below shows a nucleotide.



- (a) Use the diagram, and your own knowledge, to describe the specific structure of a nucleotide in DNA. [2]

.....

.....

.....

.....

- (b) Watson and Crick proposed that DNA replication was semi-conservative. Explain what is meant by the term 'semi-conservative replication'. [2]

.....

.....

.....

.....



- (c) The main stages of protein synthesis are shown below. However, the stages are not in the correct order.

Stage	Statement
A	RNA polymerase attaches mRNA nucleotides to their complementary base pairs.
B	A tRNA molecule will attach to the large subunit of the ribosome.
C	A polypeptide chain with amino acids in a specific order will be formed.
D	DNA helicase breaks hydrogen bonds between complementary base pairs and unzips a section of DNA.
E	The tRNA leaves and the next tRNA attaches to the ribosome.
F	The mRNA strand leaves the nucleus and attaches to the small subunit of a ribosome.
G	The ribosome moves along the mRNA and holds the tRNA in position until the amino acid is able to form a peptide bond with adjacent amino acids.

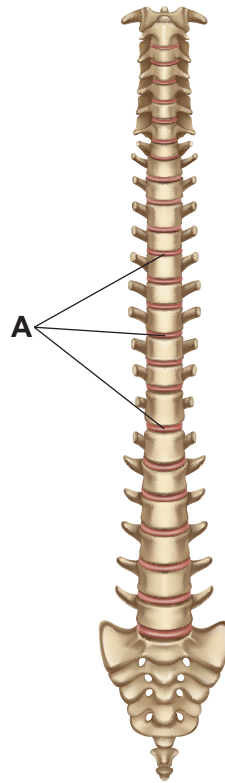
Put the statements in the correct order. Some have been done for you.

[3]

D			B		E	
---	-------	-------	---	-------	---	-------



10. The diagram below shows the spinal column.



(a) Name the joints found in the spinal column.

[1]

.....

(b) State the name and function of structure **A** which is found between the vertebrae.

[2]

Name:

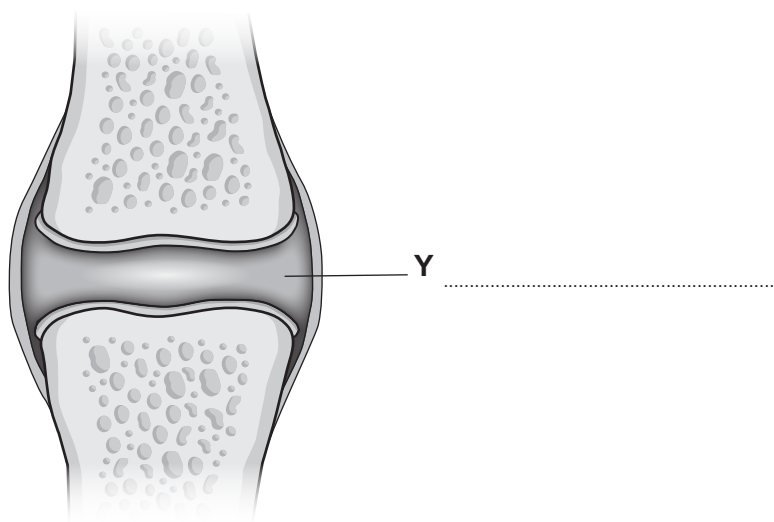
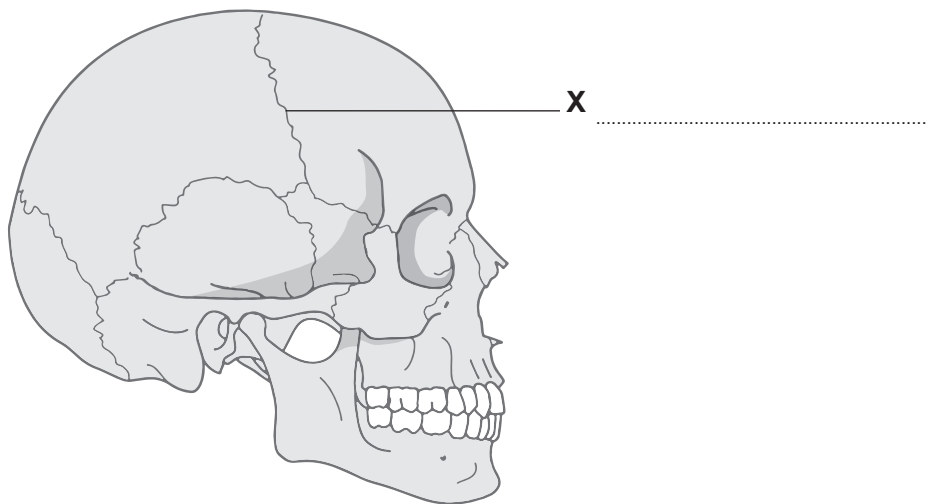
Function:

.....



- (c) Different types of joint are found in the skull and knee.
Name joints **X** and **Y** below.

[2]



11. HIV statistics for the UK in 2015 and 2019 can be seen in the table below.

	2015	2019
Number of people living in the UK with HIV	101 200	105 200
Approximate numbers of people living with unknown HIV	13 150	6600
Number of new cases of HIV diagnosed	6000	4139

- (a) Complete the table below to show the mode of transmission of HIV and ways in which a person could reduce the risk of becoming infected with the virus. [4]

Mode of Transmission of HIV	Method for reducing the risk of becoming infected with HIV
using contaminated needles	use a sterile needle
.....	
.....	
.....	
.....	

- (b) Describe **two** effects of HIV on body systems. [2]

1.

.....

2.

.....



- (c) Suggest **two** reasons for the decrease in the number of people living with unknown HIV between 2015 and 2019. [2]

.....

.....

.....

.....

- (d) Calculate the percentage change in the number of new cases of HIV diagnosed in the UK between 2015 and 2019. [3]

percentage change = ...

- (e) The table below shows the number of newly diagnosed HIV cases in different regions of England in 2018.

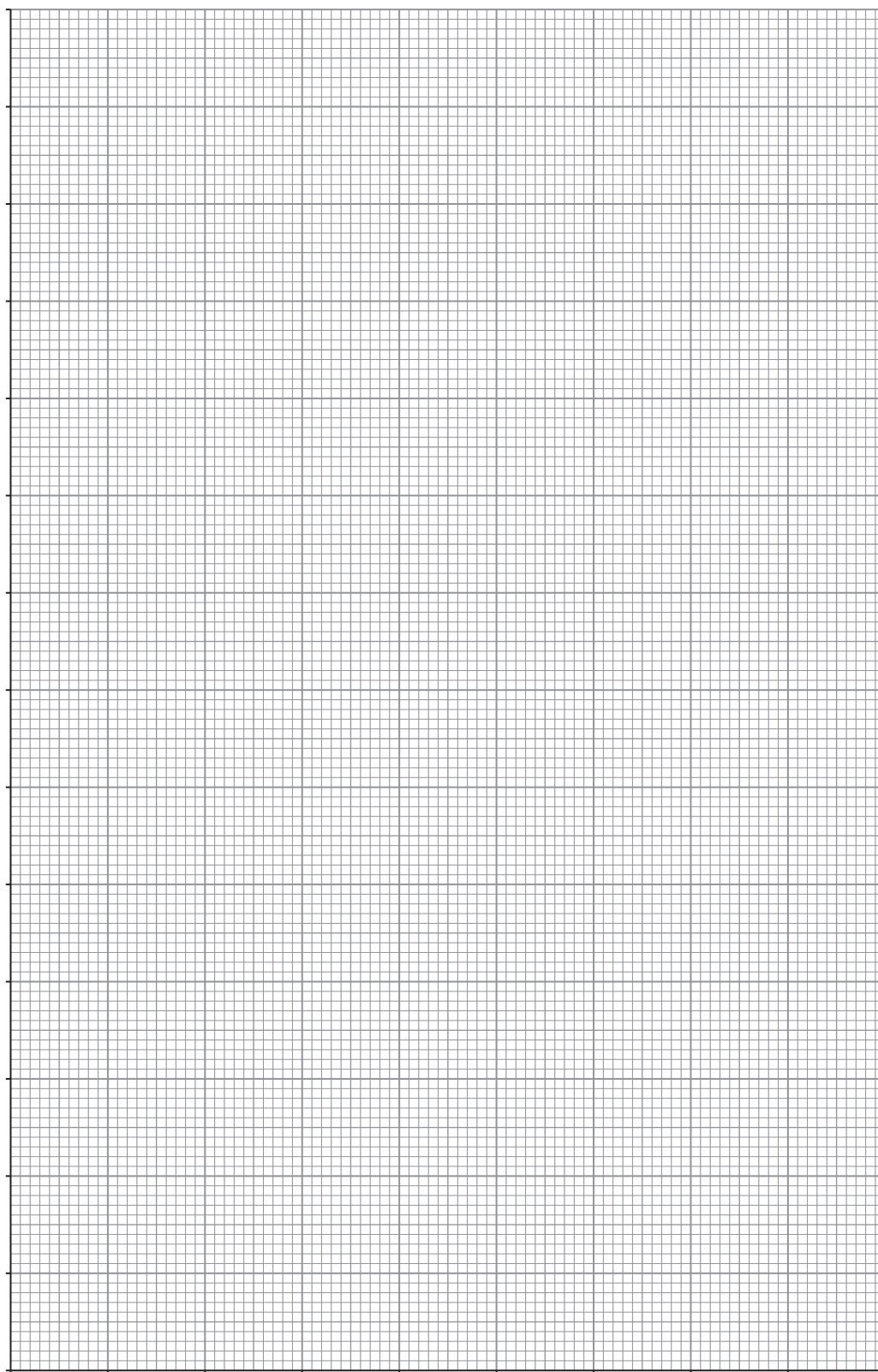
Region	Population	Newly diagnosed HIV cases
London	8 900 000	1400
East of England	6 200 000	425
North West	7 290 000	474
East Midlands	4 800 000	276
West Midlands	5 900 000	334
Yorkshire and the Humber	5 480 000	293
South East	9 130 000	440
South West	5 560 000	224
North East	2 660 000	105



(i) Plot the data for newly diagnosed cases in England on the grid below.

[4]

Examiner
only



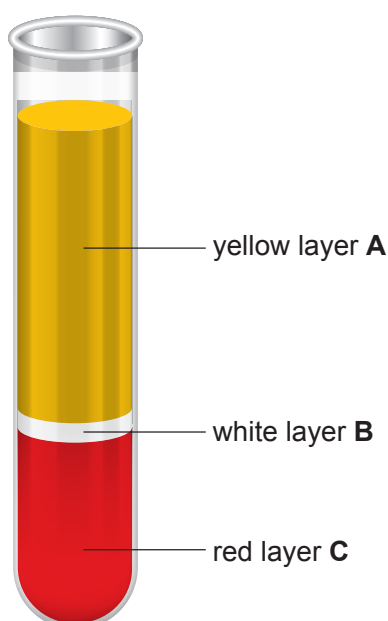
- (ii) Use the data to suggest a reason for the difference in newly diagnosed cases in London compared with other regions. [1]

.....

.....

16

12. When a blood sample is spun in a centrifuge, its component parts will settle into layers. The diagram below shows a sample of blood which has separated into layers.



- (a) (i) Name the blood components in the layers labelled **A–C**. [3]

A:

B:

C:

- (ii) Describe the function(s) of two of the blood components named in **12(a)(i)**. [2]

Component:

Function:

.....

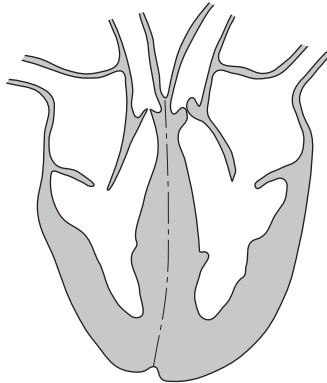
Component:

Function:

.....



- (b) Blood is transported through the circulatory system via blood vessels and the heart.



- (i) Describe the function of the valves in the heart. [1]

.....

.....

- (ii) Name another part of the circulatory system that also contains valves. [1]

.....

- (iii) The cardiac muscle is said to be 'myogenic'. Explain the term 'myogenic'. [1]

.....

.....

- (iv) State the name of the blood vessels that supply oxygen and glucose to the heart muscle. [1]

.....

- (v) Describe how heartbeat is controlled and coordinated. [4]

.....

.....

.....

.....

.....

.....



(c) The lymphatic system also contains an extensive network of vessels.

(i) State the name of the largest organ in the lymphatic system.

[1]

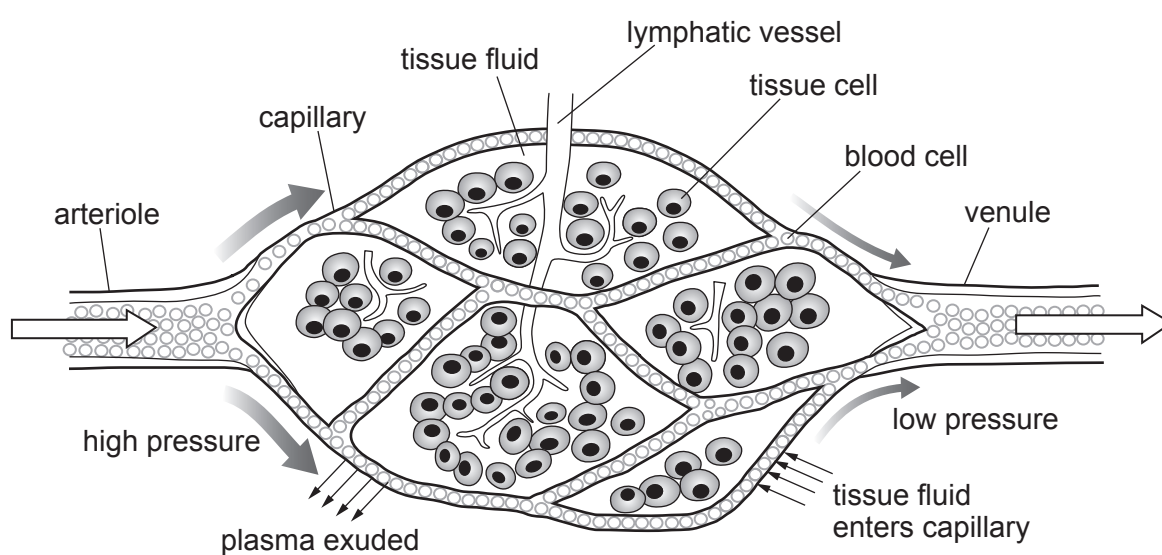
.....

(ii) Name the sac-like structures that are also part of the lymphatic system along with the vessels.

[1]

.....

The diagram below shows the capillary bed



(iii) Use the diagram, and your own knowledge, to describe how tissue fluid is produced.

[4]

.....

.....

.....

.....

.....

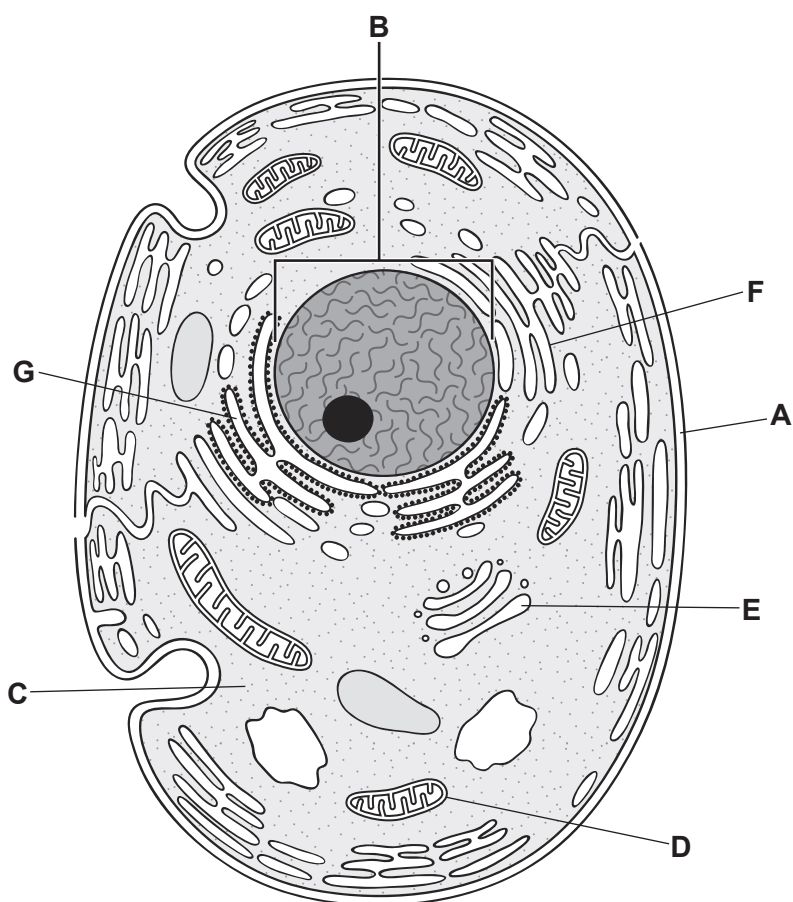
.....

.....

.....



13. The diagram below shows the generalised structure of an animal cell.



(a) Complete the table below to identify the parts of the cell.

[6]

Name of organelle	Letter
nucleus	
.....	F
.....	D
golgi body	
rough endoplasmic reticulum	
.....	C



(b) The plasma membrane is another part of the cell.

(i) In the space below, draw a simple **labelled** diagram of the fluid mosaic model. [2]

(ii) Molecules can move across the plasma membrane by simple and facilitated diffusion.

I. Name **one** other method that molecules could use to move across the plasma membrane. [1]

.....

II. Describe this method. [1]

.....

.....



14. Research and clinical trials are essential processes during the development of medications and vaccinations. Strict protocols must be followed when carrying out this research and during clinical trials.

(a) State **three** ethical considerations that must be carried out by scientists before a clinical trial or research can take place. [3]

1.

.....

2.

.....

3.

.....

(b) State **three** statistical methods that could be used when analysing data collected during research or clinical testing. [3]

1.

2.

3.

END OF PAPER



[illegible]



LEVEL 3 CERTIFICATE / DIPLOMA

4463U10-1A



S23-4463U10-1A

SUMMER 2023

MEDICAL SCIENCE

UNIT 1: Human Health and Disease

**Pre-Release Article for use in the following
examinations on Monday, 22 May 2023**

Level 3 Diploma in Medical Science

Level 3 Certificate in Medical Science

4463U101A
01

Article adapted from: <https://www.bbc.co.uk/news/newsbeat-48294987> (May 2019)

Migraines: Calls for 'life changing' drug, Aimovig, on NHS in England.

People who suffer from chronic migraines are calling for a new drug to be offered on the NHS in England.

The monthly injection of Aimovig has been described as 'life-changing' by those who have tried it. If it gets approved, it will be for people who have tried other preventative treatments unsuccessfully.

NICE, which gives advice on healthcare, rejected the drug in England on cost grounds in January 2019, but the NHS in Scotland approved it.

Migraines affect around 1 in 7 people, according to the National Migraine Centre. More women get them than men, and they usually start to affect people when they are teenagers.

There is no known cure for migraines. People normally treat them with over-the-counter painkillers, but often the symptoms are too severe for those drugs to work. Some patients have reported that transcranial magnetic stimulation alleviates symptoms, but everybody reacts in a different way.

'We tend to borrow things from other areas of medicine,' explains a doctor from the National Migraine Centre. 'Heart medication, anxiety medication and epilepsy medication we use a lot.' She hopes Aimovig will be able to help many people. In the US where it is widely available, there is evidence it can reduce the frequency of migraine attacks significantly. It works by blocking the protein thought to play a major role in starting an attack.

Migraine

A migraine is usually a moderate or severe headache felt as a throbbing pain on one side of the head.

Many people also have symptoms such as nausea, vomiting and increased sensitivity to light or sound.

Migraine is a common health condition, affecting around 1 in every 5 women and around 1 in every 15 men. They usually begin in early adulthood.



**Migraine
headache**

Symptoms

The main symptom of a migraine is usually an intense headache on one side of the head. The pain is usually a moderate or severe throbbing sensation that gets worse when a person moves and prevents them from carrying out normal activities.

In some cases, the pain can occur on both sides of the head and may affect the face or neck.

Other symptoms commonly associated with a migraine include:

- nausea
- vomiting
- increased sensitivity to light and sound
- sweating
- poor concentration
- feeling very hot or very cold
- abdominal pain
- diarrhoea
- aura

Not everyone with a migraine experiences these additional symptoms.

The symptoms of a migraine usually last between 4 hours and 3 days, although a person may feel very tired for up to a week afterwards.

Symptoms of aura

About 1 in 3 people with migraines have temporary warning symptoms, known as aura, before a migraine. Aura symptoms typically develop over the course of about 5 minutes and last for up to an hour. Some people may experience aura followed by only a mild headache or no headache at all.

Symptoms of aura include:

- visual problems, such as seeing flashing lights, zig-zag patterns or blind spots
- numbness or a tingling sensation like pins and needles, which usually starts in one hand and moves up the arm before affecting the face, lips and tongue
- feeling dizzy or off balance
- difficulty speaking
- loss of consciousness, although this is unusual.

Stages of a migraine

Migraines often develop in distinct stages, although not everyone goes through all of these:

1. Prodromal: changes in mood, energy levels, behaviour and appetite that can occur several hours or days before an attack.
2. Aura: usually visual problems, such as flashes of light or blind spots, which can last for 5 minutes to an hour.
3. Headache: usually a pulsating or throbbing pain on one side of the head, often accompanied by nausea, vomiting or extreme sensitivity to bright light and loud sounds, which can last for 4 to 72 hours.
4. Resolution: when the headache and other symptoms gradually fade away, although a person may feel tired for a few days afterwards.

Causes

The exact causes of migraines are unknown, but they are thought to be the result of abnormal brain activity. It is possible that genes make a person more susceptible to certain triggers.

Migraine triggers

Many possible migraine triggers have been suggested, including hormonal, emotional, physical, dietary, environmental and medicinal factors. These triggers vary for each individual. Keeping a diary may help to identify any consistent triggers.

It can sometimes be difficult to tell if something is really a trigger or if the experience is an early symptom of a migraine attack.

Hormonal changes

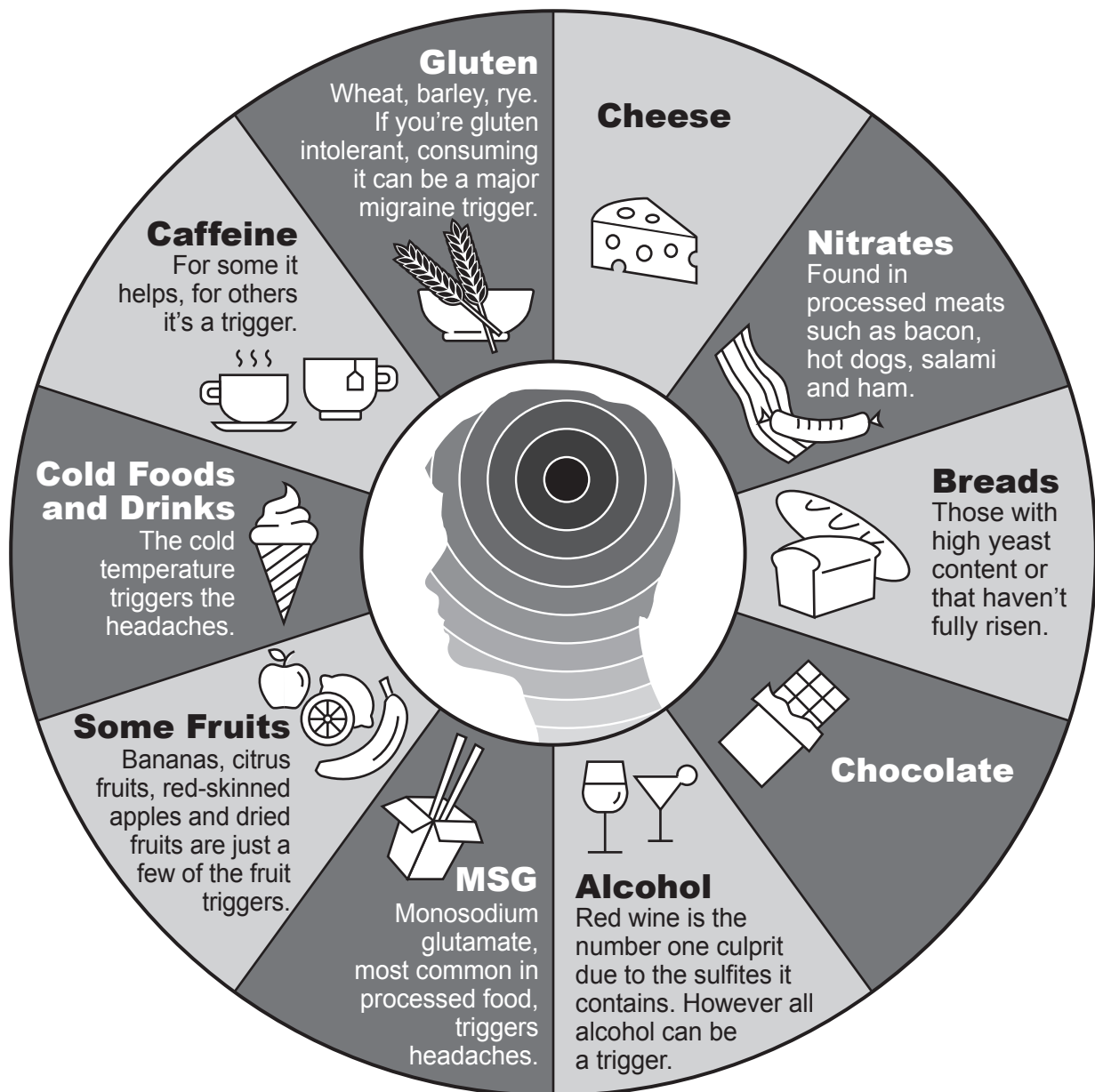
Some women experience migraines around the time of their period, possibly because of changes in the levels of hormones such as oestrogen. These types of migraines usually occur between 2 days before the start of the period and 3 days after.

Many women find their migraines improve after the menopause, although in some cases the menopause can trigger migraines or even make them worse.

Figure 1: Migraine triggers

Emotional	Physical	Dietary	Environmental	Medicines
stress	tiredness	missed, delayed or irregular meals	bright lights	some types of sleeping tablets
anxiety	poor-quality sleep	specific food triggers	flickering screens, such as a television or computer screen	combined contraceptive pill
tension	shift work		smoking	hormone replacement therapy (HRT)
shock	poor posture		loud noises	
depression	neck or shoulder tension		changes in climate, such as changes in humidity or very cold temperatures	
excitement	jet lag		strong smells	
	hypoglycaemia		a stuffy atmosphere	
	strenuous exercise if not regularly done			

Figure 2: Specific food triggers, and where they are found



Diagnosis

Migraines can be unpredictable, sometimes occurring without the other symptoms. Obtaining an accurate diagnosis can sometimes take time.

There is no specific test to diagnose migraines. For an accurate diagnosis to be made a GP must identify a pattern of recurring headaches along with the associated symptoms.

The GP may carry out a physical examination and check the patient's vision, coordination and reflexes. These will help rule out some other possible underlying causes of the symptoms.

To help with the diagnosis, the GP may ask the patient to keep a migraine diary for a few weeks to keep track of all of the headaches, symptoms suffered and possible triggers. The patient will also be asked to keep a note of any medication or painkillers that they have taken.

A GP may decide to refer the patient to a neurologist for further assessment and treatment.

Treatment

There is currently no cure for migraines, although several treatments are available to help ease the symptoms. Working out the correct treatment can take time and the patient may need to try different types or combinations of medicines before finding the most effective ones.

During a migraine attack, most people find sleeping or lying in a darkened room is the best thing to do. Others find that eating something helps, or they start to feel better after vomiting.

Many people who have migraines find that over-the-counter painkillers, such as paracetamol, aspirin and ibuprofen can help to reduce their symptoms. They tend to be more effective if taken at the first signs of a migraine attack.

Combination medicines are available for migraine without a prescription. These contain both painkillers and anti-sickness medicines.

A GP may recommend taking triptans if ordinary painkillers are not helping to relieve the symptoms. Triptan medicines are specific painkillers for migraine headaches. They are thought to work by reversing the changes in the brain activity that may cause migraine headaches. They cause the blood vessels around the brain to narrow, which reverses the widening of blood vessels which is believed to be part of the migraine process. Triptans are available as tablets, injections and nasal sprays.

Anti-sickness medicines can successfully treat migraine symptoms in some people, even if they do not experience nausea or vomiting. These are prescribed by a GP and can be taken alongside painkillers and triptans and are best taken as soon as the migraine symptoms begin.

Acupuncture can be an alternative option if medicines are unsuitable or do not help to prevent migraines. Some GP surgeries offer acupuncture, but most do not, so a person will usually have to go for the treatment privately. There is evidence to show that a course of acupuncture over an 8-week period can be beneficial.

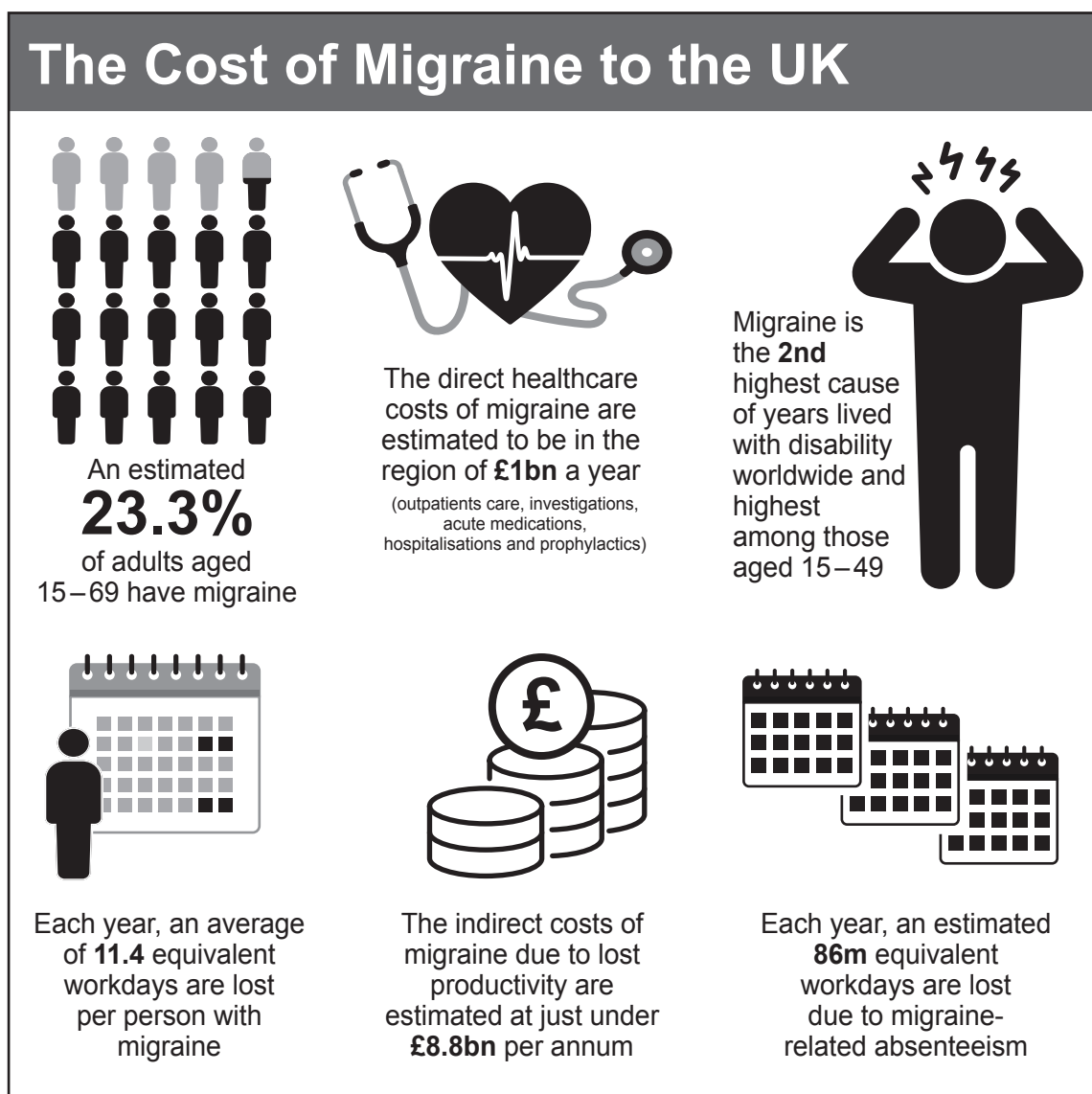
Transcranial magnetic stimulation (TMS) is a treatment that can be used to treat and prevent migraine attacks. It involves holding a small electrical device to the head that will deliver a magnetic pulse through the skin. It is unclear how this is effective in treating migraines, but studies have shown that using it at the start of a migraine can reduce its severity. It can also be used in combination with the other medicines mentioned without interfering with them. TMS does not work for everyone, but is most effective against migraines with aura.

Associated risks

Migraines are associated with a slight increased risk of ischaemic stroke. This is when the blood supply to the brain is blocked by a blood clot or fatty material in the arteries. It is not clear why ischaemic strokes are linked to migraines.

Migraines are associated with a slightly increased risk of mental health problems, including depression, bipolar disorder, anxiety and panic attacks.

Figure 3: The cost of migraines to the UK (2019)





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4463U10-1B



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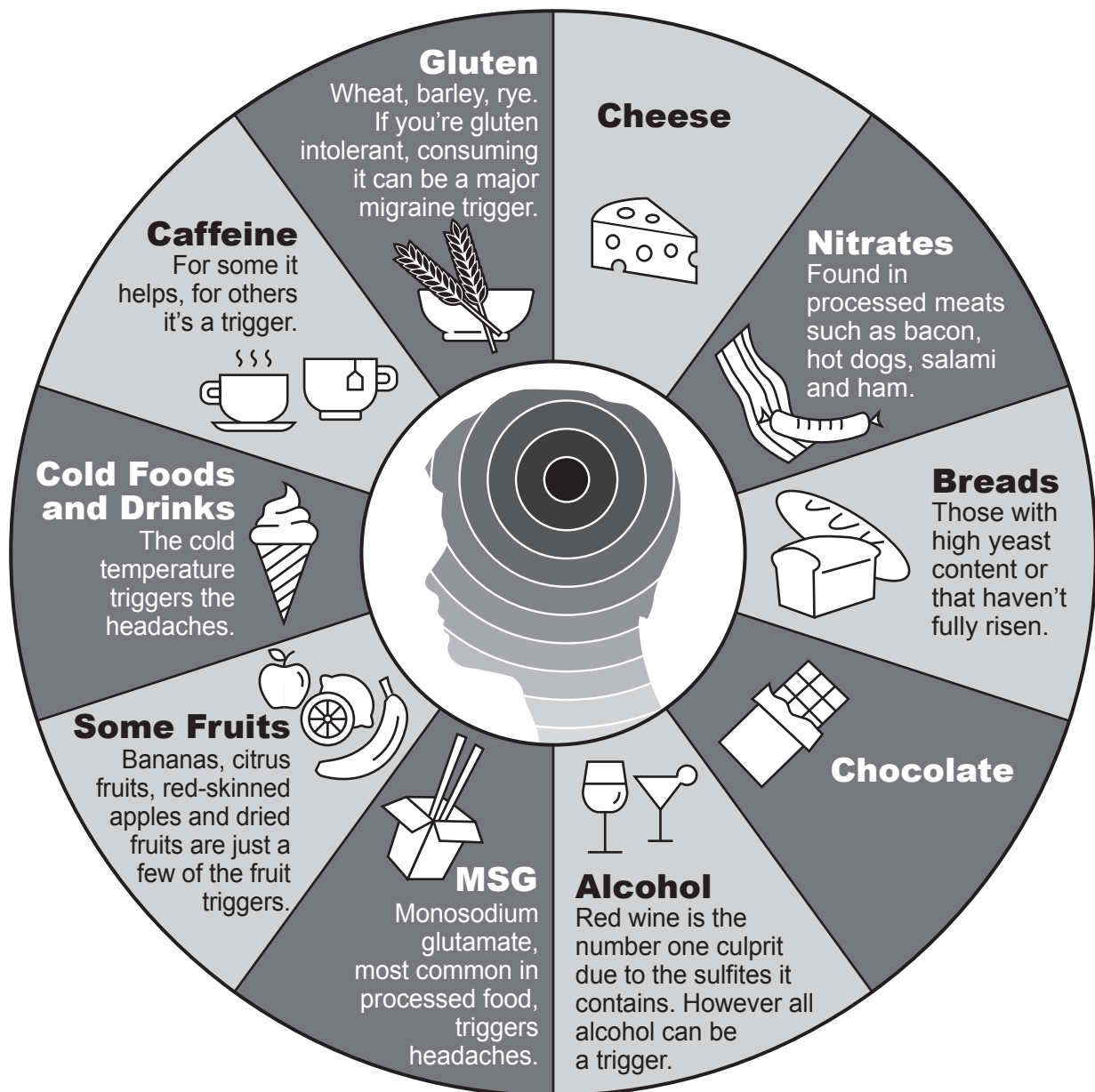
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A GP may decide to refer the patient to a neurologist for further assessment and treatment.

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A GP may recommend taking triptans if ordinary painkillers are not helping to relieve the symptoms. Triptan medicines are specific painkillers for migraine headaches. They are thought to work by reversing the changes in the brain activity that may cause migraine headaches. They cause the blood vessels around the brain to narrow, which reverses the widening of blood vessels which is believed to be part of the migraine process. Triptans are available as tablets, injections and nasal sprays.

Anti-sickness medicines can successfully treat migraine symptoms in some people, even if they do not experience nausea or vomiting. These are prescribed by a GP and can be taken alongside painkillers and triptans and are best taken as soon as the migraine symptoms begin.

Acupuncture can be an alternative option if medicines are unsuitable or do not help to prevent migraines. Some GP surgeries offer acupuncture, but most do not, so a person will usually have to go for the treatment privately. There is evidence to show that a course of acupuncture over an 8-week period can be beneficial.

Transcranial magnetic stimulation (TMS) is a treatment that can be used to treat and prevent migraine attacks. It involves holding a small electrical device to the head that will deliver a magnetic pulse through the skin. It is unclear how this is effective in treating migraines, but studies have shown that using it at the start of a migraine can reduce its severity. It can also be used in combination with the other medicines mentioned without interfering with them. TMS does not work for everyone, but is most effective against migraines with aura.

Associated risks

Migraines are associated with a slight increased risk of ischaemic stroke. This is when the blood supply to the brain is blocked by a blood clot or fatty material in the arteries. It is not clear why ischaemic strokes are linked to migraines.

Migraines are associated with a slightly increased risk of mental health problems, including depression, bipolar disorder, anxiety and panic attacks.

Figure 3: The cost of migraines to the UK (2019)

