Please check the examination details below before entering your candidate information

Candidate surname
Solved by Anubha Roberts

Other names

Centre Number

Candidate Number

Pearson Edexcel International Advanced Level

Friday 10 January 2025

Morning (Time: 1 hour 30 minutes)

Paper reference **WBI11/01**

Biology

International Advanced Subsidiary/Advanced Level
UNIT 1: Molecules, Diet, Transport and Health

You must have:
Scientific calculator, ruler, HB pencil

Total Marks

MATH TONIC

Note- The keywords in the answer are underlined.
For further enquries contact-
anubharoberts@gmail.com

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P78442A

©2025 Pearson Education Ltd.
H:1/1/1/1/1/1/

P 7 8 4 4 2 A 0 1 3 2

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The polysaccharides and proteins that we eat are digested. The products of digestion are then transported in the blood plasma as a solution in water.

(a) Which of the following statements about water are correct?

1. A single molecule of water is composed of an oxygen atom joined to two hydrogen atoms by hydrogen bonds.
2. Water is a solvent.
3. The oxygen in a water molecule has a small negative charge and the hydrogen atoms each have a small positive charge.

(1)

☐ **A** 1 and 2 only

☐ **B** 1 and 3 only

☒ **C** 2 and 3 only

☐ **D** 1, 2 and 3

(b) The table shows some information about the structure of amylose and amylopectin.

Put **one** cross ☒ in the appropriate box in each row to show whether the structure is present in these molecules.

(3)

Structure	Structure found in			
	amylose only	amylopectin only	both amylose and amylopectin	neither amylose nor amylopectin
glycosidic bonds	☐	☐	☒	☐
1-4 *α* bonds	☐	☐	☒	☐
branched side chains	☐	☒	☐	☐

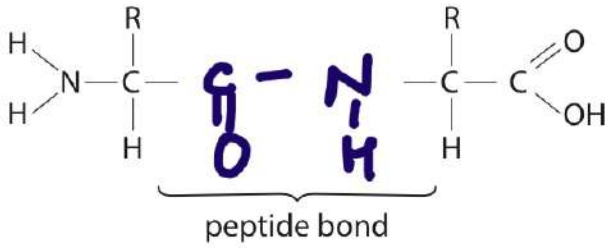
MATH TONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(c) The diagram shows parts of two amino acids.

Complete the diagram to show a peptide bond joining these two amino acids.

(1)



(Total for Question 1 = 5 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

MATH TONIC

2 Cancer can develop in many parts of the body.

(a) State what is meant by the term **cancer.**

(2)

→ Uncontrolled growth of cells which divide by mitosis.

→ They develop due to mutation in the DNA.

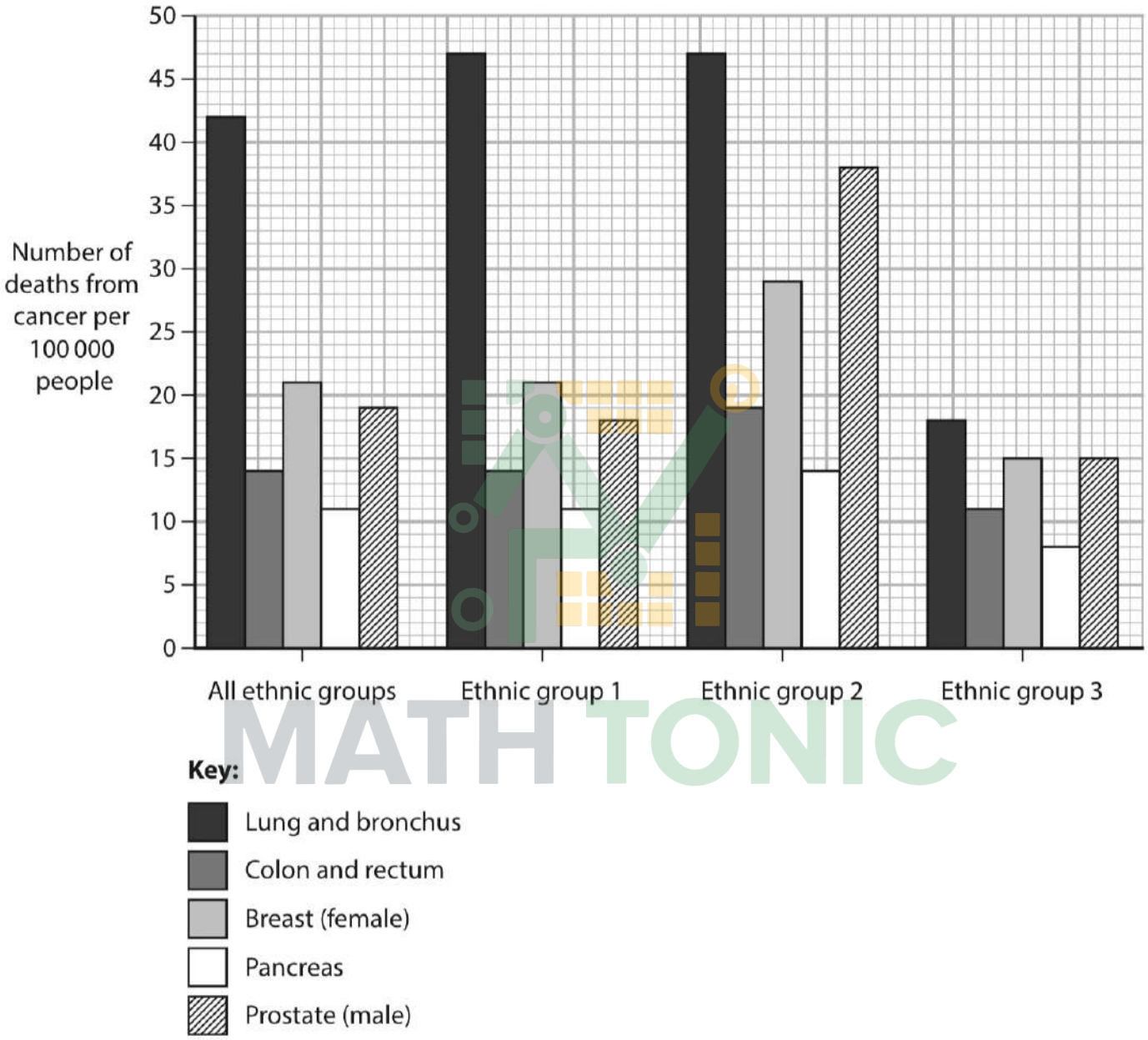
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

MATH TONIC

(b) In a study, scientists determined the number of deaths caused by five types of cancer, in one country.

The scientists then analysed the number of deaths caused by these cancers in three ethnic groups.

The graph shows the results of this study.



MATH TONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(i) Compare and contrast the number of deaths caused by these cancers in ethnic groups 1 and 2.

(3)

→ Both group 1 and 2 have highest number of lung and brbnchus deaths.
→ Both have least deaths from Pancreatic cancer
→ Overall higher deaths from all cancers in ethnic group 2.

(ii) Which is the percentage difference between the number of deaths caused by lung and bronchus cancer in ethnic group 1 and ethnic group 3?

Use the formula:

$$\text{Percentage difference} = \left(\frac{\text{difference between values}}{\text{mean of the values}}\right) \times 100$$

(1)

- ☒ **A** 0.45 %
- ☒ **B** 0.89 %
- ☒ **C** 44.62 %
- ☒ **D** 89.23 %

(iii) Calculate how many more males died of prostate cancer in ethnic group 2 than in ethnic group 1.

(1)

38 - 18

Answer 20 per 100000

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
MATH TONIC

(iv) Comment on how useful it is to determine the number of deaths from these causes of cancer in the 'all ethnic groups' part of this graph.

(2)

→ Useful in understanding the main causes of cancer for heath care programmes.

→ Not useful as the exposure to UV rays control the risk skin cancer.

(Total for Question 2 = 9 marks)

MATH TONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

3 Bears hibernate during the winter months, so are inactive for long periods of time.

The photograph shows two bears hibernating.

(Source: © Minden Pictures / Alamy Stock Photo)

Hibernating bears do not develop deep vein thrombosis (DVT).

Deep vein thrombosis is a blood clot that forms within a deep vein, often in the leg.

In humans, short-term periods of inactivity, such as sitting in an aeroplane, increase the risk of DVT.

This is due to reduced blood flow in the veins, causing damage to the walls of the veins.

(a) (i) Which molecule, released from platelets, results in blood clotting?

(1)

☒ **A** fibrinogen

☒ **B** prothrombin

☒ **C** thrombin

☒ **D** thromboplastin

(ii) Which pair of molecules are enzymes in their active form?

(1)

☒ **A** fibrinogen and prothrombin

☒ **B** prothrombin and thrombin

☒ **C** thrombin and thromboplastin

☒ **D** thromboplastin and prothrombin

MATH TONIC

(iii) Which molecule found in the blood is insoluble?

(1)

- ☒ **A** fibrin
- ☒ **B** fibrinogen
- ☒ **C** prothrombin
- ☒ **D** thromboplastin

(b) Pulmonary embolism can be caused by a DVT when the blood clot travels through the circulatory system and blocks the pulmonary artery.

Symptoms of pulmonary embolism include difficulty in breathing and a rapid heart rate.

Suggest why pulmonary embolism can result in these symptoms.

(3)

→ Due to blockage in the pulmonary artery less blood flows to the lungs.

→ Less Oxygen containing blood flows to the cells.

→ Heart beats faster to supply enough O_2 to the cells.

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(c) A study of bears in Sweden discovered that these bears produced less HSP47 protein when hibernating in the winter.

This protein is found on platelets and is involved in the binding of platelets to damaged blood vessels.

Discuss whether this discovery could be useful to humans.

(3)

→ Less HSP47 protein in blood reduces blood clotting.

→ If less HSP47 protein is produced in human platelets.

→ This would reduce risk of CVD in humans.

→ It can be used to treat CVD patients.

(Total for Question 3 = 9 marks)

MATH TONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

4 Obesity indicators are used to assess the risk of cardiovascular disease (CVD), including coronary heart disease (CHD).

Obesity indicators include body mass index (BMI) and waist-to-hip ratio (WHR).

(a) Describe the differences between CVD and CHD.

(2)

→ CHD involves disease related blockage of coronary artery.

→ CVD involves all the disease related to heart and blood vessels.

(b) A woman who was 165 cm tall had a mass of 68 kg, a waist circumference of 85 cm and a hip measurement of 101 cm.

(i) Calculate the BMI of this woman.

Use the formula:

$$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in m})^2}$$

$$\frac{68}{(1.65)^2}$$

(1)

Answer 24.97

(ii) Calculate the WHR of this woman.

(1)

$$\frac{85}{101}$$

Answer 0.84 : 1

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

MATHTONIC

(c) Scientists collected data to evaluate these two obesity indicators for their effectiveness in predicting death from CVD and CHD.

This study involved 9206 adults aged from 20 to 69 years from Australian cities.

This study started in 1989, when measurements for the obesity indicators were taken.

Risk factors including blood pressure and blood cholesterol levels were measured.

Information about other risk factors was recorded, but not measured.

By the year 2000, 473 of these adults had died. The data were compared with the causes of death.

(i) Explain why high blood pressure is a risk factor for CVD.

(2)

→ High blood pressure can damage endothelial lining of blood vessel.

→ This would cause cholesterol to deposit and result in plaque formation.

(ii) Some other risk factors were recorded as being either present or absent but were not measured.

Name **two** other risk factors that might have been recorded but not measured.

(1)

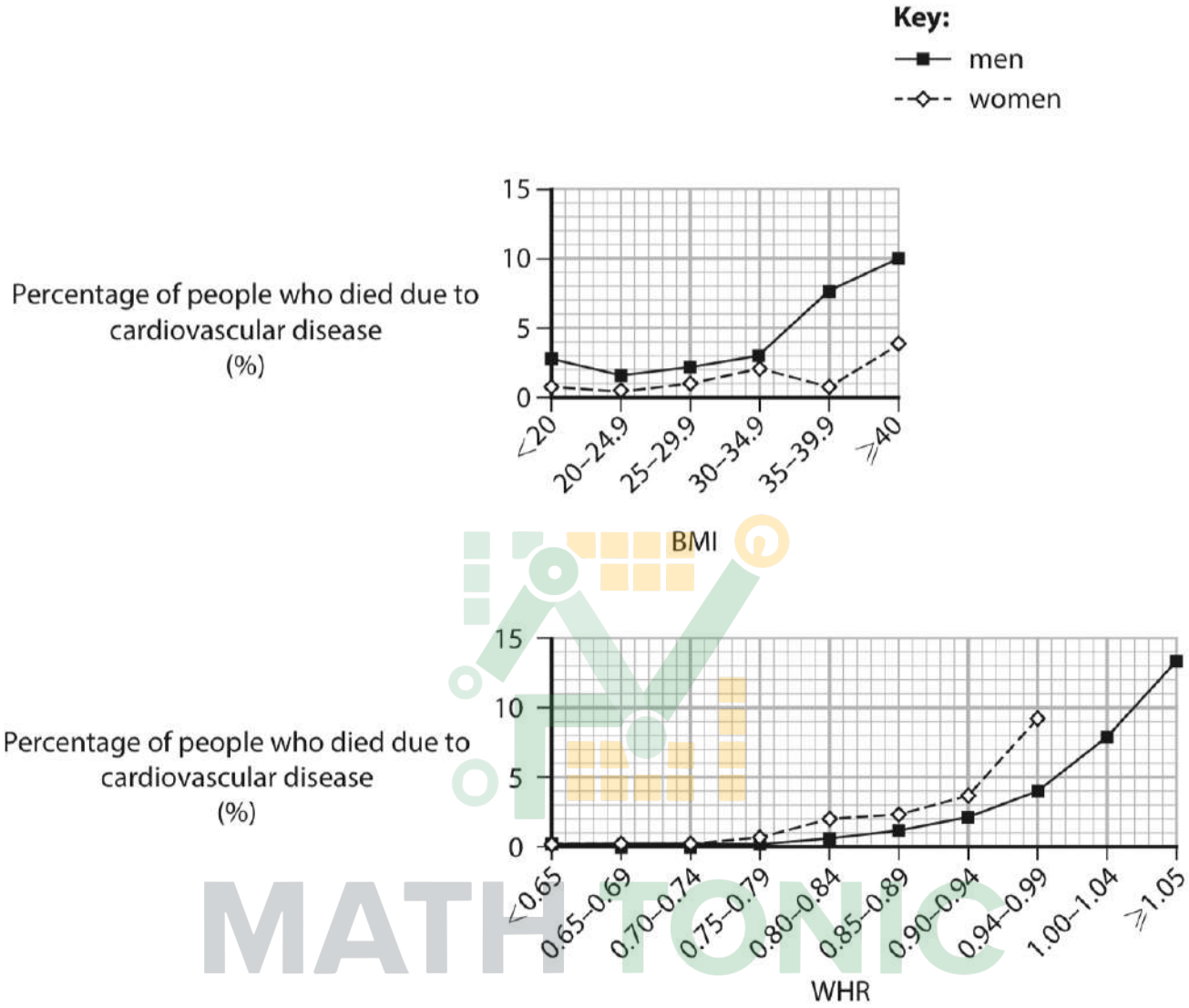
1 Salt intake

2 Exercise

MATH TONIC

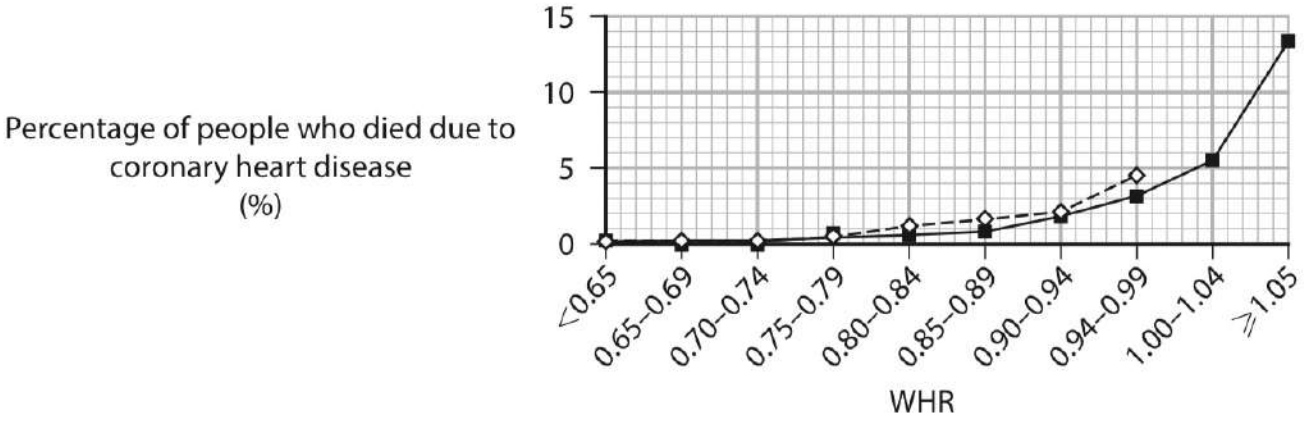
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(iii) The graphs show the BMI and WHR of the men and women who died due to either CVD or CHD.



MATHTONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA



Discuss the usefulness of these two obesity indicators in predicting death from CVD and CHD.

(3)

→ There is an increase in death by CHD & CVD above 0·79 WHR both in males and females.

→ There is an increase in death by CHD above 44·9 for men and 39·9 for women.

→ There is no error bars to indicate about significance

(Total for Question 4 = 10 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

5 Meselson and Stahl provided data that supported the theory that DNA replicates by semi-conservative replication.

(a) State the meaning of the term semi-conservative replication.

(2)

→ In the daughter DNA replication one strand is parent strand
→ and one is newly synthesised.

(b) Describe the role of DNA polymerase in the process of DNA replication.

(2)

→ DNA polymerase lines up the nucleotides for the new strand.

→ DNA polymerase forms phosphodiester bonds between nucleotides.
→ DNA polymerase also repairs any mismatched bases.

MATHTONIC

(c) Meselson and Stahl used mononucleotides made with either heavy nitrogen (N^{15}) or light nitrogen (N^{14}) in their experiments.

The flowchart summarises part of one experiment performed by Meselson and Stahl.

Stage 1

Bacteria grown for several generations in a culture medium containing mononucleotides made with heavy nitrogen (N^{15})

↓

Stage 2

Bacteria from stage 1 grown for one generation in a culture medium containing mononucleotides made with light nitrogen (N^{14})

↓

Stage 3

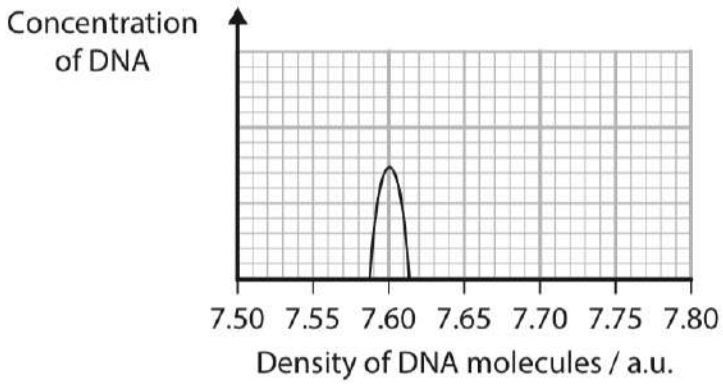
Bacteria from stage 2 grown for one generation in a culture medium containing mononucleotides made with light nitrogen (N^{14})

After each stage, a sample of DNA was taken from the bacteria and the DNA molecules separated on a density gradient in a tube.

- DNA with only heavy nitrogen has a mean density of 7.74 a.u.
- DNA with only light nitrogen has a mean density of 7.60 a.u.

Meselson and Stahl measured the concentration of DNA with different densities.

The graph shows the results of these measurements for DNA molecules with only light nitrogen.



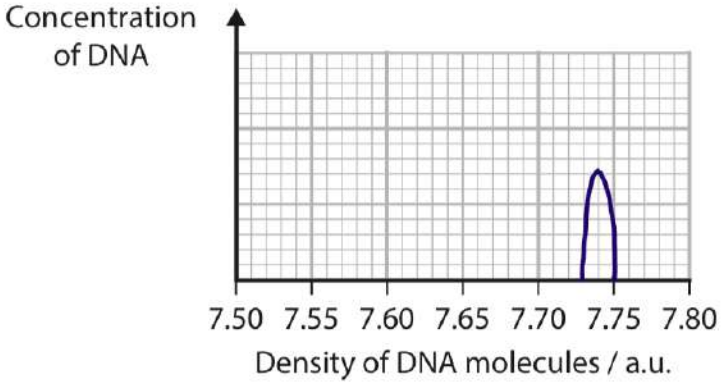
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

MATH TONIC

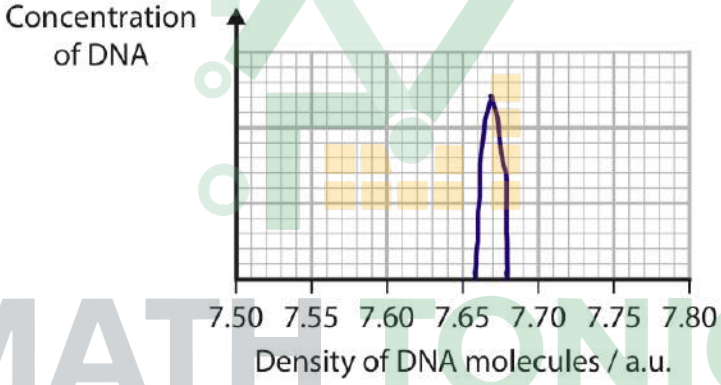
Complete the graphs to show the concentrations and densities of the DNA molecules produced at the end of stages 1, 2 and 3 shown in the flowchart.

(6)

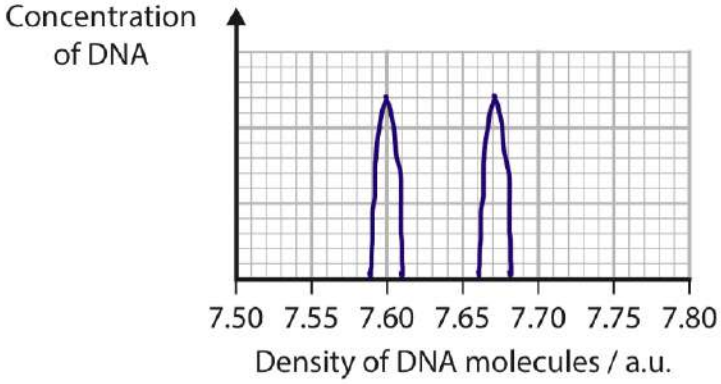
End of stage 1:



End of stage 2:



End of stage 3:



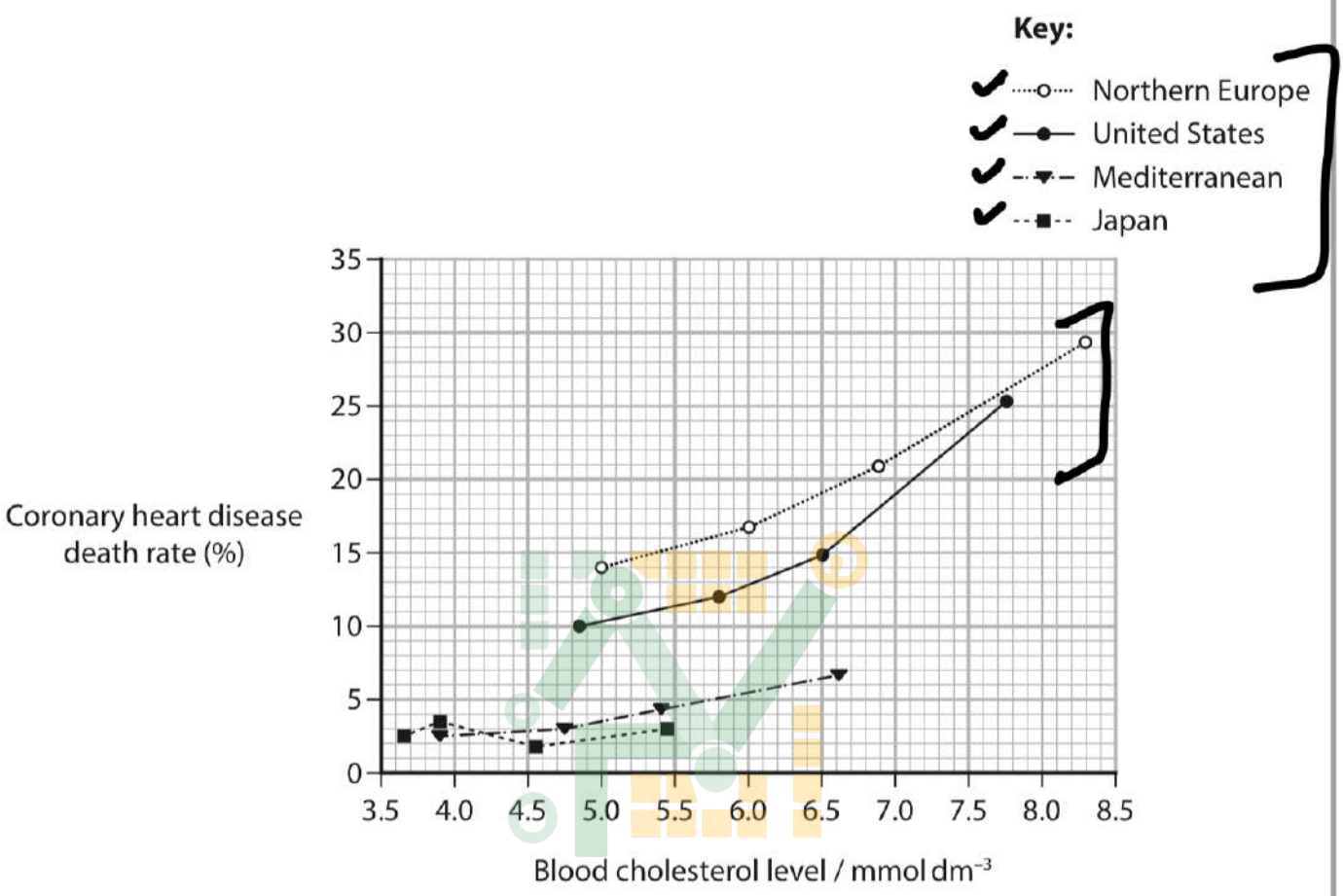
(Total for Question 5 = 10 marks)

MATH IONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

6 A high blood cholesterol level is associated with an increased risk of cardiovascular disease (CVD).

(a) The graph shows the relationship between blood cholesterol levels and the coronary heart disease death rate in men in four parts of the world.



Describe **two** conclusions that can be made about coronary heart disease death rate in these parts of the world.

(2)

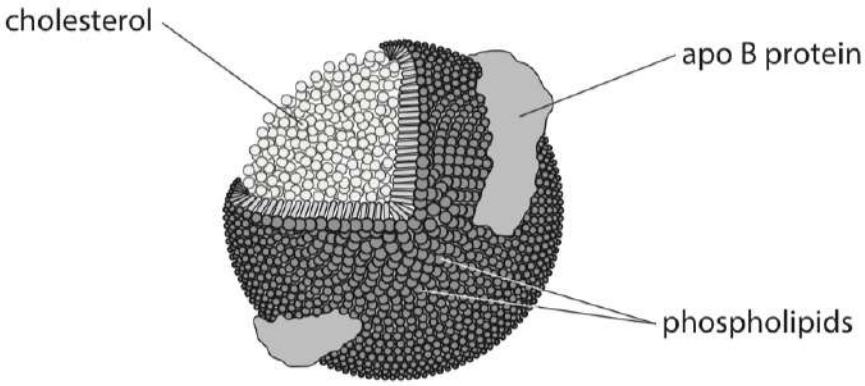
1 As the blood cholesterol increases the CHD death rate increases. (Ex. Japan).

2 Death rate is higher in USA and Northern Europe.

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) Cholesterol can be transported in the blood as low-density lipoproteins (LDLs) that are made in the liver.

The diagram shows a LDL.



Statins can be used to reduce blood cholesterol levels.

Statins reduce cholesterol synthesis, reduce the synthesis of apo B protein and increase the number of LDL receptors on the surface of liver cells.

(i) Statins can cause side effects.

Give **two** side effects of taking statins.

(1)

1 Liver damage

2 Headache

(ii) Liver cells take up cholesterol by endocytosis.

Explain how an increase in these LDL receptors will help to reduce blood cholesterol levels.

(2)

→ More LDL cholesterol is taken inside the cells of liver

→ by endocytosis so more vesicles of LDL inside liver cells.

MATH TONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(c) Familial hypercholesterolemia (FH) is a genetic disorder that results in high levels of LDLs in the blood.

(i) In the UK, approximately 270 000 people have FH.

The disorder affects 1 in 250 people in the UK.

Calculate the population size of the UK.

Express your answer in standard form.

(2)

$270\,000 \times 250$

$= 67\,500\,000$

$= 6.75 \times 10^7$

Answer 6.75×10^7

(ii) The disorder can be caused by a mutation in the gene that codes for LDL receptors.

Suggest why statins are less effective in treating people who are homozygous for this disorder.

(2)

→ Alleles to code for LDL receptors are not present and

→ Transcription and Translation will not form receptor proteins

→ No receptors on liver cells to transport LDL inside it.

MATH TONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(iii) Another drug, used to treat FH, is a short antisense strand of DNA from the apo B gene.

Suggest how this antisense strand of DNA would reduce the levels of apo B protein.

(2)

→ Antisense strand of DNA on transcription will produce an m-RNA which undergoes.
→ translation to produce a faulty apo protein on surface of liver cells.

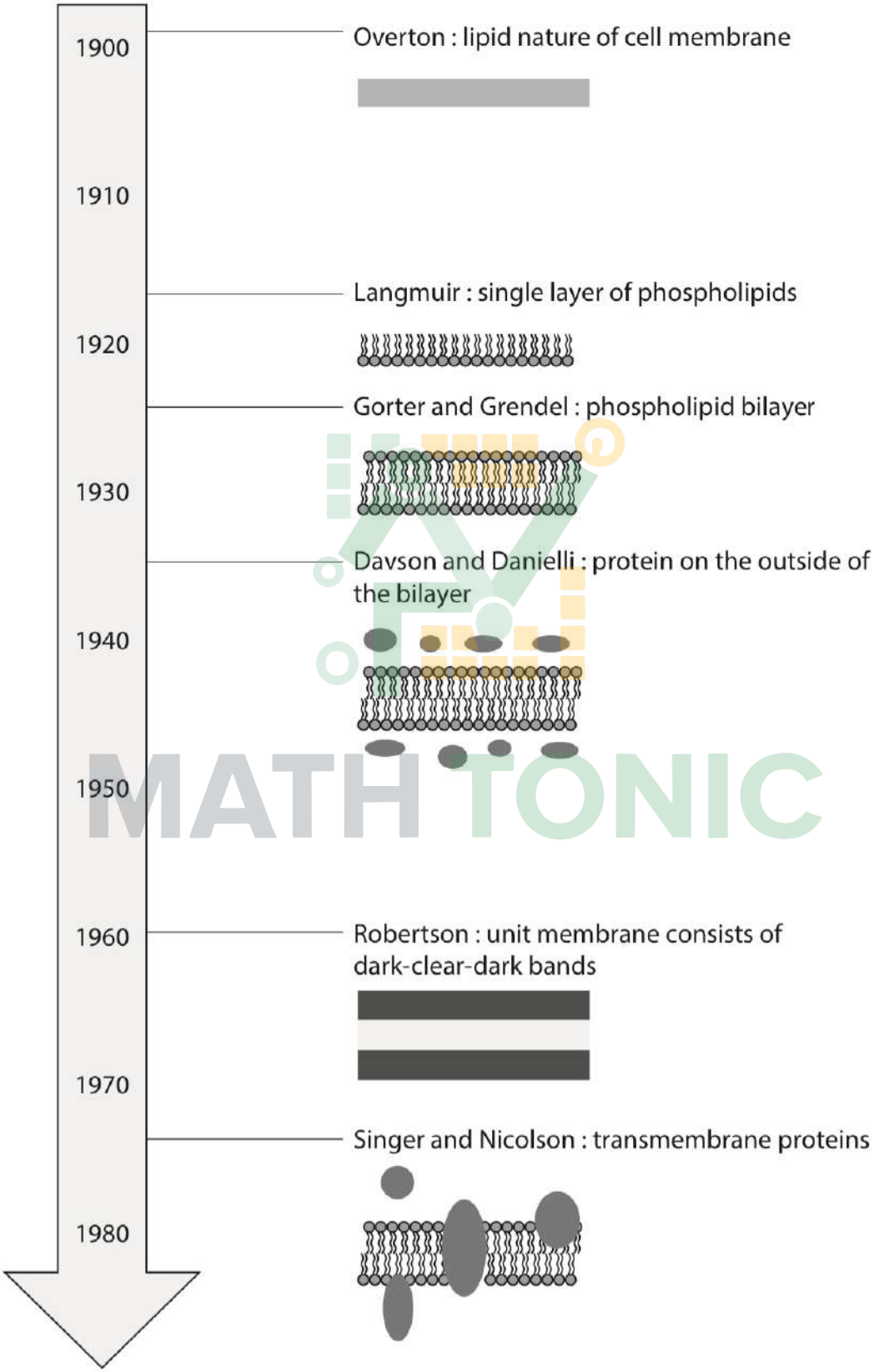
(Total for Question 6 = 11 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

MATH TONIC

7 The structure of the cell membrane has been modelled to interpret the data available at the time.

The diagram shows a timeline of six models proposed for the structure of the cell membrane.



MATH TONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(a) Overton suggested that some types of solute could cross the lipid membrane, whereas other types of solute could not.

Explain the difference between these two types of solute and why only one type can cross the lipid membrane.

(2)

→ Non-polar solutes can cross the cell membrane as lipids in membrane are non-polar.

→ Polar solutes can't cross the membrane because they cannot dissolve in non-polar lipids.

(b) Langmuir's model was a single layer of phospholipids.

Explain why the phospholipids in a cell membrane cannot be arranged in a single layer.

(2)

→ Phospholipids have polar heads and non polar fatty acid tails.

→ Heads can face the aqueous solution but the fatty acid tails repel water.

(c) Gorter and Grendel suggested that there were various types of phospholipid but they were all arranged in a bilayer.

Give **two** ways in which phospholipids can be different from each other.

(2)

1 There can be different number of carbons in fatty acid tails.

2 There can be different number of saturated and unsaturated fatty acids.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

MATH TONIC

(d) The Davson and Danielli model was the first to include proteins.

Explain why some membrane proteins would **not** be able to carry out their transport functions if they were located only on the surface of the phospholipid bilayer.

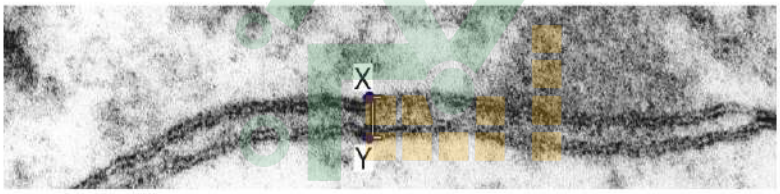
(2)

→ Proteins need to span over the membrane to transport substances.

→ Proteins carriers transport molecules in active transport crossing the membrane.

(e) Robertson implied that there was no space between the phospholipid layers and that the thickness of the membrane could be measured.

The photograph shows part of two adjacent cell membranes.



(Source: © DENNIS KUNKEL MICROSCOPY/SCIENCE PHOTO LIBRARY)

The thickness of these cell membranes between X and Y is 22.8 nm.

Calculate the magnification of this photograph.

Express your answer to **two** significant figures.

(2)

$XY = 5\text{ mm} \times 10^6$

$A = 22.8\text{ nm}$

$M = \frac{\text{Image}}{\text{Actual}} = \frac{5000000}{22.8}$

$= 219,298.24$

Answer 2.2×10^5 x

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
MATH TONIC

(f) In 1972, Singer and Nicolson proposed the fluid mosaic model of the cell membrane.

Explain why their model has been given this name.

(2)

→ Membrane is fluid so the phospholipids can move in the bilayer.

→ Proteins are randomly distributed in between phospholipids.

(Total for Question 7 = 12 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

MATH TONIC

8 Osteogenesis imperfecta (OI) is a group of rare genetic disorders which results in bones that are not formed properly and can break easily.

There are several types of OI, as a number of different genes can be affected.

Some of the symptoms of OI can be life-threatening.

The commonest types of OI are caused by mutations in genes coding for the structure of collagen.

(a) In some types of OI, the collagen is poorly formed and lacks strength.

Explain how a substitution mutation could result in collagen that lacks strength.

(4)

→ Substitution can cause change one base of codon to another.
→ This changes the amino acid.
→ and primary structure of protein is changed.
→ Reduced hydrogen bonding in the secondary structure.
→ Reduces the strength in triple helix.

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(b) In most types of OI the allele responsible for causing the condition is **dominant**.

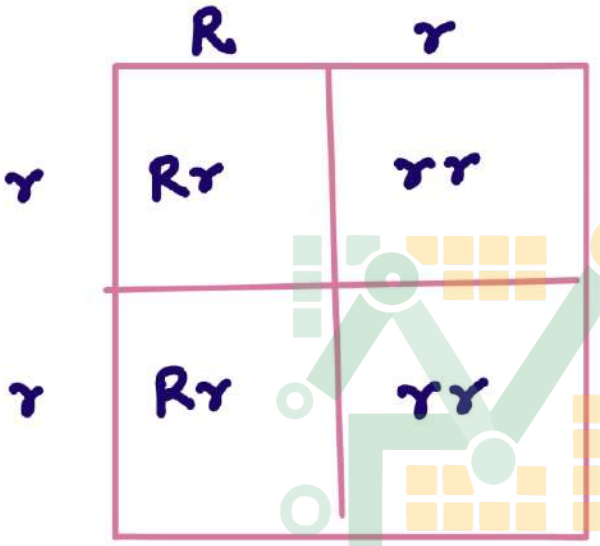
Determine the probability that a child could inherit OI if one parent has OI and is heterozygous and the other parent does not have OI and is therefore homozygous recessive.

Use a genetic diagram to support your answer, indicating the phenotypes of the offspring and their corresponding genotypes.

(4)

Genotype of parent with OI: Rr

Genotype of parent without OI: rr



MATH TONIC

Probability that a child could inherit OI 1 : 1

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

*(c) Genetic screening can be used by couples who are at risk of having a child with OI.

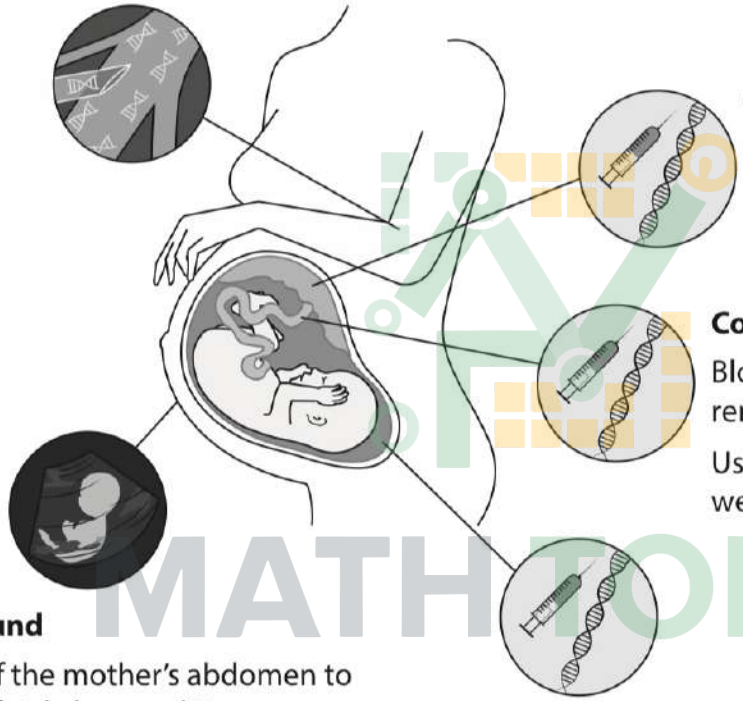
The genetic screening options include pre-implantation genetic diagnosis (PGD) and prenatal testing.

The diagram gives some information about some of the types of prenatal testing available to these couples.

NIPT

Sample of mother's blood removed and fetal DNA used for genetic analysis

Used between 7th and 10th week of pregnancy



Chorionic villus sampling

Used between 10th and 12th week of pregnancy

Cordocentesis

Blood from the umbilical cord removed for genetic analysis

Used between 22nd and 24th week of pregnancy

Ultrasound

A scan of the mother's abdomen to look for fetal abnormalities

Used after 20th week of pregnancy

Amniocentesis

Used between 15th and 20th week of pregnancy

MATHTONIC

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Discuss the advantages and disadvantages of the genetic screening options available to couples at risk of having a child with OI.

Use all the information in the question and your own knowledge to support your answer.

(6)

Chorionic villi sampling -
→ Can be used to detect disorder early
→ There is a risk of spontaneous abortions.
Ultrasound -
→ Can be used safely as there is no involvement of tissue removal.
→ It can be used only in the later stages of pregnancy.
PGD
→ Involves implantation of healthy embryo.
→ Ethical concerns for the unused embryos.
Cordocentesis -
→ Test can be done considerably late in pregnancy by that time parents would developed. emotional bond and don't want to abort it.

(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 80 MARKS

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA