A-Level Edexcel

BIOLOGY

UNIT 1(IAL)

2020 — 2025

1 – ((WBI11)/1(IAL)_Summer_2020_Q1) – *Molecules, Transport And Health*

The primary structure of a protein determines its secondary structure and its three-dimensional structure.

(a) Read through the following account of the primary structure of a protein.

(5)

Complete the account by writing the most appropriate word or words on the dotted lines.

The primary structure of a protein is the specific sequence of amino acids joined together by ..... bonds.

These bonds are formed between the ..... group of one amino acid and the ..... group of an adjacent amino acid by a ..... reaction.

These bonds are formed during the stage of protein synthesis called ..... .

(b) The table describes the types of bond that hold the secondary and the three-dimensional structures together.

Which type of bonding is true for each structure?

(2)

Structure	Hydrogen bonds only	Ionic bonds only	Both hydrogen and ionic bonds	Neither of these bonds
secondary structure	☒	☒	☒	☒
three-dimensional structure	☒	☒	☒	☒

2 – ((WBI11)/1(IAL)_Summer_2020_Q2) – *Molecules, Transport And Health*

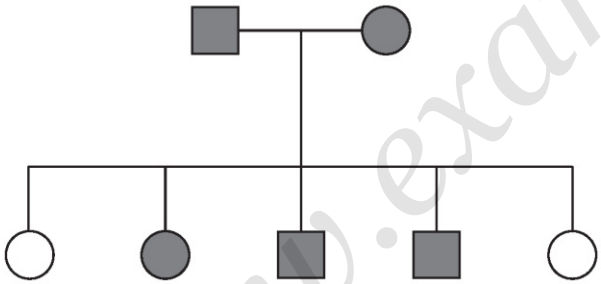
Most Bengal tigers are orange with black stripes but there is a very small number of Bengal tigers that are white with black stripes.

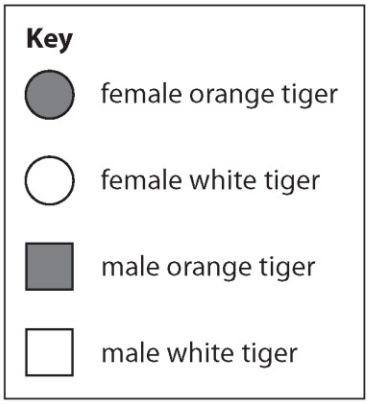
The photograph shows a white Bengal tiger with black stripes.

(Source: Caroline Wilcox)

White tiger offspring are produced by two Bengal tigers that each carry at least one recessive allele for a gene affecting coat colour.

The pedigree diagram shows the phenotypes in one family of tigers, bred in captivity.





(a) The phenotype is affected by the genotype.

State what is meant by the term **genotype**.

(1)

(b) State the probability that the next tiger born to these two parents will be female.

(1)

.....

(c) Determine the expected phenotypic ratio of orange tigers to white tigers born to the parents shown in this pedigree diagram.

Use a genetic diagram to support your answer.

(3)

Answer .....

(d) The incidence of white tigers in the wild is 1 in 10 000 Bengal tigers.

There are approximately 6000 Bengal tigers in captivity, 200 of which are white.

Calculate the incidence of white tigers in captivity.

(1)

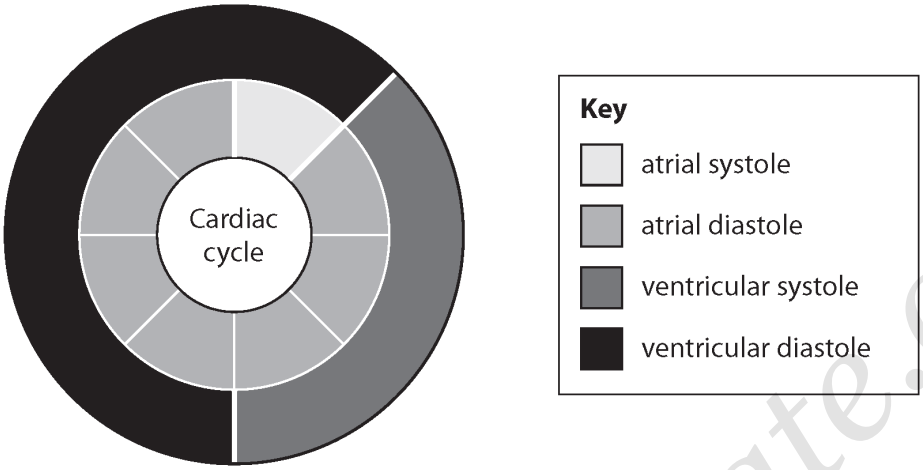
Answer .....

3 – ((WBI11)/1(IAL)_Summer_2020_Q3) – *Molecules, Transport And Health*

The cardiac cycle is the sequence of events that occurs when the heart beats.

A typical cardiac cycle takes 0.86 seconds.

(a) The diagram illustrates the cardiac cycle.



(i) Which row of the table describes the atria and ventricles during atrial systole?

(1)

		Atria	Ventricles
☒	**A**	contracted	contracted
☒	**B**	contracted	relaxed
☒	**C**	relaxed	contracted
☒	**D**	relaxed	relaxed

(ii) Explain why there is a delay of 0.01 seconds between atrial systole and ventricular systole.

(2)

(iii) Using the information in the diagram, calculate the duration of ventricular systole in milliseconds.

Express your answer in standard form.

(2)

Answer ..... ms

(iv) State what proportion of the cardiac cycle is spent in ventricular diastole.

(1)

.....

.....

(b) A typical cardiac cycle takes 0.86 seconds.

During exercise, the heart rate increases and the duration of the cardiac cycle decreases.

Calculate the increase in heart rate if the cardiac cycle decreases by 0.4 seconds.

(3)

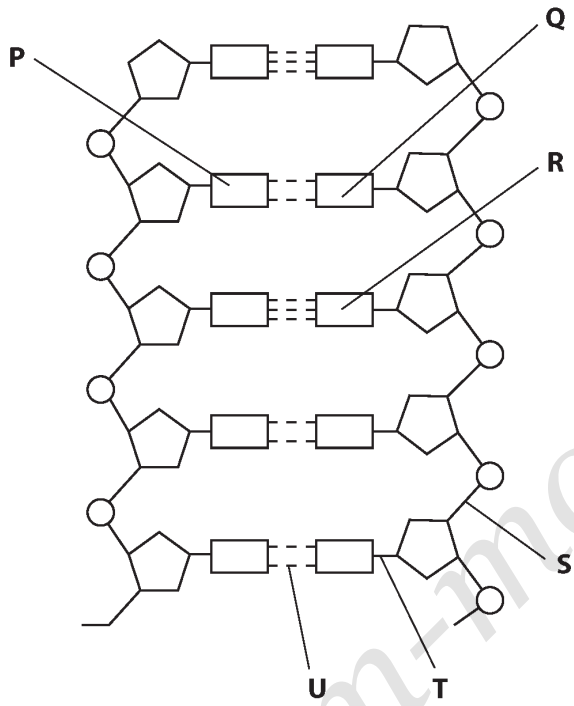
Answer ..... beats per minute

4 – ((WBI11)/1(IAL)_Summer_2020_Q4) – *Molecules, Transport And Health*

The polynucleotide DNA is composed of mononucleotides linked together.

Two polynucleotides form a DNA molecule.

(a) The diagram shows part of a DNA molecule.



(i) Draw a circle around **one** mononucleotide that includes the base labelled **R**.

(1)

(ii) Which row of the table identifies the bonds labelled **S**, **T** and **U**?

(1)

	S	T	U
☐ **A**	hydrogen	phosphodiester	covalent
☐ **B**	hydrogen	covalent	phosphodiester
☐ **C**	phosphodiester	hydrogen	covalent
☐ **D**	phosphodiester	covalent	hydrogen

(iii) The base labelled **P** is adenine.

Which is the base labelled **Q**?

(1)

☐ **A** cytosine

☐ **B** guanine

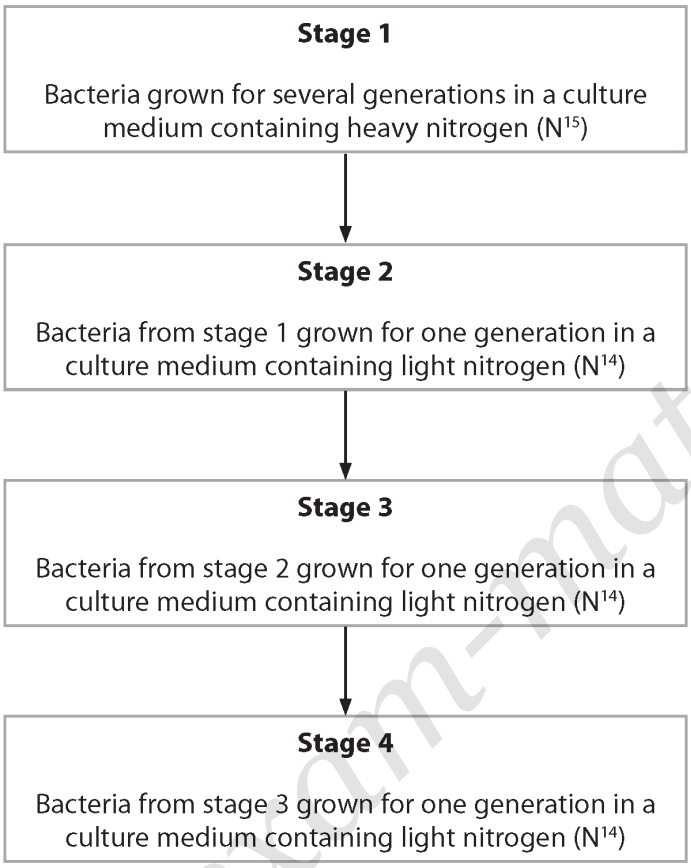
☐ **C** thymine

☐ **D** uracil

(b) Meselson and Stahl carried out experiments that provided evidence for the semi-conservative replication of DNA.

Heavy nitrogen (N^{15}) and light nitrogen (N^{14}) were used in these experiments.

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



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

The heavier DNA molecules form bands lower down the gradient than the lighter DNA molecules.

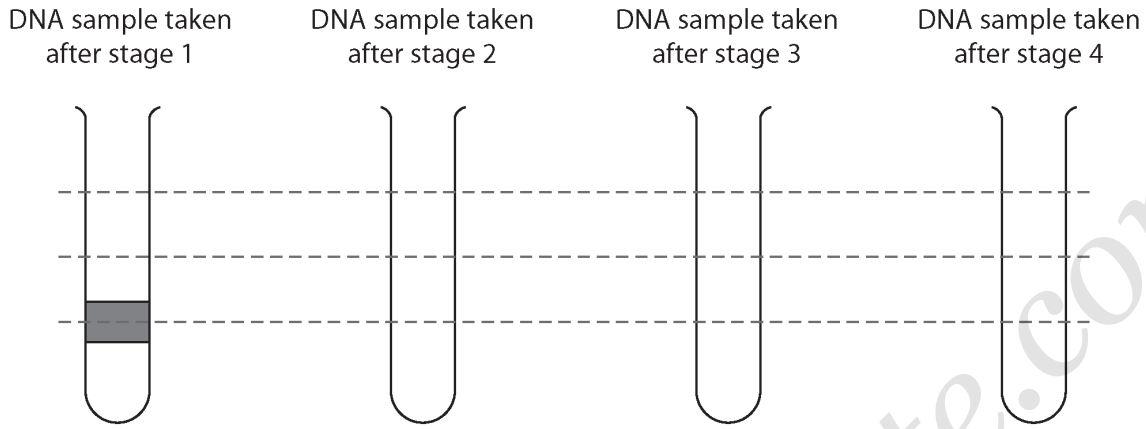
The height of each band is proportional to the percentage of DNA molecules in the sample.

(i) Complete the diagram to show the results of this experiment.

Use the dotted lines to help you to position the bands on the diagram.

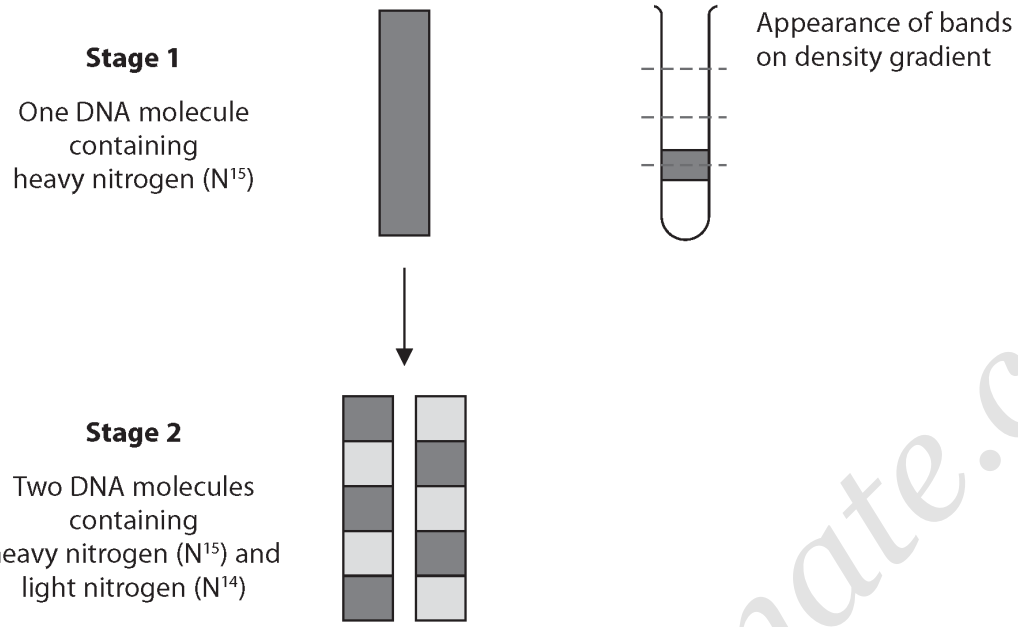
The first one has been done for you.

(5)



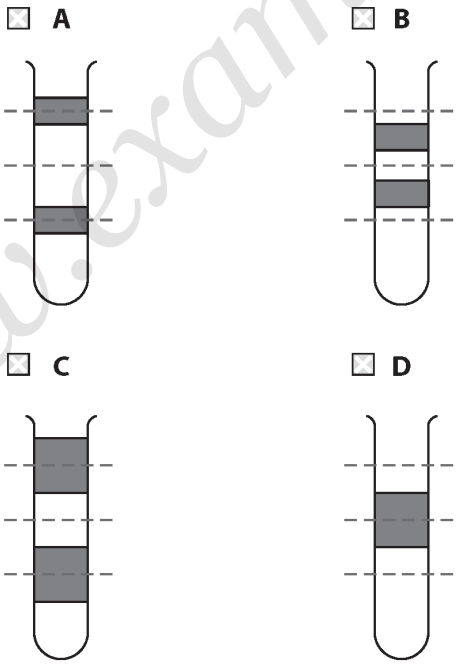
(ii) The experiments of Meselson and Stahl disproved the dispersive theory of DNA replication.

The diagram shows the expected results if the dispersive theory was correct.



Which diagram would show the bands of DNA molecules on the density gradient at stage 2, if the dispersive theory was correct?

(1)



ANSWERS

1 – ((WBI11)/1(IAL)_Summer_2020_Q1) – *Molecules, Transport And Health*

Question number	Answer	Additional guidance	Mark
(a)	peptide (1) amino / NH_2 / NH_3^+ / amine (1) carboxyl / COOH / CO_2H / COO^- / carboxylic (acid) (1) condensation (1) translation (1)	**DO NOT ACCEPT** dipeptide / polypeptide / amide **ACCEPT** second and third point either way round **ACCEPT** polymerisation / addition elimination	(5)

Question number	Answer	Mark
(b)		(2)

Structure	Hydrogen bonds only	Ionic bonds only	Both hydrogen and ionic bonds	Neither of these bond
secondary structure	X	☒	☒	☒
three-dimensional structure	☒	☒	X	☒

2 – ((WBI11)/1(IAL)_Summer_2020_Q2) – *Molecules, Transport And Health*

Question number	Answer	Additional guidance	Mark
(a)	• combination of alleles (1)	**IGNORE** genetic composition / combination of information carried in the genes / all genetic {information / make up} **DO NOT ACCEPT** genes	(1)

Question number	Answer	Additional guidance	Mark
(b)	• 1 in 2 / 50:50 / 50% / 0.5 / ½	**ACCEPT** 2 in 4 / 1:1 / 2:2	(1)

Question number	Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following points: • parents shown as heterozygotes (1) • genotypes of offspring shown (1) • 3 (orange) : 1 (white) (1)	CEs throughout **ACCEPT** any pair of letters chosen to represent alleles from Punnet square **ACCEPT** 1 white : 3 orange	(3)

Question number	Answer	Additional guidance	Mark
(d)	• 1 in 30 / 0.03 / 3.3% / $\frac{1}{30}$	ACCEPT 0.03 recurring / 3.3% recurring	(1)

3 – ((WBI11)/1(IAL)_Summer_2020_Q3) – *Molecules, Transport And Health*

Question number	Answer	Mark
(a)(i)	**The only correct answer is B** contracted | relaxed ***A*** *is incorrect because the ventricles are relaxed* ***C*** *is incorrect because the atria are contracted and the ventricles are relaxed* ***D*** *is incorrect because the atria are contracted*	**(1)**

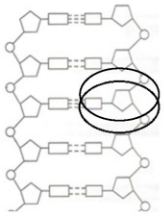
Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes the following points: • because the atrioventricular valves have to close (before the ventricles contract) (1) • to prevent backflow of blood into the atria (1)	**ACCEPT** {bicuspid / mitral} valve **and** tricuspid valve **DO NOT ACCEPT** valves close during ventricular systole	**(2)**

Question number	Answer	Additional guidance	Mark
(a)(iii)	• cardiac cycle time multiplied by proportion of cycle spent in ventricular systole (1) • 3.2×10^2 / 3.23×10^2 (1)	Example of calculation: $0.86 \times {}^{3}/_{8}$ / 0.3225 / 0.32 / 0.323 Correct answer with no working gains 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
(a)(iv)	• 63% / 5/8 / 0.63	**ACCEPT** 0.625 / 62.5% / 5 out of 8	**(1)**

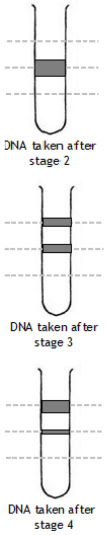
Question number	Answer	Additional guidance	Mark
(b)	• heart rate if cardiac cycle lasts 0.86 seconds (1) • heart rate if cardiac cycle last 0.46 seconds (1) • increase in heart rate = 60 / 61 beats per minute (1)	Example of calculation: 60 ÷ 0.86 = 69.76744186046512 60 ÷ 0.46 = 130.4347826 Answer in range of 60.2 to 60.7 gains 2 marks CE from calculations of heart rate Correct answer alone gains 3 marks	**(3)**

4 – ((WBI11)/1(IAL)_Summer_2020_Q4) – *Molecules, Transport And Health*

Question number	Answer	Additional guidance	Mark
(a)(i)	• circle drawn around R, the attached sugar and a phosphate group	 **ACCEPT** the phosphate group on either C3 or C5	(1)

Question number	Answer	Mark
(a)(ii)	**The only correct answer is D** phosphodiester | covalent | hydrogen ***A*** *is incorrect because S is a phosphodiester bond, T is a covalent bond and U is a hydrogen bond* ***B*** *is incorrect because S is a phosphodiester bond and U is a hydrogen bond* ***C*** *is incorrect because T is a covalent bond and U is a hydrogen bond*	(1)

Question number	Answer	Mark
(a)(iii)	**The only correct answer is C Thymine** ***A*** *is incorrect because adenine is complementary to thymine* ***B*** *is incorrect because adenine is complementary to thymine* ***D*** *is incorrect because adenine is complementary to thymine*	(1)

Question number	Answer	Additional guidance	Mark
(b)(i)	A diagram that shows the following points: • a band the same width as stage 1 in the middle of the tube (1) • bands drawn at the top and middle of tube (1) • both bands narrower than stage 1 (1) • bands drawn at the top and middle of tube (1) • top band drawn narrower than stage 1 but wider than stage 3 and lower band drawn narrower than stage 3 (1)		**(5)**

Question number	Answer	Mark
(b)(ii)	**The only correct answer is B** ***A*** *is incorrect because neither DNA molecule is made of all heavy nitrogen or light nitrogen* ***C*** *is incorrect because neither DNA molecule is made of all heavy nitrogen or light nitrogen + bands are too wide* ***D*** *is incorrect because it has only one band*	**(1)**

5 – ((WBI11)/1(IAL)_Summer_2020_Q5) – *Molecules, Transport And Health*

Question number	Answer	Additional guidance	Mark
(a)	ACCEPT any two from : • BMI / body mass index • waist to hip ratio / hip to waist ratio • waist to height ratio / height to waist ratio • waist circumference • skin fold (thickness)	**IGNORE** risk factors **ACCEPT** mass ÷ height^2 / weight ÷ height^2	**(1)**

Question number	Answer	Mark
(b)(i)	**The only correct answer is B** B 1-6 only ***A*** *is incorrect because 1-4 bonds are present in straight chains only* ***C*** *is incorrect because 1-4 bonds are present in straight chains only* ***D*** *is incorrect because 1-6 bonds form the branches*	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(ii)	• makes the person feel full / prevents so much food from being in the stomach / fills up the stomach so less food needed to satisfy hunger / glucomannan takes the space of the food (1)	**IGNORE:** reduces food intake decreases volume of stomach	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that includes the following points: • because it contains lots of {monosaccharides / glucose / energy} (1) • therefore {energy input could be greater than energy output / (excess) glucose converted to fat} (1) • glucomannan would no longer be filling up the stomach so more food could be eaten (1)	**ACCEPT** sugar for glucose polymer of glucose lots of mannose broken down into lots of {glucose / monosaccharides / mannose} **ACCEPT** excess energy stored as fat	**(2)**

Question number	Answer	Additional guidance	Mark
(c)(i)	An answer that includes the following points: • group on low fat diet lost 4.3 (kg) and group on very low-carbohydrate diet lost 8.1 (kg) (1) • (overall) loss of 8.1 (kg) is {1.88 / 1.9} times more weight (1) • which is slightly lower than the other studies are claiming (1) • claims are referring to low-carbohydrate diet but this one is a very low-carbohydrate diet (1)	**ACCEPT** group on low fat diet lost 3.8 (kg) more **ACCEPT** about twice as much / for low-fat diet this is 4.6% of starting weight and for very low-carbohydrate 8.9% starting weight **ACCEPT** results are at the lower end of the claim	**(3)**

Question number	Answer	Additional guidance	Mark
(c)(ii)	An answer that includes two of the following points: • (blood) {cholesterol / LDL} levels (1) • blood pressure (1) • heart rate (1)	**IGNORE** other named risk factors **ACCEPT** LDL : HDL	**(2)**