AS Level Biology A
H020/02 Depth in biology
Practice Question Paper

Date – Morning/Afternoon
Time allowed: 1 hour 30 minutes

You must have:
- Ruler (cm/mm)

You may use:
- a scientific calculator

First name									
Last name									
Centre number						**Candidate number**				

INSTRUCTIONS
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **18** pages.

Answer **all** the questions.

1 Evolution is the change of species over time. Natural selection is the mechanism by which this change occurs.

(a) Fig. 1.1 shows two species of trilobites, a group of arthropods that became extinct about 240 million years ago. Species **A** is 20 million years older than species **B**.

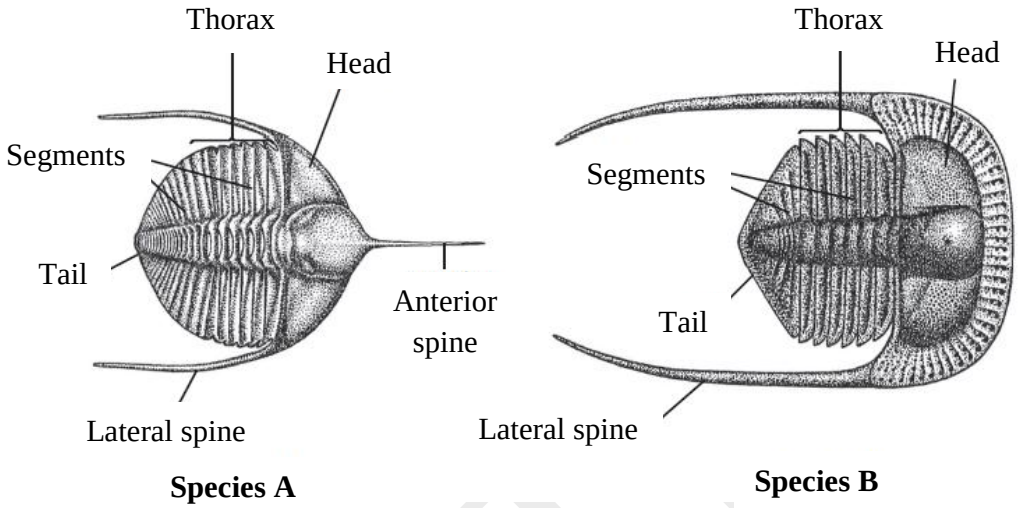


Fig 1.1

(i) Explain how scientists are able to estimate the age of extinct organisms, such as species **A** and species **B**.

……

……

……

…… **[2]**

(ii) Identify two features **visible** in both species that suggest that species **A** and species **B** evolved from a relatively close common ancestor.

1……

2……

[1]

(iii) A student used Fig. 1.1 to make a number of observations comparing species **A** and **B**.

One such observation was "species **B** had longer lateral spines than species **A**".

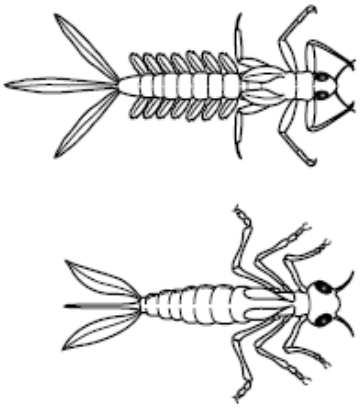
Explain why this is not a valid observation to make on the basis of Fig. 1.1.

……

……

…… **[2]**

(iv) Fig. 1.2 shows two modern arthropods.



C

D

Fig. 1.2

Modern species **C** and **D** live in water. The trilobite species, **A** and **B** also lived in water.

Identify and briefly explain an adaptation present in all four species, **A**, **B**, **C** and **D**, that would be advantageous for an organism that lives in water.

Adaptation ……

Explanation ……

[1]

(b) Explain how biological molecules can provide evidence that species have evolved.

You should refer to different types of molecule in your answer.

……

……

……

……

……

……

……

…… **[4]**

(c) In his book 'On the Origin of Species', Charles Darwin made the following four observations.

E Offspring generally appear similar to their parents.
F No two individuals are identical.
G Organisms have the ability to produce large numbers of offspring.
H Populations in nature tend to remain relatively stable.

From these observations he made a number of deductions, listed in the table below.

The deductions are supported by one **or more** of the observations (**E**, **F**, **G** or **H**).

In the table, indicate which of the above observations contributed to each deduction.

You may use each letter (**E**, **F**, **G**, or **H**) once, more than once, or not at all.

Deduction	**Supporting observation(s)**
Characteristics are passed on to the next generation.	
There is a struggle for existence.	
Individuals with beneficial characteristics are among the few who survive.	

[3]

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

2 On a biology field trip, some students carried out a survey of butterfly species in two areas of heathland.

One part of the heathland was used regularly by walkers, while the other had been deliberately fenced-off by the National Park Authority in an attempt to promote biodiversity.

Area 1 was the area accessible to walkers.
Area 2 was the fenced off area.

On two different mornings in June the students walked along a transect in each area 4 times, at 30 minute intervals, and recorded every butterfly sighting.

(a) The aim of the survey was to compare the biodiversity of butterfly species in the two areas.

Suggest how the procedure could be improved so that a valid comparison could be made.

……

……

……

……

…… **[3]**

(b) The students' results are shown in Table 2.1.

	Area 1	**Area 2**		
Species of butterfly	**Number of individuals (*n*)**	**Number of individuals (*n*)**		
Grayling	2	5		
Large heath	16	10		
Gatekeeper	9	7		
Green hairstreak	3	5		
Silver-studded blue	0	2		
Small heath	8	11		
Simpsons Index	0.7131			

Table 2.1

(i) Identify the area with the higher species **richness** and justify your answer.

Area**……..……**

Justification **……..……**

……..……

[1]

(ii) Identify the area with the higher species **evenness** and justify your answer.

Area**……..……**

Justification **……..……**

……

……..……

[1]

(iii) Using the formula below, the students calculated Simpsons Index of Diversity in **Area 1** to be 0.7131.

$D = 1\text{-}(\Sigma(n/N)^2)$

Where N is the total number of individuals of all species.

Simpson's Index of Diversity in **Area 2** is greater than in **Area 1**.

Use the formula to show that this is the case.

You may use the blank spaces in Table 2.1 to assist in your calculations.

Answer**……** **[4]**

(c)* The students concluded that "fencing off the area of heathland has increased the biodiversity of butterflies".

Evaluate the validity of the students' conclusion using all of the information you have been given, including Table 2.1.

……

……

……

……

……

……

……

……

……

……

……

…… **[6]**

3 **(a)** A school biology class carried out a dissection of a mammalian heart. A student drew the diagram shown in Fig. 3.1.

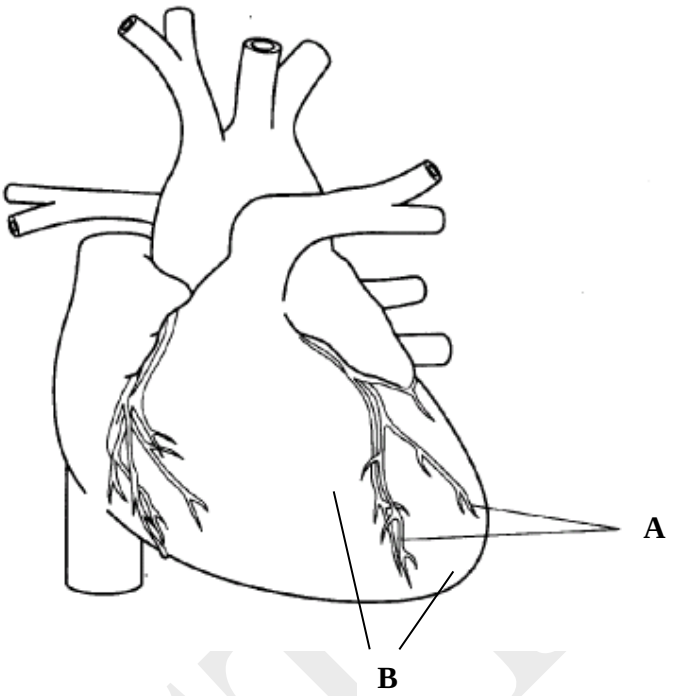


Fig. 3.1

(i) Name the structures labelled **A**.

…… **[1]**

(ii) Name the tissue labelled **B**.

…… **[1]**

(iii) Table 3.1 lists some features of a mammalian heart.

One heart being examined in the lesson had both atria missing. The internal structure of this heart was examined by a pair of students.

Complete Table 3.1 to indicate which features were **visible to the naked eye** on the heart with **no atria**.

Feature	Visible (✓) or Not Visible (X)
AV valve	
bundle of His	
left ventricular wall	
Pulmonary vein	
Purkyne fibres	
SA node	
semi-lunar valve	
septum	

Table 3.1

[3]

(b) Fig. 3.2 shows the changes in pressure inside the heart during one cardiac cycle.

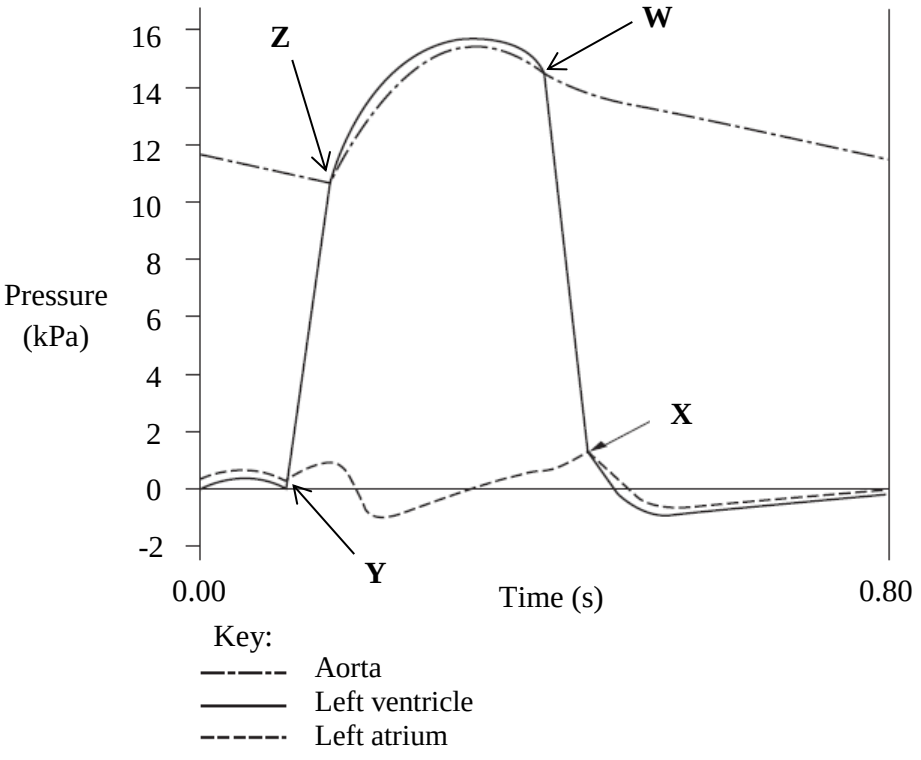


Fig. 3.2

(i) Draw a line **on Fig. 3.2** that shows the pressure changes in the **right ventricle**. **[2]**

(ii)* Describe the events taking place at the points marked **W**, **X**, **Y** and **Z** and explain how these events are related to the changes in pressure shown in the diagram.

……

……

……

……

……

……

……

……

……

……

……

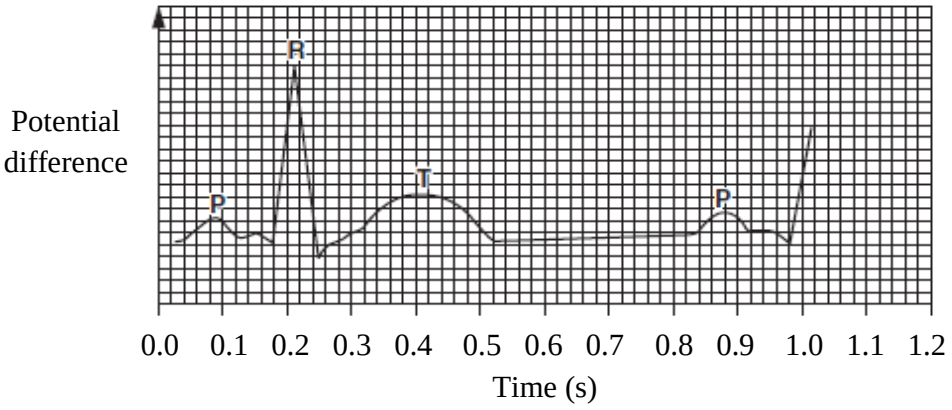
……

…….. **[6]**

(c) Fig. 3.3 shows two ECG traces.

- **Trace A** is a normal trace
- **Trace B** is from a patient that has been treated with the drug digoxin.

Trace **A** - an electrocardiogram from a normal heart



Trace **B** - an electrocardiogram from a heart after treatment with digoxin

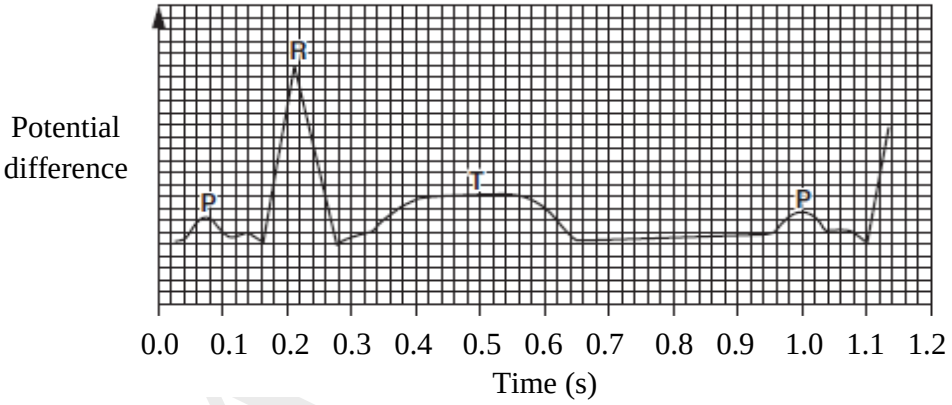


Fig. 3.3

(i) Before being given digoxin, the patient's heart rate was 75 beats per minute.

Using **Trace B** in Fig. 3.3, calculate the percentage change in the patient's heart rate after receiving digoxin.

Answer **……**% **[3]**

(ii) Explain why the answer calculated in part **(i)** may not be an accurate representation of the patient's heart rate **and** suggest how a more accurate answer could be obtained.

……

……

……

……

…… **[3]**

(iii) Digoxin caused the heart rate to change.

Identify **one other** effect of digoxin evident from Fig. 3.3.

……

…… **[1]**

4 Triglycerides, phospholipids and proteins are important biological molecules.

Triglycerides are found in a variety of foods, such as milk, and are an important part of a human diet. They are digested and absorbed in the small intestine. Bile salts present in the small intestine speed up the digestion of triglycerides.

An investigation was carried out into the breakdown of triglycerides in milk using the enzyme lipase.

Tube A contained a solution of bile salts.
Tube B contained an equivalent volume of water.

Both tubes also contained:

- full fat milk
- phenolphthalein indicator
- sodium carbonate solution (to ensure an alkaline pH to start with).

Phenophthalein is an indicator that is pink in alkaline solutions. When the pH drops below 8.3 the indicator turns colourless.

Lipase solution was added last and immediately after this the tubes were mixed thoroughly.

After mixing, the solutions were pink. The tubes were then kept in a water bath at 35°C and the time taken for the solutions to turn from pink to white was recorded using a stopwatch.

The experiment was replicated three times and the results are shown in Table 4.1.

	Time for pink colour to disappear (s)				
Tube	**Replicate 1**	**Replicate 2**	**Replicate 3**	**Mean**	**Standard deviation**
A (bile salts)	324	362	298	328.0	32.2
B (water)	725	699	824	749.3	

Table 4.1

(a) Explain why phenolphthalein indicator was able to detect the breakdown of triglycerides.

……

……

…… **[2]**

(b) **(i)** Use the formula to calculate the standard deviation for Tube **B**.

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Where,
x is the values measured
$\bar{x}$ is the mean
n is the number of replicates

Answer…… s **[2]**

(ii) Standard deviation is a measure of the spread of results.

All significant variables were controlled during the investigation.

Identify a limitation to the experimental procedure that caused a high standard deviation and suggest an improvement to the method that could reduce this spread of results.

Limitation ……

……..

Improvement ……

……..

[2]

(c) Triglycerides contain three elements.

(i) **M** and **N** are formulae for two macromolecules,

$C_{55}H_{98}O_6$	$C_{18}H_{30}O_{16}$
M	**N**

Which of the formulae, **M** or **N**, corresponds to a triglyceride?
Explain your answer.

Formula ……

Because ……

…….. **[1]**

(ii) Phospholipid molecules are similar to triglycerides but they also contain the element phosphorus as part of a phosphate group.

Explain how the structure of phospholipids allows them to form the bilayer of a plasma membrane.

……

……

……

……

……

…… **[3]**

(d) The plasma membrane also contains proteins, which are made within the cell**.**

Outline the process and organelles involved in the translation of these proteins from RNA.

……

……

……

……

……

……

……

…… **[4]**

5 The English elm tree, *Ulmus procera*, was once widespread in Britain. The English elm is much less common now because of a disease known as Dutch elm disease.

- The disease is caused by a fungus that first arrived in Britain in 1967.
- Beetles living under the bark pick up fungal spores while feeding.
- Within a few years approximately 25 million trees were dead.

(a) Suggest two reasons for the **rapid** spread of the fungus in the elm population.

1 ……

……

2 ……

……

[2]

(b) Malaria is a disease that affects many millions of people.

Identify one similarity in the way malaria is transmitted compared with the way Dutch elm disease is spread.

……

…… **[1]**

(c) Complete the passage using the most appropriate terms.

The pathogen that causes malaria is called …… . This organism belongs to the kingdom …… . The pathogens that cause malaria and Dutch elm disease are both in the domain …… .

[3]

(d) Explain how the malarial parasite is able to bypass the body's primary defences.

……

……

…… **[2]**

END OF QUESTION PAPER