Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced Subsidiary
Unit 3: Practical Biology and Research Skills

Monday 9 May 2016 – Afternoon
Time: 1 hour 30 minutes

Paper Reference
WBI03/01

You must have:
Ruler, Calculator, HB pencil

Total Marks

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.*

Information

- The total mark for this paper is 40.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

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

Turn over ▶

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PEARSON

Answer ALL questions.

1 A student wanted to investigate the effect of alcohol on heart rate. He used water fleas (*Daphnia*), which are crustaceans, because studying this in humans has ethical difficulties.

(a) Suggest **one** practical and **one** ethical reason why *Daphnia* was chosen for this investigation.

(2)

Practical

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Ethical

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(b) *Daphnia* were first placed in filtered pond water. After 30 minutes the *Daphnia* were split into two groups. The first group was transferred to fresh, filtered pond water (the control group). The second group was transferred to 5% ethanol (the alcohol treatment group).

After another 30 minutes they were transferred back into filtered pond water and left for a further 30 minutes.

The heart rate was recorded three times at 10 minute intervals for the entire 90 minutes of the investigation.

(i) The student kept the temperature constant throughout the investigation. Suggest a suitable temperature. Give an explanation for your answer.

(2)

Temperature.....

Explanation.....

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(ii) Name **one** variable, other than temperature, that should be controlled.

Describe how this variable could be controlled.

(2)

Variable

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How the variable could be controlled.....

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(iii) Explain why *Daphnia* in the control group were transferred into fresh pond water after 30 minutes.

(2)

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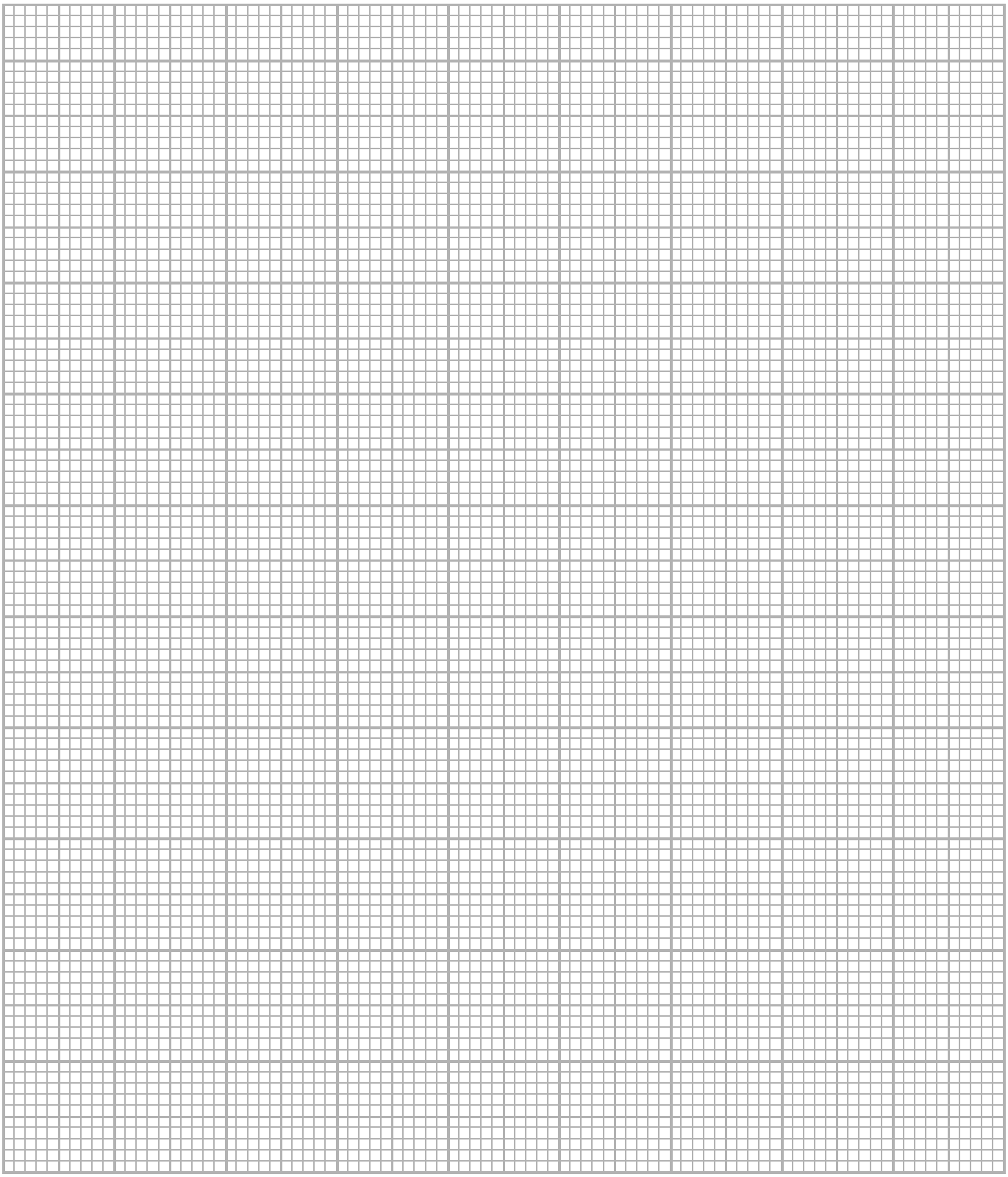
(c) The table below shows the mean heart rate and the standard deviation (SD) for the alcohol treatment group and the control group.

Time from start / minutes	Mean heart rate / beats per minute			
	Control group	SD	Alcohol treatment group	SD
0	350	3.50	350	3.50
10	350	5.25	350	3.50
20	350	2.80	350	3.50
30	340	4.08	245	1.96
40	335	5.70	77	1.00
50	340	3.11	68	3.40
60	345	3.40	78	3.59
70	340	3.40	150	3.45
80	345	3.45	245	9.30
90	350	3.50	340	3.40

(i) Plot a suitable graph to show all the data for the alcohol treatment group. Do not include the standard deviations. Join the points with ruled, straight lines.

(4)



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(ii) The student concluded that there was no significant effect in the control group but there was in the alcohol treatment group. With reference to the data, explain why the student came to this conclusion.

(2)

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(d) The student now wanted to see if there was any evidence that the data from *Daphnia* could help to suggest what effect alcohol has on human heart rate.

The student found the following data in a research paper on the effect of alcohol on human heart rate.

Heart rate without alcohol / bpm	59
Heart rate after drinking alcohol / bpm	66

(i) Calculate the percentage change in the heart rate of a human after drinking alcohol.

Show your working.

(3)

Percentage change .....

(ii) Taking all the information into account, comment on the suggestion that the *Daphnia* heart might be a good model for suggesting the effect of alcohol on the human heart.

(3)

(Total for Question 1 = 20 marks)

2 Read the following extract from a student's unfinished visit or issue report on the topic of Przewalski's horses.

1. Przewalski's horses (or Tahki) belong to the subspecies *Equus ferus przewalskii*. They can hybridise with domestic horses to produce fertile offspring, but they have two more chromosomes and are therefore classified as a separate subspecies. They are also different in appearance from domestic horses.

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2. At present there are fewer than 50 mature individuals in the wild. They are classified as critically endangered and are at risk of extinction due to:
   - hybridisation with domestic horses
   - loss of genetic diversity after being reduced to a very small population
   - infectious diseases transmitted from domestic horses
   - hunting
   - increased competition from domestic livestock for limited grazing and water.

   The entire current population of Przewalski's horses is descended from 13 individuals. It has been estimated that 60% of their unique alleles have been lost. This loss of genetic diversity has led to:
   - higher levels of genetic disease, particularly underdeveloped ovaries, making breeding more difficult
   - increased chance that less healthy foals will be born, leading to higher infant mortality rates
   - increased risk that a disease or virus could have a devastating effect on the entire population as they are genetically similar.

3. In addition to the 325 Przewalski's horses that live in reserves or in the wild in Mongolia, the number of living animals in the International Studbook was 1 872 in early 2008. These are mostly in zoos which play a vital role in the breeding of Przewalski's horses. A total of 2 652 Przewalski's horses were born in captivity between 1901 and 2004. The countries in which these births occurred are shown in the table.

Australia	79	Czech Rep	215	Great Britain	512	Poland	106	Switzerland	39
Austria	82	Denmark	10	Japan	5	Russia	84	Taiwan	31
Belgium	55	Estonia	19	Kazakhstan	7	South Africa	10	U.S.A.	415
Canada	45	Finland	10	Lithuania	7	Slovakia	13	Ukraine	139
Croatia	2	France	57	Mongolia	13	Spain	3	Vietnam	4
Cuba	3	Germany	570	Netherlands	91	Sweden	10	Other	16

4. In order to make sure that the genetic diversity within the captive population is maintained, and to avoid the inbreeding that leads to genetic diseases, the zoos attempt to breed only the least related horses. Lost alleles can never be recovered and so it is necessary to take great care in selectively breeding using the International Studbook.

5. The annual breeding programme is very successful; 92% of the mares became pregnant each year. There have also been releases of their offspring into reserves in Europe. This means they have a much more natural diet of grasses. However, the climate in Europe is far less harsh than in Mongolia, creating problems for their reintroduction into the natural habitat.

6. They live naturally in herds consisting of a stallion and several mares. However, for selective breeding, a stallion and a mare are put in an enclosure together. The animal is thus deprived of its natural social structure. To keep their genetic diversity, horses from different parts of the world are mated. This involves flying them across the world.

7. The cost of transporting each horse is 15 000 US$. They require vitamins to supplement hay in order to recreate natural diet and to reduce the risk of catching laminitis. Veterinary care during foaling and at other times is a huge expense. They require yearly flu jabs as well as worming every six months. Przewalski's horses act as an attraction in zoos and may increase visitor numbers and revenue. This can increase awareness of the plight of the horses and encourage donations to support the work being done to conserve this species. This allows zoos to conserve the species and habitats, locally and globally.

8. Przewalski's horses have been bred in captivity for 90 years but they remain unreliable and there are risks to humans handling them. When their hooves are trimmed, they are anaesthetised, because they are strong animals with a dangerous kick. During reintroduction, Przewalski's horses bred in captivity could bring diseases into the wild population.

9. Artificial insemination can be used to breed these horses, rather than relying on sexual intercourse. The procedure involves collecting sperm from the male selected for breeding, freezing it, and transporting the sperm to the female selected for impregnation. The sperm is then placed in the uterus so that fertilisation can take place. The sperm have a short distance to swim before reaching the egg so this method has a higher fertilisation success rate. Artificial Insemination also helps to reduce costs as the horses do not have to be transported.

10. Another possibility is to use in-vitro fertilisation (IVF), which has an even higher success rate than artificial insemination. Eggs are drawn out of the uterus and are isolated. Sperm from the male is cleaned, deprived of liquid and frozen in preparation for IVF. It can then be transported to the location of the female. The sperm and eggs are combined in a glass dish, to allow fertilisation to take place. The fertilised egg is left in the laboratory for several days to begin to divide. The embryo is then transferred into the uterus of a female Przewalski's horse. IVF is more expensive than artificial insemination but less than an ordinary breeding programme.

(a) A visit or issue report requires a problem to be identified.

Identify the problem described in this extract.

(1)

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(b) These visit and issue reports are expected to identify **economic** implications of the issue being investigated.

The implications might be negative (costs) or positive (benefits).

Complete the table below by identifying **two** costs and **two** benefits of the Przewalski's horse captive breeding programmes.

(4)

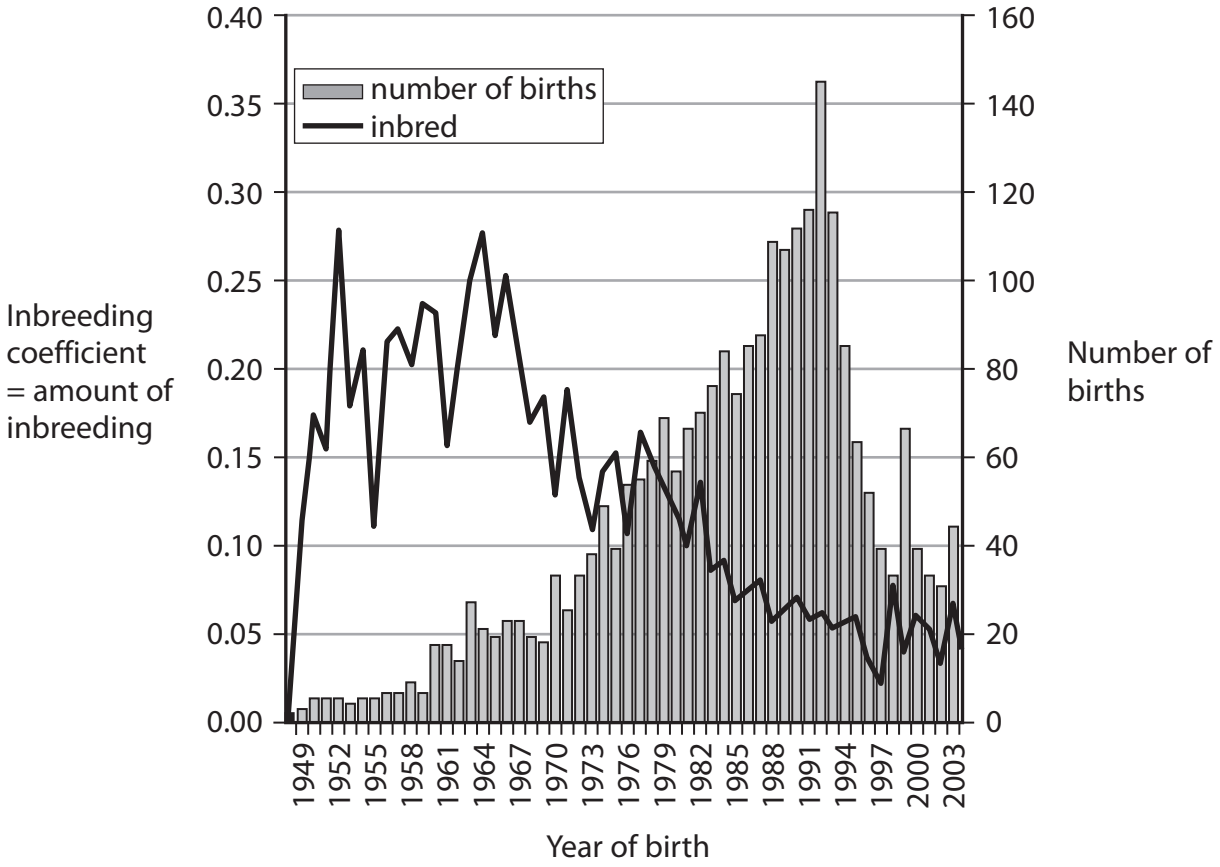
Costs	Benefits

(c) This unfinished report should include a graph.

Explain how you could make a graph of the data in the table in paragraph 3.

(3)

(d) The student found the following graph about inbreeding and the number of births of Przewalski's horses in zoos.



(i) Suggest an explanation for the data in the graph.

(2)

(ii) Write a caption for the graph and suggest where in the report it should be placed.

(3)

Caption .....

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Paragraph number .....

(iii) The graph was in a scientific paper referred to in the report as follows:

Inbreeding in captive bred Przewalski horses from local populations by A. Wolc, M. J. Nitka, P. Szablewski and T. Szwaczkowski in vol. 57 of Folia Zool. published in 2008 on pages 300–307.

Rewrite the reference in the correct way.

(3)

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(e) Identify and describe **two** methods of selective breeding mentioned in this report.

(4)

1. .....

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2. .....

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(Total for Question 2 = 20 marks)

TOTAL FOR PAPER = 40 MARKS

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