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Edexcel GCE

Biology

Advanced Subsidiary

Unit 3B: Practical Biology and Research Skills

Monday 7 May 2012 – Morning	Paper Reference
Time: 1 hour 30 minutes 	6BI07/01

<p>You must have: Ruler, Calculator, HB pencil</p>	Total Marks
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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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Answer ALL questions.

1 In humans, lactic acid is produced by respiration when there is very little oxygen present. This lowers the pH of the blood which has an effect on the heart rate.

A student decided to investigate the effect of lactic acid on heart rate. Studying this in humans is difficult so he used water fleas (*Daphnia sp.*).

Daphnia were placed in solutions of different concentrations of lactic acid, kept at 25 °C. Their heart beats were observed using a microscope and the heart rates were recorded. The procedure was repeated three times for each concentration.

(a) (i) Suggest **two** practical reasons why *Daphnia* was chosen for this investigation. (2)

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(ii) Discuss the ethical implications of using *Daphnia* in this investigation. (2)

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(iii) Explain why the temperature was kept at 25 °C in this investigation. (2)

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(iv) Apart from temperature, name **one other** variable that should be controlled. Describe how it could be controlled.

(2)

Variable

How it could be controlled

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(b) To present the results of his investigation, the student calculated the means and the standard deviation for each concentration.

The means and standard deviation are shown in the table below.

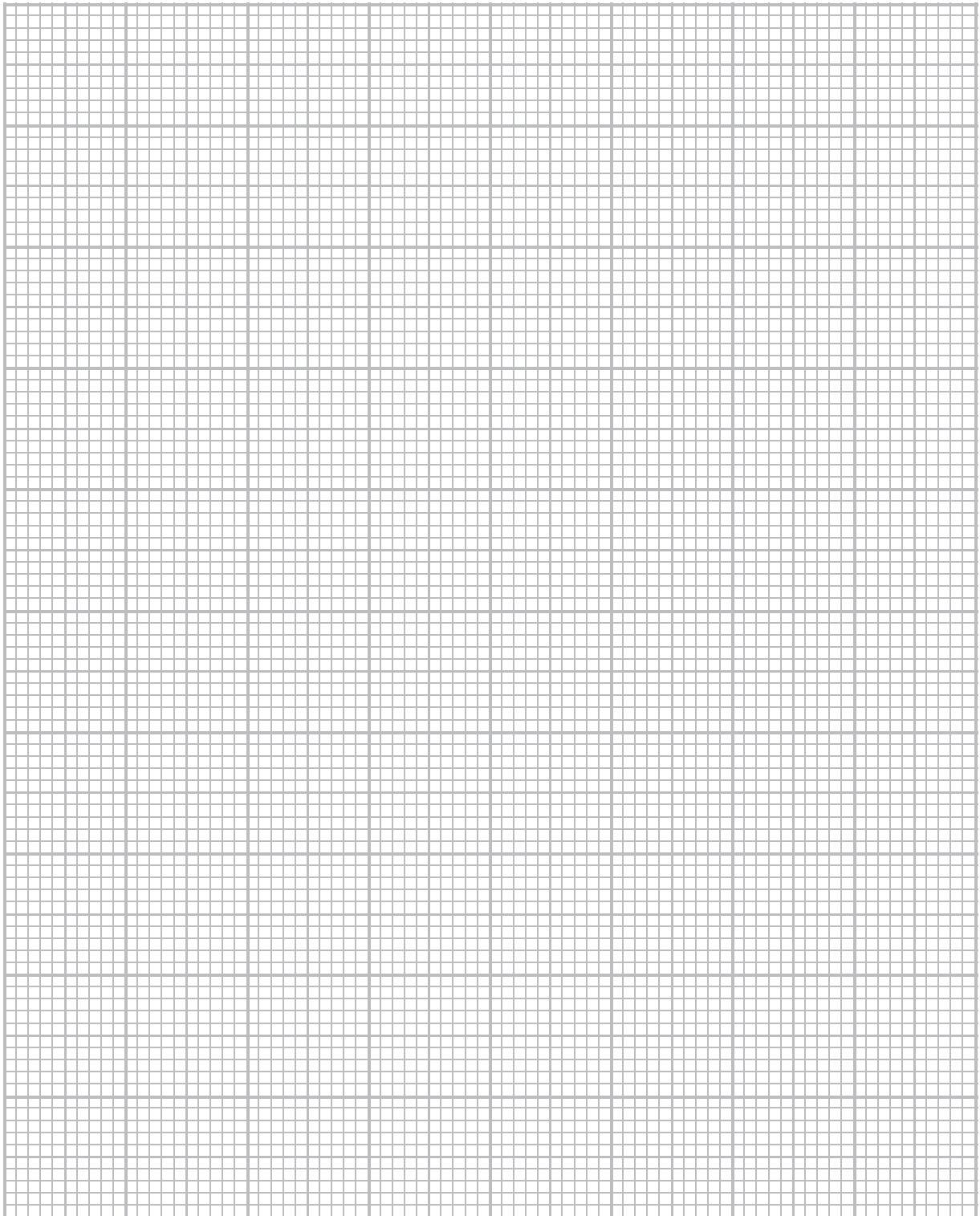
Lactic acid concentration / arbitrary units	Heart rate of <i>Daphnia</i> / beats per minute				Standard Deviation
	1	2	3	Mean	
0.0	282	275	277	278	3.6
1.0	266	220	251	246	23.5
4.0	200	193	176	189	12.3
10.0	140	160	157	10.8
80.0	70	60	67	66	5.1

(i) Complete the table by calculating the mean heart rate for the lactic acid concentration of 10.0 arbitrary units. Show your working below.

(2)



- (ii) Plot a suitable graph to show the effect of lactic acid concentration on the mean heart rate of *Daphnia*. On your graph, include the standard deviations. (5)



(iii) Describe and suggest an explanation for the trend shown by this graph.

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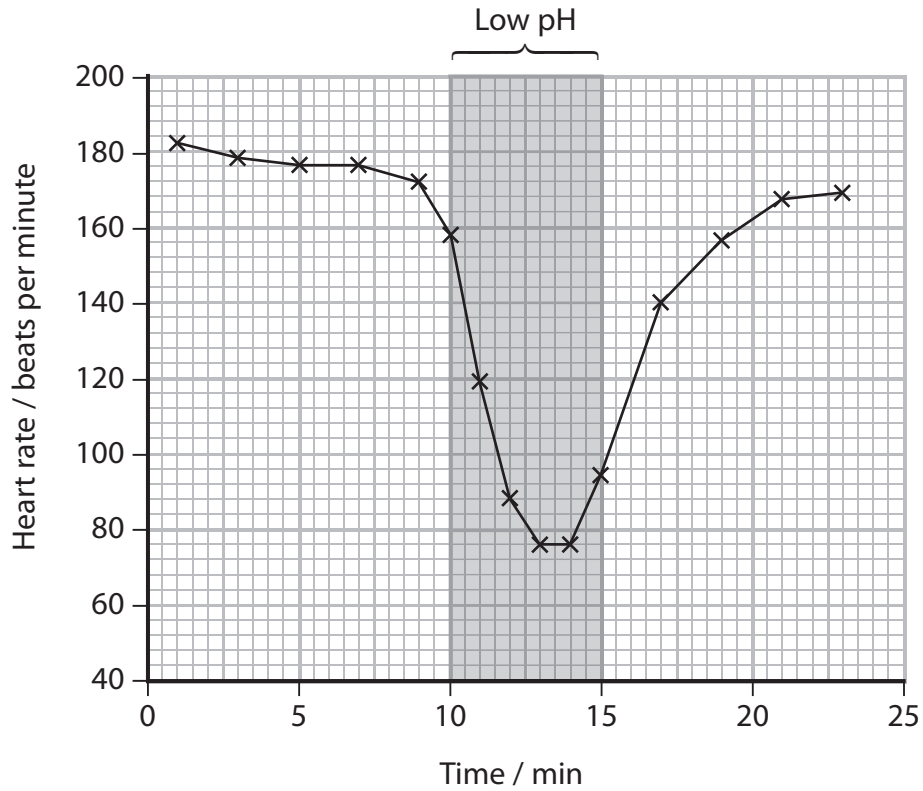
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(c) In order to check the validity of his data, the student looked for information in the literature about lactic acid and heart rates.

He found the following graph on the effect of pH changes on the heart rate of rats in a peer-reviewed journal.



The shaded area on the graph shows when the isolated rat heart was subjected to a low pH.

Comment on the significance of these data for the student's *Daphnia* investigation.

(3)

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(Total for Question 1 = 20 marks)



2 Read the following extract from a student’s **unfinished** draft report on the topic of pain.

- 1 Pain is nature’s ‘warning’. When pain is felt, pain receptors activate, sending impulses through the nerve into the spinal cord and to the brain. An area of the spinal cord called the dorsal horn simultaneously sends a message to the area where pain has been felt so the brain doesn’t have to tell you to pull away from the source of pain because the dorsal horn has already done it.
- 2 Sometimes the pain receptors keep firing, this can be caused by a disease or condition that continuously causes damage, known as ‘chronic pain’. However, there may no longer be a physical cause of pain, but the response is still the same, making chronic pain difficult to pin down and even more difficult to treat.
- 3 Acupuncture is an ancient method of healing that dates back at least 2,500 years and is widely practised in China. There have been many studies on the effectiveness of acupuncture compared to medical treatments such as drugs.
- 4 One study was by L Loh, PW Nathan, GD Schott, and KJ Zilkha. 48 patients were used, with the intention of having each patient use each type of treatment for three months then swap. 19 patients were unwilling to change from one to the other.

The results were as follows:

Method of treatment	Total number of patients	Number of patients showing			
		Great improvement	Moderate improvement	Slight improvement	No improvement
Acupuncture	41	9	7	8	17
Drug	36	3	1	5	27

It should be pointed out that all the patients in this study had previously been receiving treatment that was not effective for them. It has been shown that patients who have found no improvement with drugs beforehand will find no improvement a second time round.



- 5 Some studies used placebos to determine whether acupuncture had any effect. There is a study that looked at the effects of acupuncture versus a placebo in the treatment of headache. Thirty-nine patients received both placebo treatments and acupuncture treatments for 6 weeks. Effectiveness of treatments was evaluated by the use of patient diaries. In the end, acupuncture was about 20% more effective than the placebo in relieving headaches, but the difference was not significant.
- 6 Another study done by Tavola, Gala, Conte, & Invernizzi in 1992 with a control group researched acupuncture and tension-type headaches. Thirty patients with tension-type headache were randomly chosen to undergo either acupuncture or pretend acupuncture. Although frequency of headaches and pain relief drug consumption decreased significantly with time after the two treatments, the results show that there were no significant differences between acupuncture and placebo treatments.
- 7 There have been shown to be a few side effects to do with acupuncture. A study was conducted by Ernst G, Strzyz H and Hagmeister H in 2003 entitled the 'Incidence of adverse effects during acupuncture therapy – a multicentre survey'. The results showed that, out of 3535 treatments, 402 resulted in minor adverse events including bleeding, bruising, dizziness, fainting, nausea, increased pain and in one case, aphasia (the inability to speak). The study concluded that, although some side effects had been recorded, if the treatment was conducted according to established safety rules and at appropriate anatomic regions, then it is a safe treatment method. Although this conclusion said the treatment is safe, many other side effects have been recorded, including: nerve injury, infection (from unsterilised needles), small bleedings and nausea.
- 8 The benefits to humans would be a reduced amount of pain combined with a reduced amount of pain relief medication, which would be economically beneficial.
- 9 There are many risks to medical treatment, most being more harmful and more common than ones associated with acupuncture. For example, the drug used in the main acupuncture study for pain relief has many and varied side effects:

Reduced blood flow

Nausea

Trouble breathing

Trouble sleeping

Persistent sore throat

Vision problems

Easy bruising or bleeding

Addiction



- 10 An implication of replacing medical treatments with acupuncture would be ethical. As many of the patients of acupuncture for chronic pain would need repeat treatments over a period of months, possibly years, when new patients start the treatment there will already be many old patients there so it would be difficult to start new patients with the beginning weekly treatments. So after a while many patients would have to be turned down or referred to less easy to get to places, making the patients that start the treatment later either unable to begin treatment or they would have to take more time out of their day to travel farther to have treatment.
- 11 A second implication would be economic as, if acupuncture is accepted as a regular medical treatment under the NHS, doctors would need to be trained how to use it and this would cost money. Also lots more equipment would need to be bought so acupuncture could be done properly.
- 12 A third implication would also be economic as repeat treatments of acupuncture would be more costly than medication. Cancer research UK stated that: 'Roughly you should expect to pay between £40 and £80 for your first consultation and between £30 and £70 for following treatments'. Making it around £400 for a year's worth of treatment minimum. Whereas cheap pain medication can cost around £300 per year maximum making a saving of at least £100.

Bibliography

In this report I used a paper, called *Acupuncture versus medical treatment for migraine and muscle tension headaches* by Loh and others from a peer reviewed journal published in 1984 called *Neurology, Neurosurgery and Psychiatry*. It was in Volume 47 and on pages 333–337. I also looked at another peer reviewed journal called *Pain* in which Dowson, Lewith, and Machin reported their work in a paper called *The Effects of Acupuncture versus Placebo in the Treatment of Headache*. It was in Vol. 21 pages 35–42 and published in 1985. Also in *Pain* I found Tavola, T., Gala, C., Conte, G., & Invernizzi, G. *Traditional Chinese acupuncture in tension-type headache: a controlled study*. This time it was published in 1992 and was on pages 325–329 and in Vol. 48.

These were all mentioned on a website at

http://www.vanderbilt.edu/ans/psychology/health_psychology/Acupuncture.htm



(a) A visit or issue report requires a problem to be identified.
Suggest a problem that this extract identifies.

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(b) Explain how you could make a comparative visual presentation of the data in the table in paragraph 4. Use a sketch or sketches to help you.

(2)

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(c) The student's bibliography is not arranged clearly. Part of the student's bibliography is shown below.

'In this report I used a paper, called Acupuncture versus medical treatment for migraine and muscle tension headaches by Loh and others from a peer reviewed journal published in 1984 called Neurology, Neurosurgery and Psychiatry. It was in Volume 47 and on pages 333–337.'

(i) Rewrite this in a suitable format for a bibliography.

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(ii) Apart from the format of the references in the bibliography, in what way is the bibliography incomplete?

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(d) Comment on the validity of the information presented in paragraphs 4 to 7.

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(e) Suggest **two** ways in which the study, as described in paragraph 4, could be improved.

(2)

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(f) The student writes about economic implications of acupuncture in paragraphs 8, 11 and 12.

Using the information in these three paragraphs, discuss the economic implications of the use of acupuncture in the treatment of pain.

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(g) (i) Using the information in the report, review the evidence for acupuncture as an effective treatment for pain.

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- (ii) With reference to the student’s report, discuss the alternative solution to the use of acupuncture in the treatment of pain.
Give the numbers of the paragraphs, in the report, you have used.

(3)

(Total for Question 2 = 20 marks)

TOTAL FOR PAPER = 40 MARKS



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