Year 12 Biology

Taster Day

Daphnia DS Work

Please answer all questions

Leave blank

Answer ALL questions

1. Sam studied the effect of varying the concentration of the stimulant drug caffeine on heart rate. She chose to use the water flea, *Daphnia*, for ethical reasons.

In her study, Sam attempted to keep the temperature of the various caffeine solutions constant. As an extension of this work, she decided to investigate the effect of temperature on heart rate in more detail.

In this new investigation Sam used a small glass chamber which could hold the *Daphnia* and water at a set temperature. The whole apparatus could be placed under a microscope so that the *Daphnia* heart could be seen. She videoed four *Daphnia* at each of five different temperatures for 30 seconds. She used a slow motion replay of the video to count the number of heart beats in 30 seconds for each *Daphnia* at each temperature. Her data are summarised in the table below:

Temperature (°C)	**Number of heart beats in 30 seconds**				**Mean heart rate / minute (bpm)**
	***Daphnia* 1**	***Daphnia* 2**	***Daphnia* 3**	***Daphnia* 4**	
5	91	75	84	69	
10	101	106	103	112	
18	125	124	119	127	
24	144	137	126	127	
30	160	175	160	180	

(a) (i) State and explain **one** ethical reason why Sam chose to use *Daphnia* for this investigation.

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(2)

Leave blank

(ii) Suggest **one** reason for her choice of maximum temperature (30 °C) and **one** reason for her choice of minimum temperature (5 °C) used.

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(2)

(iii) In her investigation, how did Sam try to ensure the reliability of her data?

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(1)

(iv) Which aspect of her investigation was improved when Sam decided to video the *Daphnia*?

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(1)

(b) (i) Calculate the mean heart rate in **beats per minute** for each temperature. Write your answers in the spaces provided in the table. Show your working in the space below.

(3)

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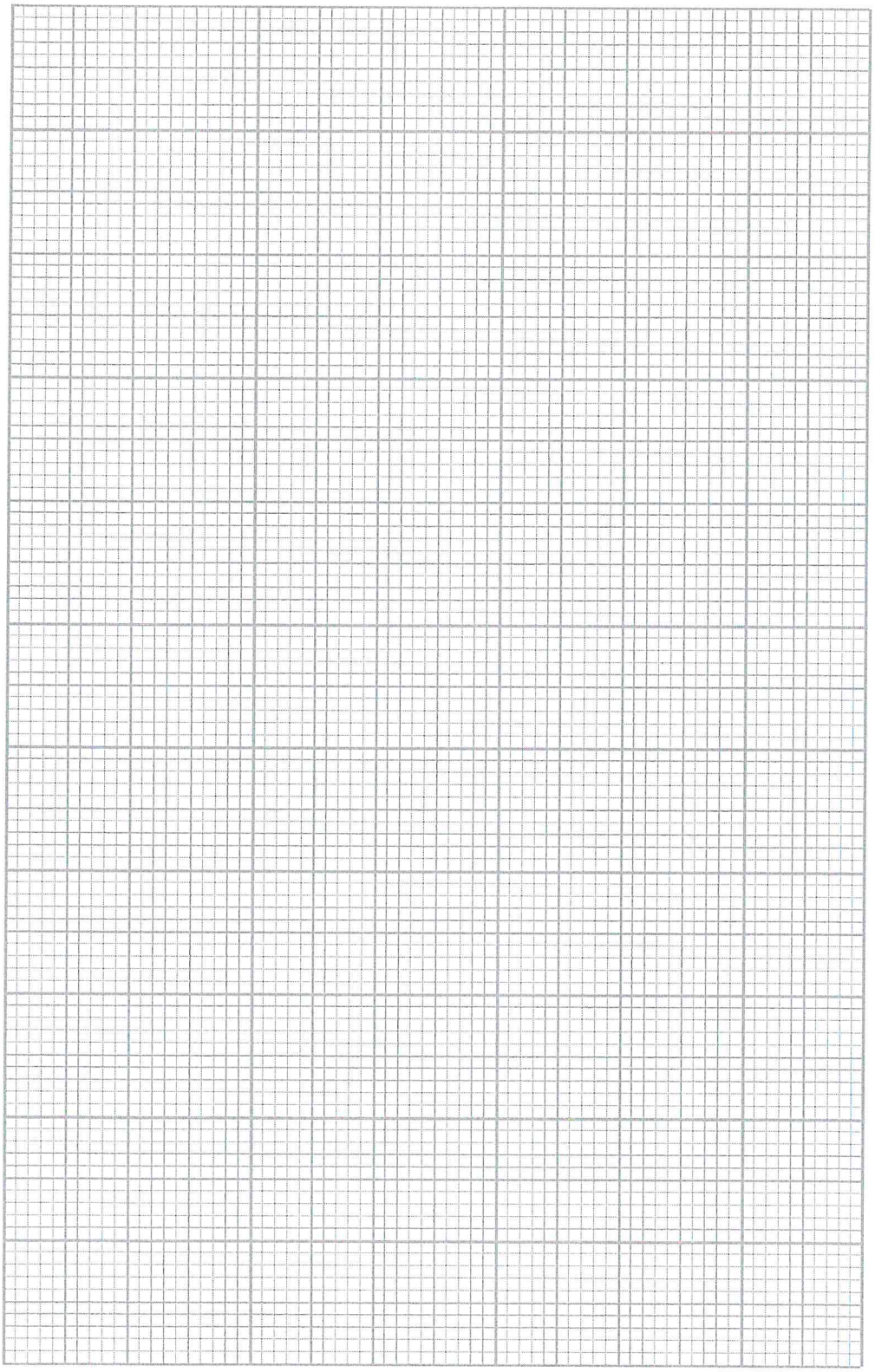
(ii) Use these data to plot a fully-labelled graph to show the effect of temperature on the mean heart rate of *Daphnia*. On your graph, show the variability of the data.



(5)

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(c) In order to get some idea of the validity of her data, Sam searched the Internet for similar studies. She could not find any studies that had used her method exactly, especially the video technique, but she did find data from studies in which direct observation had been used to count heart rates in *Daphnia*. She compared the results from one such study, shown in the following table, with her own.

Temperature (°C)	Mean heart rate (beats per minute)
5	75
10	160
15	155
20	205
25	200
30	212
40	175

(i) State **one** similarity and **one** difference in the conclusions Sam could make about the effect of temperature on *Daphnia* heart rate, based on these two sets of data.

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(2)

(ii) Suggest **one** explanation for the similarity and **one** explanation for the difference you have given above.

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(4)

Q1

(Total 20 marks)