SL DP Biology
Summer Assignment

Due August , 2022- First day of classes

Part A: Chapter Notes

Read unit 5 : Chapters 5.1 – 5.2 and write chapter notes.

Part B

Lab Report

a. Use the class data of the experiment about respiration in yeast to complete the lab report. Use the following documents to help you write your lab report.

   i. Class data: the link to the document below has the data and the specifications of the gas pressure sensor used. And some helpful hints.

      Effect of substrate concentration of the rate of respiration in yeast

      https://docs.google.com/spreadsheets/d/18IU991GK5qm50UFNeVGHZpkQSpypO3GwbnUmT5YQ194/edit#gid=0

   ii. Model Lab report posted in the resources course

      Model lab report/ Lab report help

      https://drive.google.com/file/d/1ue-XMTm7ZCb3ztK4va98rO5Sh9PfZetr/view?usp=sharing

   iii. Lab report check list

      Check List

      https://drive.google.com/file/d/1H79s5v1ofSI7bchwVUudWZ716ARoLbZW/view?usp=sharing

   iv. Lab marking criteria

      Marking Criteria

      https://drive.google.com/file/d/1Rgewu1J_n8lBcNE1bh6iAQnR0A_VG5VZ/view?usp=sharing

   v. **Statistical Analysis** chapter to help you analyze your data

      Statistical Analysis -2021

https://drive.google.com/file/d/1NcDhrDY7rXQFbca7jyse7MjrxqoZ8eJP/view?usp=sharing

Part C: **Data Base Questions**

Answer questions 1-3

Questions 4-5 are optional but highly recommended

Hints that help you answer database questions:

a. Read carefully the **introduction** to each question and highlight key information.

b. Read carefully the l**abels** on the x-axis and y-axis.

c. Read the **units** of the axes.

d. Read the **key** of the graph and familiarize yourself with the symbols.

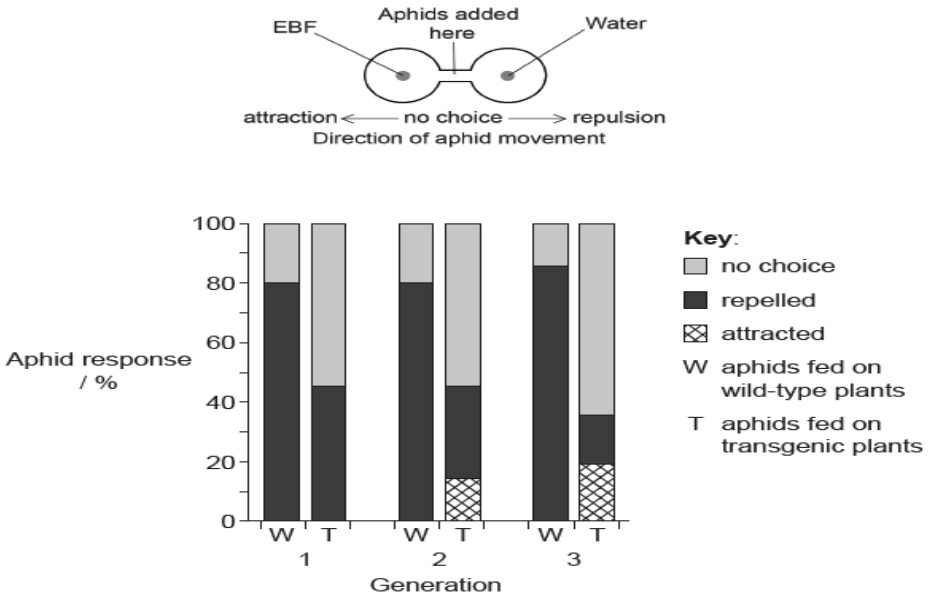
e. Do not read too much into each questions, the answers are simple and found in the graph.

f. The number of points given to each question are a key to how detailed your answer should be.

Question1

A study was carried out on the defence systems in aphids (*Myzus persicae*) which feed on thale cress plants (*Arabidopsis thaliana*). Individual aphids release an alarm compound containing the chemical (E)-β-farnesene (EBF) when attacked by a predator. Other aphids are repelled and leave the thale cress plant or hide.

The gene for EBF was inserted to produce transgenic (T) thale cress plants to test aphid reaction to EBF over several generations. Aphids were raised on wild type (W) thale cress and then allowed to feed for three generations on either W or T thale cress. Aphids were tested in each generation for their reaction when EBF was added to a choice chamber. The percentages of aphids attracted to or repelled by EBF and those which made no choice were recorded.



[Source: M De Vos, *et al*., (2010), *PNAS*, **107** (33), pages 14673–14678]

1a. Identify, with a reason, the aphids that were most strongly repelled by EBF.

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1b. *[2 marks]*

Outline the conclusions that can be drawn from the data in the graph for the group of aphids fed for three generations on transgenic thale cress plants (T).

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1c. *[2 marks]*

Discuss whether natural selection would favour the transgenic EBF-producing thale cress plants if they were released into the wild.

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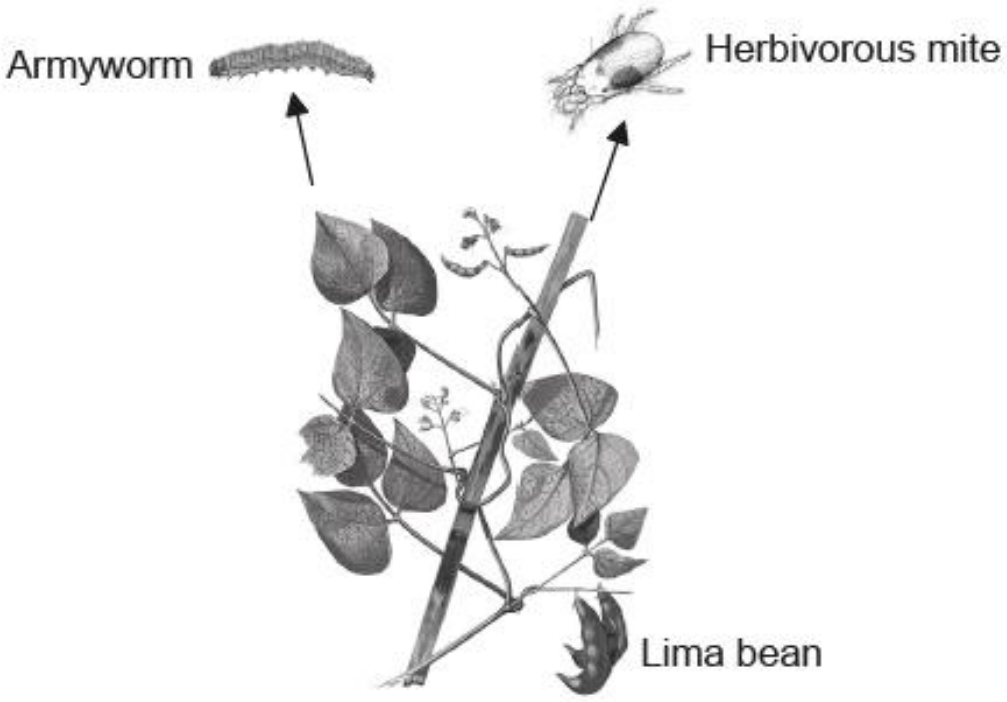
Question 2

Organisms often release chemicals when attacked as part of their defence system. Scientists studied lima bean plants (*Phaseolus lunatus*) infested with either an armyworm, *Spodoptera exigua*, or a herbivorous mite, *Tetranychus urticae*. Both organisms feed on lima bean leaves, causing the leaves to release chemicals.

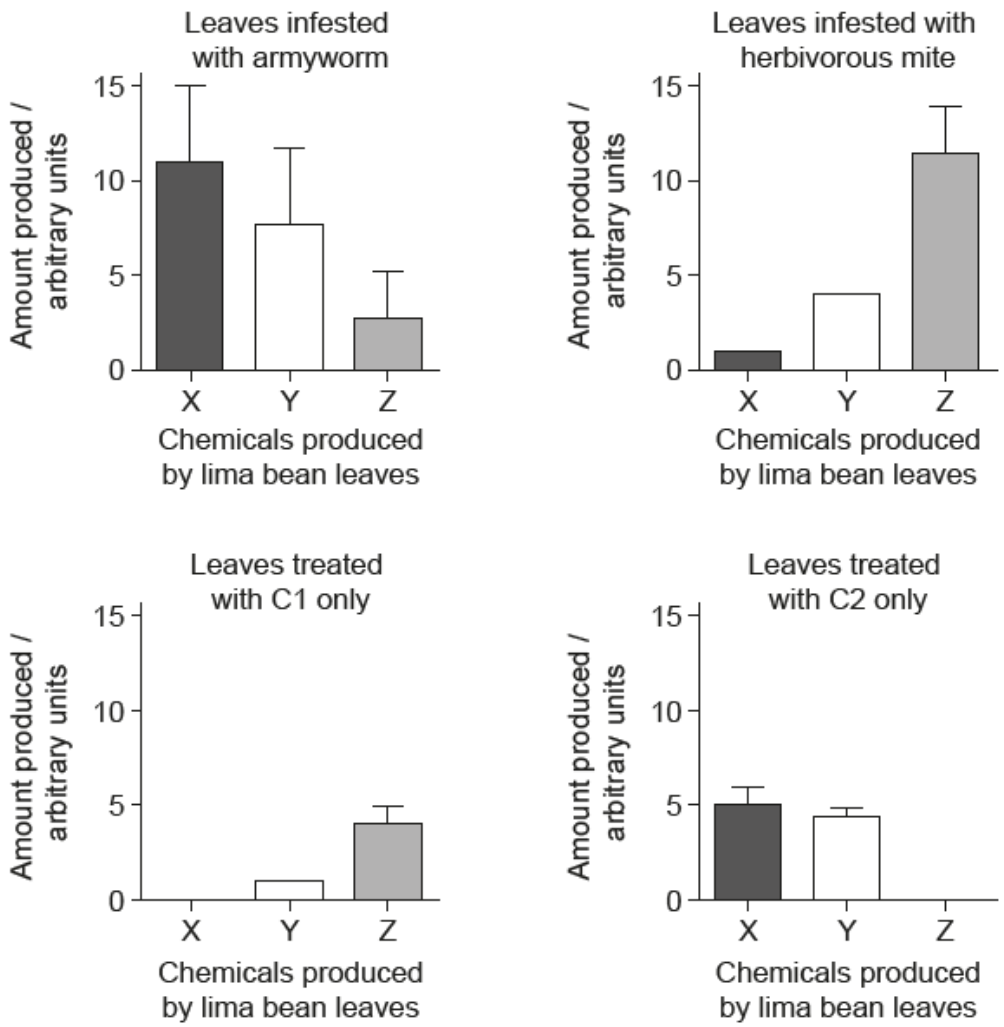


[Source: https://commons.wikimedia.org/wiki/File:Phaseolus_lunatus_Blanco2.369.png]

The study was conducted to see which defence chemicals were produced by lima bean leaves when infested by armyworms or herbivorous mites. The scientists identified a mixture of compounds (C) released by the plant when attacked. Two of the chemicals in this mixture were identified (C1 and C2).

The scientists hypothesized that the defence chemicals in C act as signals to produce other chemicals (X, Y and Z) that are also involved in the defence of the plant.

The graphs show the amounts of chemicals X, Y and Z produced when the plants were infested by either one of the two herbivores or treated with the different chemicals C1 or C2.



[Source: R Ozawa and G Arimura, Involvement of Jasmonate- and Salicylate-Related Signaling Pathways for the Production of Specific Herbivore-Induced Volatiles in Plants, *Plant and Cell Physiology*, 2000, **41**, 4, 391–398, by permission of Oxford University Press]

2a. Distinguish between the data for the leaves infested with the armyworm and the leaves infested with the herbivorous mite. *[3 marks]*

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2b. *[3 marks]*

Compare and contrast the effects of treatment of the leaves using C1 and C2 with the effects of infestation.

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2c. *[1 mark]*

RNA was collected from leaves of the plants after each treatment (armyworm, herbivorous mite and the chemicals C1 and C2). DNA copies of the extracted RNA were made by a process called reverse transcription. Targeted genes in the DNA were then amplified.

Identify the process that was used to amplify the targeted genes.

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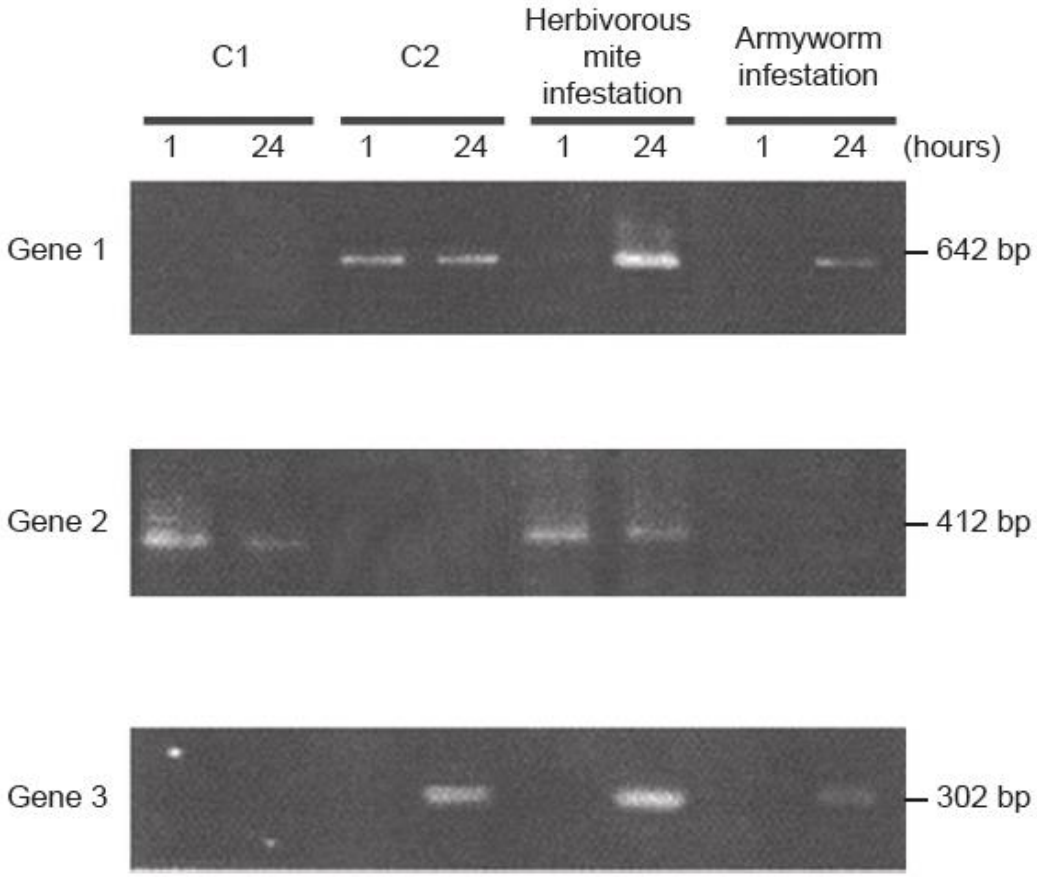
2d. *[1 mark]*

The scientists then used the transcribed DNA of each treatment to study the activation of three genes of the plants' defence system. The DNA was separated by gel electrophoresis. The activation was tested one hour after treatment and again after 24 hours.



[Source: R Ozawa and G Arimura, Involvement of Jasmonate- and Salicylate-Related Signaling Pathways for the Production of Specific Herbivore-Induced Volatiles in Plants, *Plant and Cell Physiology*, 2000, **41**, 4, 391–398, by permission of Oxford University Press]

Deduce, with a reason, which gene is first transcribed when exposed to C2.

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2e. *[3 marks]*

Each gene is activated by one or more of the treatments. From the gel electrophoresis data, discuss the impact of the herbivorous mite infestation on gene activation compared to treatment with C1 and C2.

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2f. *[2 marks]*

Using the gene activation data, deduce, giving **two** reasons, whether the armyworm or the herbivorous mite has infested lima bean plants over a longer period of time.

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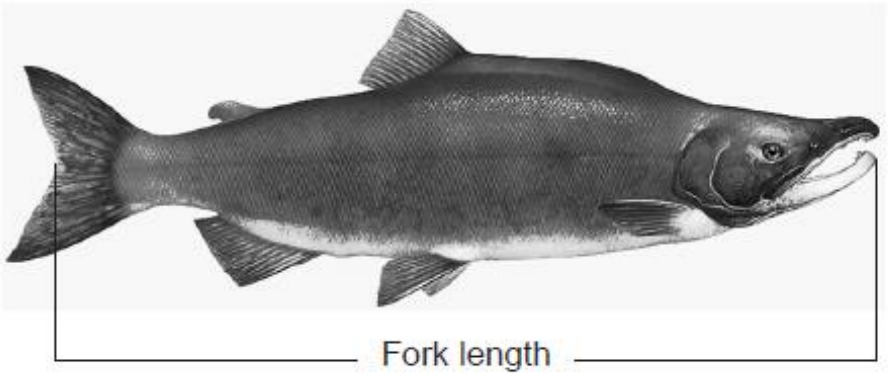
Question 3

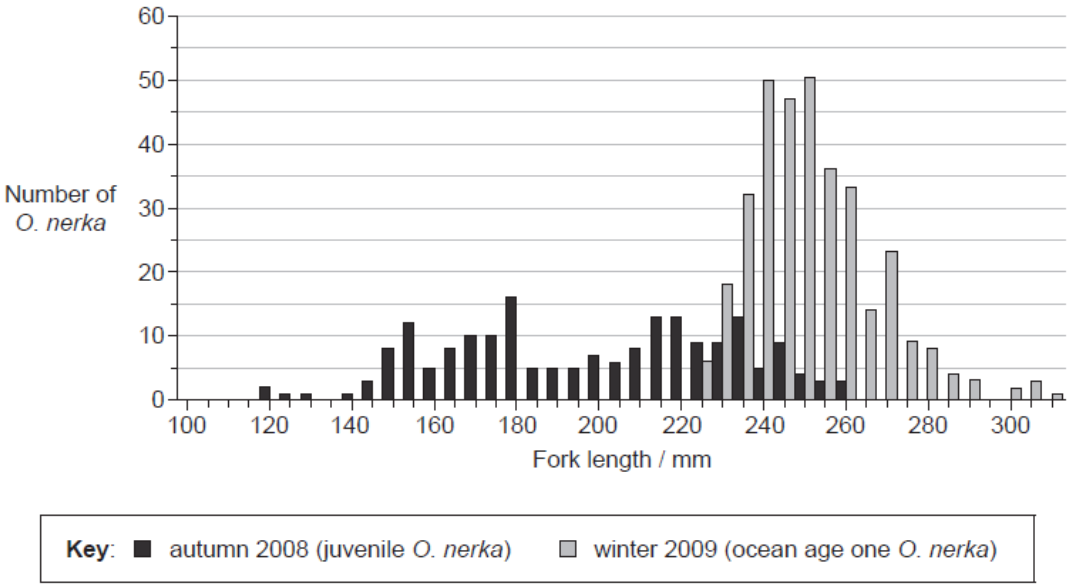
3a. *[1 mark]*

Sockeye salmon (*Oncorhynchus nerka*) spend the first years of their lives in the freshwater lakes of Alaska before migrating to marine waters. Their first months in marine waters are spent foraging and growing near the shore line. They then move to offshore regions of the North Pacific Ocean for 2 to 3 years.



[Source: adapted from http://pnwfolklore.org]

The graph shows fork length frequency of juvenile *O. nerka* caught during their first months in marine waters in autumn 2008 and ocean age one *O. nerka* caught 15 months later during winter 2009 in the North Pacific Ocean.



[Source: adapted from E V Farley, *et al.*, (2011), *ICES Journal of Marine Science*, **68** (6), pages 1138–1146]

Identify the most frequent fork length for *O. nerka* caught during autumn 2008 and winter 2009.

Autumn 2008: ……

Winter 2009: ……

3b. *[2 marks]*

Distinguish between the fork lengths of *O. nerka* in autumn 2008 and winter 2009.

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3c. *[1 mark]*

Suggest a reason for the variation in fork length of ocean age one *O. nerka*.

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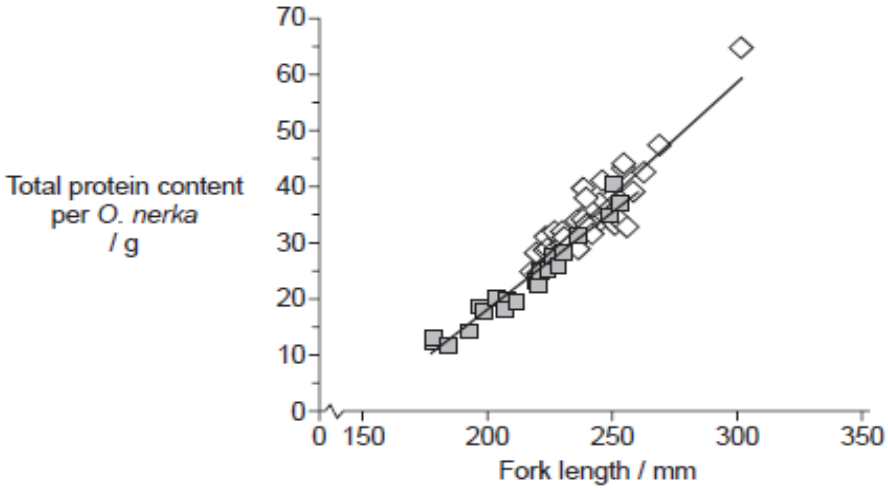
3d. *[2 marks]*

Protein content in *O. nerka* was measured to evaluate possible differences during their first 15 months at sea. The graph shows the relationship between fork length and total protein content per *O. nerka* caught during autumn 2008 and winter 2009.



[Source: adapted from EV Farley, *et al.*, (2011), *ICES Journal of Marine Science*, **68** (6), pages 1138–1146]

Compare the protein content for *O. nerka* caught during autumn 2008 and winter 2009.

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3e. *[1 mark]*

Outline the difficulty in predicting the age of *O. nerka* from fork length.

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3f. *[1 mark]*

Using the data, suggest **one** reason for the relationship between protein content and fork length.

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3g. *[2 marks]*

Scientists measured mercury levels in different fish. The table shows the results.

	Mercury / $\mu g\,g^{-1}$				
	Mean	Standard deviation	Minimum	Maximum	Number of samples
Cod	0.111	0.066	0.001	0.989	115
Monkfish	0.181	0.075	0.056	0.289	9
Shark	0.979	0.626	0.001	4.540	356
Trout	0.071	0.025	0.001	0.678	35

Compare the results shown in the table for monkfish and shark.

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3h. *[1 mark]*

Suggest additional information that would be helpful in evaluating these data.

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3i. *[1 mark]*

State which type of fish shows the most variation.

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Question 4

Urease is an enzyme that breaks down urea into ammonia and carbon dioxide. The ammonia produced causes the pH of the solution to rise. This reaction can be followed using a pH indicator or a pH probe.

In an experiment conducted by a student the time taken for the pH indicator, thymol blue, to change from yellow to blue was recorded at different temperatures.

Temperature / °C ± 1	Time / s ± 1						
	Trials					Mean	Standard deviation
	1	2	3	4	5		
30	109	62	79	59	65	75	21
40	54	46	38	42	43	45	6
50	31	30	31	34	27	31	3
60	23	18	19	21	18	20	2
70	19	29	29	31	36	29	6

4a. Outline what the standard deviations reveal about the data from this experiment..

[2 marks]

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4b. *[2 marks]*

One result in this experiment can be classified as an outlier as its value is very distant from those of the other values.

Explain an appropriate procedure for dealing with outliers.

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4c. *[2 marks]*

Outline the effect of temperature on the activity of urease enzyme.

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4d. *[1 mark]*

State **one** factor that would need to be controlled in this experiment.

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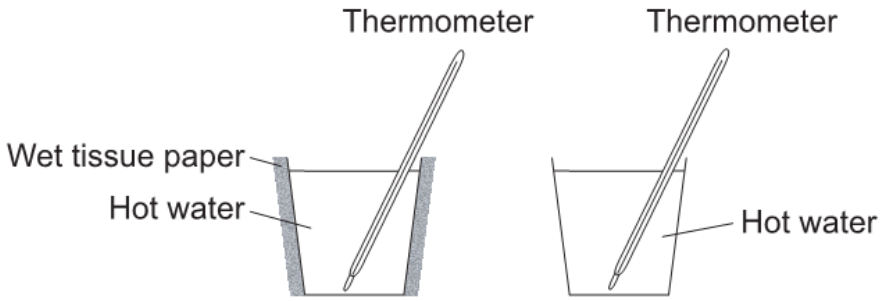
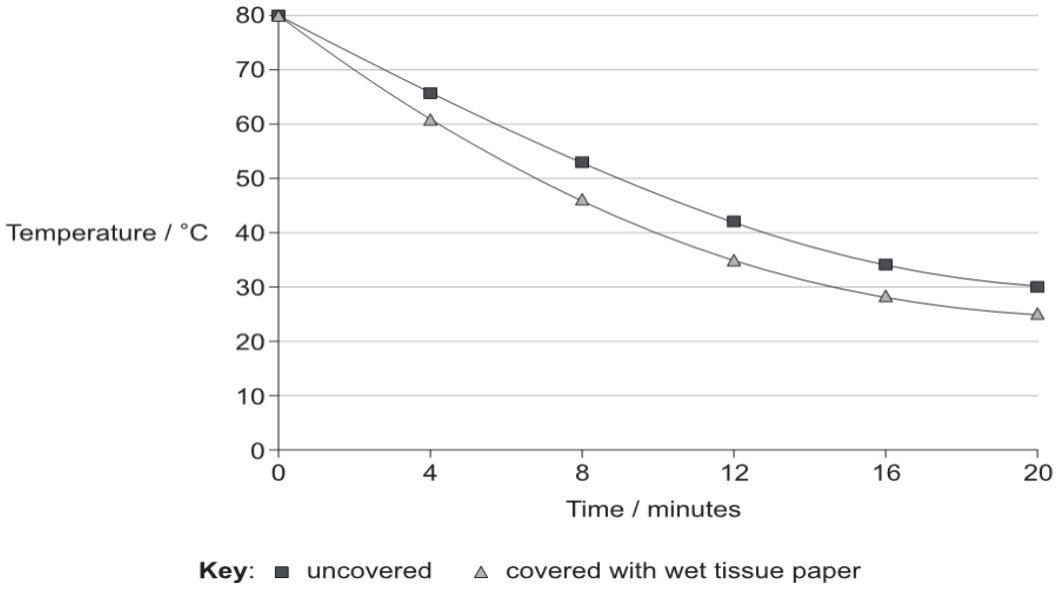
Question 5

To investigate the thermal properties of water, students placed hot water in two thin plastic cups and measured their rate of cooling. The sides of one cup were covered with tissue paper soaked in hot water; the other cup was left uncovered. The temperature was recorded with a thermometer every 4 minutes for 20 minutes. The temperature in the laboratory was 18 °C.



[Source: © International Baccalaureate Organization 2017]



[Source: © International Baccalaureate Organization 2017]

5a. *[1 mark]*

Calculate the change in temperature in each cup after 20 minutes.

Uncovered:

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Covered with wet tissue paper: ……

5b. *[2 marks]*

State **two** conditions that must be the same for each cup at the start of the experiment.

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5c. *[1 mark]*

Predict the temperature of the water in the cups after 3 hours.

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5d. *[3 marks]*

Explain, with reference to the thermal properties of water, how this experiment helps demonstrate how humans respond to overheating.

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Have a great summer and I am looking forward to seeing you in August.