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PROCESSING LABEL HERE

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Write your **student number** in the boxes above.

**Letter**

# VET Laboratory Skills

## Question and Answer Book

VCE Examination – Wednesday 13 November 2024

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- Reading time is **15 minutes**: 9.00 am to 9.15 am
- Writing time is **1 hour 30 minutes**: 9.15 am to 10.45 am

### Approved materials

- One scientific calculator

### Materials supplied

- Question and Answer Book of 24 pages
- Multiple-Choice Answer Sheet

### Instructions

- Follow the instructions on your Multiple-Choice Answer Sheet.
- At the end of the examination, place your Multiple-Choice Answer Sheet inside the front cover of this Question and Answer Book.

Students are **not** permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

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Contents	pages
<b>Section A</b> (20 questions, 20 marks) _____	2–6
<b>Section B</b> (10 questions, 80 marks) _____	7–20

## Section A – Multiple-choice questions

### Instructions

- Answer **all** questions on your Multiple-Choice Answer Sheet.
  - Choose the response that is **correct** or that **best answers** the question.
  - A correct answer scores 1; an incorrect answer scores 0.
  - Marks will **not** be deducted for incorrect answers.
  - No marks will be given if more than one answer is completed for any question.
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### Question 1

Quality control in the laboratory can be defined as

- A. tests that have numerical results.
- B. the responsibility of the laboratory manager.
- C. the guarantee that standard operating procedures (SOPs) that are to be followed have been repeated many times.
- D. a set of processes that ensure laboratory procedures are fit for purpose, reproducible and accurate.

### Question 2

Which fluid could be used to prepare a wet mount slide of pond water?

- A. water and ethanol
- B. water and glycerine
- C. water and aqueous nitrate
- D. water and acetone

### Question 3

Which of the following SOP steps would demonstrate 'clean as you go' in the laboratory to reduce the risk of accidents and increase laboratory productivity?

- A. Dispose of waste at the end of a test.
- B. Clean up chemical spills when they happen.
- C. Return all reagents and equipment only when finished.
- D. Pour all excess dispensed chemicals back into the correct reagent bottles.

### Question 4

After collecting a sample of river water, the technician prepared a wet mount slide and examined it using a compound microscope. At first there appeared to be moving protozoa. After some time, there was no movement observed.

The reason for this could be that the

- A. protozoa were resting.
- B. protozoa lacked oxygen.
- C. protozoa were affected by contaminants in the water.
- D. heat from the microscope's light evaporated the water.

**Question 5**

A technician is aliquoting extraction buffer into microcentrifuge tubes to be used for DNA analysis. Select the best method to prevent cross-contamination.

- A. Use a sterile micro-pipette tip for every tube, and leave the tubes open, ready for the next step.
- B. Handle the specimens carefully; there is no need to wear gloves because the buffer is not hazardous.
- C. The same micro-pipette tip can be used for all tubes, but ensure the tip does not touch the bench or the solution in the tubes.
- D. Wipe down the bench and all equipment, such as micro-pipettes, with a decontamination solution at the end of the process.

**Question 6**

The number of moles of chloride ions in 250 mL of a 0.500 M solution of  $\text{CaCl}_2$  is

- A. 1.25 mmol
- B. 2.50 mmol
- C. 125 mmol
- D. 250 mmol

**Question 7**

What does a solution with a pH of 8.0 indicate?

- A. that it is acidic
- B. that it is alkaline
- C. that it is neutral
- D. that it has a concentration of 8.0 M

**Question 8**

A safety cabinet that protects both the sample and the operator from contamination is a

- A. fume cupboard.
- B. laminar flow cabinet.
- C. biological cabinet Class II.
- D. clean bench cabinet.

**Question 9**

The purpose of volumetric analysis is to

- A. calculate the concentration of an unknown substance.
- B. observe the colour change of a solution.
- C. measure the pH of a solution.
- D. determine the volume of the titre.

**Question 10**

How should organic chemical residue be disposed of?

- A. poured down the sink, diluting with water
- B. neutralised and then poured down the sink
- C. in a labelled organic waste container for collection
- D. placed in the biological waste bin

**Question 11**

Which one of the following is correct when using stereo and compound microscopes?

- A. Slides must be used to mount the specimens to be viewed for both stereo and compound microscopes.
- B. Stereo microscopes can be used to view thinner, smaller specimens more effectively than compound microscopes.
- C. Stereo microscopes can be used to view three-dimensional images of specimens, and compound microscopes can be used to view two-dimensional images of specimens.
- D. Stereo microscopes can be used to view two-dimensional images of specimens, and compound microscopes can be used to view three-dimensional images of specimens.

**Question 12**

Which of the following is an example of a quality control measure that might be used to check whether a sterile sample is contaminated after a transfer?

- A. Use a sterile dropper to aliquot a drop onto an agar plate and incubate overnight at 37 °C, then check for changes.
- B. Make a visual examination of the sample for any changes after a day or two in the refrigerator.
- C. Incubate the whole sample at 37 °C overnight, then check for changes.
- D. Autoclave the whole sample and then check for any visual changes.

**Question 13**

A concentration unit of 15 g/100 g would be written as

- A. 15% w/v.
- B. 15% w/w.
- C. 15% v/v.
- D. 15 ppm.

**Question 14**

A facultative anaerobic bacterium

- A. can grow with or without oxygen.
- B. requires light and oxygen to grow.
- C. can grow using carbon dioxide and oxygen.
- D. requires light and carbon dioxide to grow.

**Question 15**

What would be the correct term for potassium hydrogen phthalate ( $C_8H_5KO_4$ ) when used to standardise a solution of sodium hydroxide (NaOH)?

- A. secondary standard
- B. primary standard
- C. primary solution
- D. stock solution

**Question 16**

A technician used a compound light microscope to view a patient's blood smear using a 10× ocular and 40× objective lens to best visualise all blood components.

What was the total magnification?

- A. 400×
- B. 40×
- C. 10×
- D. 4×

**Question 17**

When handling blood samples before leaving the laboratory at the end of a roster, technicians should

- A. discard the remaining samples into the general waste bin, remove all personal protective equipment (PPE) and place it in the biohazard waste.
- B. discard the remaining samples into the biohazard waste, remove all PPE and wipe down the benches with soap and water.
- C. wipe down the benches with disinfectant, place remaining samples in the refrigerator for later reference, remove all PPE and place it in the general waste bin.
- D. place the remaining samples in the refrigerator for later reference, swab the bench with 70% ethanol, remove all PPE and place it in the biohazard waste.

**Question 18**

An ongoing issue for laboratories is the production of waste while trying to follow sustainable practices.

The volume of waste will probably increase if

- A. chemical spills are minimised.
- B. standard operating procedures are followed.
- C. procedures are repeated when poor quality materials are used.
- D. minimal quantities of chemicals are used during quality control testing.

**Question 19**

Which solution is **not** used as a staining solution for wet or dry mounts?

- A. iodine
- B. crystal violet
- C. methylene blue
- D. phenolphthalein

**Question 20**

Working in teams can have a positive impact on the accuracy of laboratory results by

- A. reducing technician stress.
- B. saving management time and effort.
- C. being more profitable financially for the company.
- D. allocating tasks based on strengths.

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## Section B – Short-answer questions

### Instructions

- Answer **all** questions in the spaces provided.
  - Write your responses in English.
  - Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.
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### Question 1 (6 marks)

A technician observed white frosting on some chemical bottles while they were replacing a bottle of acid in the corrosives cabinet. The cabinet houses both acids and bases separately, and has a large double door and internal dividing wall between the two halves.

- a. Explain what could be causing the white frosting on the containers in the cabinet. 2 marks

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- b. Describe **two** actions the technician could take to remedy the situation. 4 marks

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**Question 2** (4 marks)

A doctor has called a pathology testing laboratory asking for urgent test results before a patient’s surgery. It appears that the samples have not been processed because the courier was delayed.

- a. Suggest **two** things the technician could say to the doctor to meet customer service principles. 2 marks

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- b. Propose **two** possible actions that could be taken before processing the samples. 2 marks

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**Question 3** (10 marks)

A laboratory technician prepares to subculture liquid cell cultures in a laboratory. The technician puts on a laboratory gown, safety glasses and gloves, and then organises their workspace in the tissue culture cabinet.

- a. In the table below, list three items of equipment that the laboratory technician would need to utilise in this procedure. Provide a valid explanation for each choice.

3 marks

Equipment	Explanation
1.	
2.	
3.	

- b. Describe two possible actions the technician should undertake to prevent cross-contamination when transferring sterile tissue culture media stock into new culture flasks.

4 marks

Action 1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Action 2 \_\_\_\_\_

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\_\_\_\_\_

**Question 3** continues on the next page.

c. While carrying out the transfer of the culture media, the technician notices that the media in one container is very cloudy.

i. What could be **one** possible cause for the cloudiness?

1 mark

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ii. Describe the best course of action the technician should take in response to the media's cloudiness.

2 marks

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**Question 4** (5 marks)

You are the laboratory technician at a genomic testing laboratory, processing frozen blood samples for DNA sequencer runs. To do this job you follow an SOP for DNA extraction, part of which is shown below.

**Steps**

1. Obtain the blood samples from the  $-70\text{ }^{\circ}\text{C}$  freezer.
2. Thaw the frozen samples, add 0.8 mL of buffer, and mix.
3. Transfer to a microcentrifuge tube.
4. Centrifuge for 1 minute at 12 000 rpm in the microcentrifuge.
5. Remove 1 mL of the supernatant and discard into disinfectant (bleach).
6. Add 1 mL of buffer, resuspend, centrifuge as in step 4 for 1 minute, and remove all the supernatant.
7. Add 375  $\mu\text{L}$  of 0.2 M sodium acetate to each pellet and briefly mix in a vortex mixer.
8. Add 25  $\mu\text{L}$  of 10% detergent solution and 5  $\mu\text{L}$  of proteinase, vortex briefly and incubate for 1 hour at  $55\text{ }^{\circ}\text{C}$ .

- a. What is **one** important instruction missing from Step 3 above?

Give a reason for your answer.

2 marks

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- b. List two different types of control measures that should be taken to prevent contaminating the blood samples with foreign DNA.

2 marks

Measure 1 \_\_\_\_\_

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Measure 2 \_\_\_\_\_

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- c. Name **one** hazard the laboratory technician might be exposed to when processing the samples for the DNA sequencer.

1 mark

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**Question 5** (5 marks)

A laboratory technician has been asked to prepare some sterile agar plates. They are not sure of the method they need to follow.

- a. Where could the technician find the method to make the plates? 1 mark

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- b. Identify **two** factors that affect sterilisation in an autoclave. 2 marks

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- c. The technician finds that the autoclave indicator tape did not change colour after completing an autoclave cycle. Suggest **two** things that they should do in this situation. 2 marks

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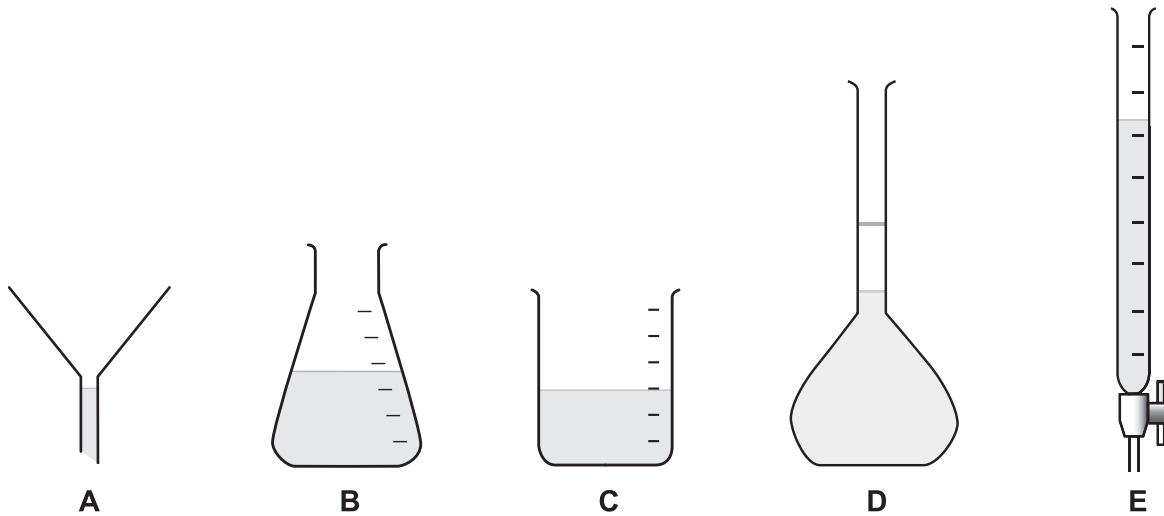
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**Question 6** (6 marks)

Five pieces of laboratory equipment labelled A, B, C, D and E are shown in the diagram below.



Source: Created with chemix <chemix.org>

a. Identify the **two** volumetric pieces of equipment.

2 marks

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b. Name two pieces of equipment shown in the diagram above that would be required to perform a titration. Describe how each of these pieces of equipment would be used.

4 marks

Equipment 1

Name \_\_\_\_\_

Use \_\_\_\_\_

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Equipment 2

Name \_\_\_\_\_

Use \_\_\_\_\_

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**Question 7** (20 marks)

A technician working in a school laboratory has been asked to prepare 2.00 L of 1.00 M sulfuric acid for a senior chemistry class.

- a. The technician first prepares a label for the bottle in which the solution will be stored.
- i. Draw or describe one safety symbol that would be required on the bottle. 1 mark



- ii. List **one** other piece of information that would be needed on the bottle label for the prepared solution. 1 mark

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- b. i. Give the chemical formula for sulfuric acid. 1 mark

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- ii. Is sulfuric acid an element or a compound? Explain the reasoning behind your answer. 2 marks

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- c. Where could the technician find the safe handling and disposal instructions for the sulfuric acid? 1 mark

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- d. List **two** pieces of personal protective equipment (PPE) the technician should wear when preparing this solution. 2 marks

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- e. Upon checking the corrosives cabinet, the technician finds a stock solution of 5.00 M sulfuric acid that could be used to prepare the solution.

Describe **two** things the technician should check to ensure the solution is fit for purpose. 2 marks

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- f. The technician has decided the 5.00 M stock solution is fit for purpose and commences to prepare 2.00 L of the 1.00 M sulfuric acid solution.

- i. Calculate the amount of 5.00 M sulfuric acid required. Show all workings. 2 marks

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- ii. List **two** pieces of equipment required for the preparation of the sulfuric acid solution. 2 marks

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- iii. Outline the four steps in the preparation of the sulfuric acid solution. 4 marks

Step 1 \_\_\_\_\_

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Step 2 \_\_\_\_\_

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Step 3 \_\_\_\_\_

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Step 4 \_\_\_\_\_

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- g.** In the process of making the sulfuric acid solution, the technician spills some of the 5.00 M stock solution on the bench. Describe the steps necessary to clean this spill. 2 marks

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**Question 8** (8 marks)

A large batch of nutrient agar plates were freshly prepared in a laboratory, and five of them were selected randomly for a test procedure. Four of the selected plates were inoculated with a pure bacterial culture, and all five plates were incubated for 48 hours at 37 °C. On examination, growth of colonies of varying colour, size and shape were observed on all five plates.

- a. Laboratory staff concluded that appropriate quality control checks were most likely not followed. What evidence was there to support this conclusion?

1 mark

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- b. The laboratory supervisor suggests there may have been cross-contamination when preparing the nutrient agar plates. Describe **three** techniques to prevent cross-contamination that could be followed in future to improve the laboratory's quality control processes.

3 marks

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- c. In the laboratory, disinfectants and antiseptic solutions are routinely used.

- i. What are **two** differences between a disinfectant and an antiseptic?

2 marks

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- ii. Give an example of how a disinfectant solution and an antiseptic solution could be used to prevent cross-contamination.

2 marks

Disinfectant \_\_\_\_\_

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Antiseptic \_\_\_\_\_

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**Question 9** (12 marks)

Below are images of a compound and stereo microscope.

The base of each microscope is labelled A.



**Image 1**



**Image 2**



Source (Image 1): <https://scioly.org/wiki/index.php/microscope>; (Image 2): [bhphotovideo.com](http://bhphotovideo.com)

- a. Label the two images with tagged letters (B, C, D, E) to show the location of each of the microscope parts listed in the table below.

Complete the table, indicating which letters represent each of the parts.

An example has been provided.

4 marks

Microscope part	Image 1	Image 2
Base	Letter: A	Letter: A
Eyepiece/ocular lens	Letter:	Letter:
Objective lens	Letter:	Letter:
Focus control	Letter:	Letter:
Stage clips	Letter:	Letter:

- b. i.** Describe a hazard associated with using a light microscope. 1 mark

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- ii.** Suggest how you could control the risk associated with this hazard. 1 mark

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- c.** Outline four important steps that should be taken when a microscope is being cleaned and transported after use. 4 marks

Step 1 \_\_\_\_\_

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Step 2 \_\_\_\_\_

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Step 3 \_\_\_\_\_

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Step 4 \_\_\_\_\_

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- d.** Explain what is meant by the term 'inversion phenomenon' when using a microscope. 2 marks

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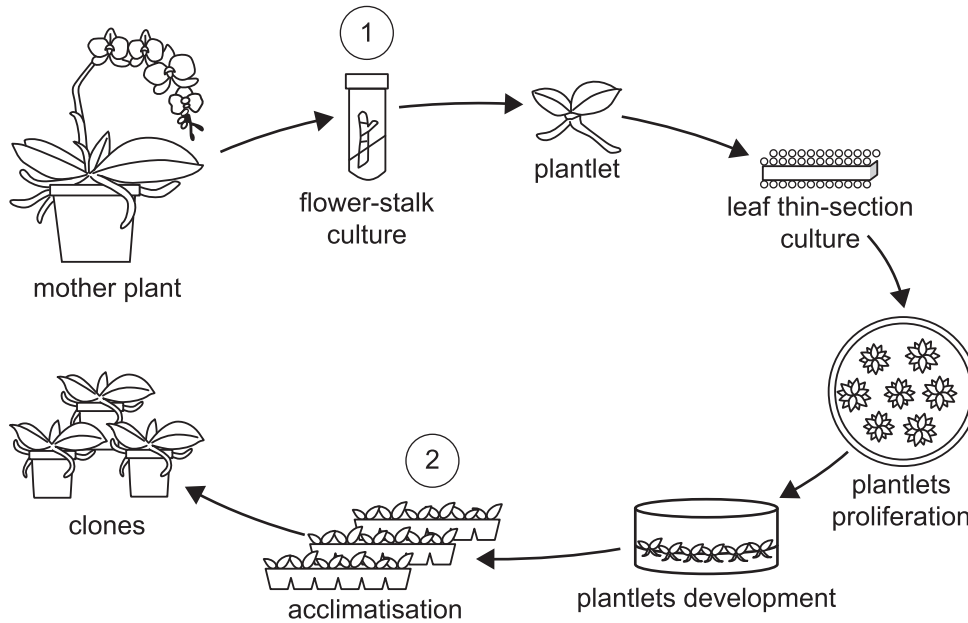
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**Question 10** (4 marks)

A large orchid breeding company has a plant tissue culture laboratory. There are several quality control points to be monitored when preparing tissue culture samples. There are two numbered points in the diagram below. Suggest a control measure that might need to be monitored regularly at each numbered point.



Source: Adapted from Kee Yoeup Pack, Eun Joo Hahn and So Young Park (2011). 'Micropropagation of *Phalaenopsis* Orchids via Protocorms and Protocorm-Like Bodies', *Methods in Microbiology* (Clifton, N.J.) <[https://experiments.springernature.com/articles/10.1007/978-1-61737-988-8\\_20](https://experiments.springernature.com/articles/10.1007/978-1-61737-988-8_20)>

Point 1 \_\_\_\_\_

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Point 2 \_\_\_\_\_

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