

**Victorian Certificate of Education
2018**

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER Letter

VCE VET LABORATORY SKILLS
Written examination

Wednesday 21 November 2018

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
A	20	20	20
B	17	17	80
			Total 100

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

- Question and answer book of 19 pages
- Answer sheet for multiple-choice questions

Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

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

SECTION A – Multiple-choice questions**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

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.

Question 1

What information should be included on the label for an agar streak plate that has been streaked?

- A. employee name, date of birth, sample identification
- B. employee name, client name, date of sample receipt
- C. date of sample receipt, laboratory name, room temperature
- D. employee name, date of sample preparation, sample identification

Question 2

When using a compound microscope with its high-power objective lens, which one of the following should **not** be adjusted?

- A. coarse focus
- B. diaphragm
- C. stage clips
- D. fine focus

Question 3

Laboratory staff have been informed by the laboratory supervisor that a new model of sterilising equipment will be installed in the laboratory the following week.

Based on this information, what action should an inexperienced technician take?

- A. Wait for the laboratory supervisor to tell them when the training for the new equipment model will take place.
- B. Research information about the new equipment model before it arrives, to help train their colleagues on how to use it.
- C. Research information about the new equipment model, then ask the laboratory supervisor about training opportunities.
- D. Research information about the new equipment model and inform the laboratory supervisor that they do not require any training.

Question 4

The correct procedure is being used to prepare primary standard solutions accurately.

During this procedure, quantitative transfer of a solid is used in order to

- A. transfer an exact mass of solute during preparation of the solution.
- B. operate the balance according to the manufacturer's instructions.
- C. find a probable estimate of the final concentration of the solution.
- D. ensure the correct materials are chosen for preparation of the solution.

Question 5

A dilution of potassium chloride, KCl, is to be prepared in the laboratory. 100 mL of a 0.1 M solution of KCl is transferred to a 200 mL volumetric flask and deionised water is added to the mark.

The deionised water is **best** identified as the

- A. liquid.
- B. solute.
- C. solvent.
- D. solution.

Question 6

A laboratory technician receives a call from a client's partner, requesting the client's test results.

What is the most appropriate action that should be taken by the laboratory technician?

- A. Retrieve the test results and then pass the details on to the client's partner efficiently and politely.
- B. Request further identifying details about the client and their test, and inform the partner that the client's results are not yet ready to be released.
- C. Request further identifying details about the client and tell the partner that they will be informed of the test results once the results are released.
- D. Explain that the test results cannot be released to anyone other than the client and request that the client calls the laboratory for the results.

Question 7

Duplicate sample test values were found to be out of the expected range.

When this occurs, the sample test values should be

- A. retested every time.
- B. ignored as an odd occurrence.
- C. reported and noted in the workplace recording system.
- D. treated as a serious breakdown in quality control.

Question 8

Samples from a potential new supplier of hazardous chemical reagents for a laboratory

- A. should be tested and evaluated before use.
- B. do not need to be supplied with safety data sheets (SDS).
- C. should only be reordered if there are significant cost savings.
- D. should not be used, in order to avoid changes to important standard operating procedures (SOP).

Question 9

What is the correct ergonomic posture for a laboratory technician working with a microscope in a seated position?

- A. straight back and neck, arms level with the bench, knees bent 45° and toes stretched to touch the floor
- B. straight back and neck, arms level with the bench, knees bent 45° and feet resting level on the floor
- C. straight back and neck, arms leaning forward onto the bench, knees bent 45° and feet resting level on the floor
- D. straight back, arms leaning forward onto the bench, neck stretched towards the microscope eyepieces, and legs relaxed and hanging from a high stool

Question 10

When rotating the objective lens on a microscope to a higher-powered lens, the

- A. diaphragm must be closed.
- B. light intensity must be increased.
- C. light intensity must be decreased.
- D. working distance must be increased.

Question 11

A food sample requiring urgent bacterial contamination tests has arrived at a laboratory.

The most appropriate action for a laboratory technician to take would be to

- A. inform the laboratory supervisor about the test request and wait for the supervisor to assign the work to a laboratory technician.
- B. test the food sample immediately, but only after referring to the test request specifications.
- C. test the food sample immediately with a general growth media to see what grows.
- D. check with the laboratory supervisor first before any testing is done.

Question 12

The **best** way to sterilise an inoculating loop, while minimising the formation of aerosols, is to

- A. soak the loop in a sterilising solution for 24 hours.
- B. place the loop directly in the blue flame of a Bunsen burner and hold it there for a full minute.
- C. first heat the tip of the loop gradually in the flame of a Bunsen burner, beginning with the handle end of the wire.
- D. place the loop directly in the orange flame of a Bunsen burner and pass it back and forth until the loop glows red.

Question 13

A laboratory technician prepares some agar streak plates from a broth culture. During the next shift, another laboratory technician checks the agar streak plates after incubation and observes confluent growth in all sectors of the plates.

The **best** explanation for this observation would be that the previous laboratory technician

- A. did not flame the neck of the broth bottle.
- B. forgot to flame the loop between sectors.
- C. was not working near the Bunsen burner flame.
- D. forgot to clean the bench before starting the procedure for preparing the agar streak plates.

Question 14

Glassware and other solid materials that require autoclaving

- A. do not require labelling as liquids would.
- B. must only be sterilised with the autoclave set on a dry cycle.
- C. must only be sterilised with the autoclave set on a wet cycle.
- D. can be sterilised in a mixed load with the appropriate autoclave settings.

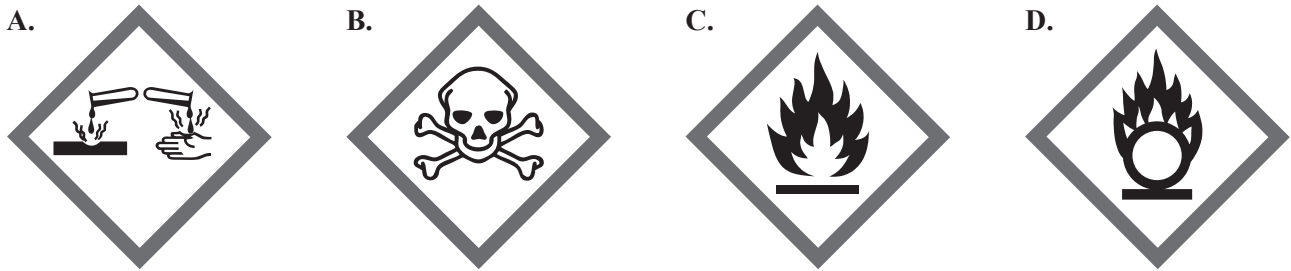
Question 15

Which one of the following would contribute the **most** to reducing the shelf life of a working chemical solution?

- A. returning any decanted solution to the bottle
- B. making up a solution immediately before it is required
- C. keeping the solution in a refrigerator while it is not being used
- D. wrapping the solution in aluminium foil when it is light-sensitive

Question 16

A laboratory technician would identify the physical hazard sign for an oxidising substance by which one of the following pictograms?



Sources: Standard Studio/Shutterstock.com (A., C., D.);
Migren art/Shutterstock.com (B.)

Question 17

A laboratory technician has been asked to carry out a starch test on a potato sample.

Which of the following pairs of stain and colour structures would show a positive result when examined under a microscope?

- A. Gram stain, pink granules
- B. iodine stain, brown granules
- C. iodine stain, blue-black granules
- D. Gram stain, purple-black granules

Question 18

The laboratory supervisor in an environmental testing laboratory instructs a technician to aseptically transfer some soil samples for microbial evaluation.

Transferring aseptically in this instance would **best** be achieved by

- A. sterilising each sample by heat under steam pressure.
- B. storing cultures in a culture collection for future study or reference.
- C. applying a treatment that results in death or removal of all living organisms in the samples.
- D. using procedures for handling cultures, media and equipment that ensure no contamination, and that only the desired organisms are present.

Question 19

A pathology laboratory receives a notice from the National Association of Testing Authorities (NATA), Australia, about an audit visit.

The information that the auditors are likely to concentrate on are the

- A. makes and models of the laboratory equipment.
- B. laboratory resources, procedures and documentation.
- C. profitability and efficiency of the testing procedures.
- D. speed and efficiency with which the laboratory technicians complete their tasks.

Question 20

What is the volume of a 50× stock solution that is required to prepare 200 mL of a 1.0× working solution?

- A. 4.0 mL
- B. 40.0 mL
- C. 400 mL
- D. 0.04 L

SECTION B – Short-answer questions**Instructions for Section B**

Answer **all** questions in the spaces provided.

Question 1 (6 marks)

- a.** A pathology laboratory technician receives a call from a veterinary surgeon requesting an urgent result on a submitted blood sample.

List three pieces of information that the technician will need to obtain from the veterinary surgeon while still on the phone.

3 marks

1. _____
2. _____
3. _____

- b.** The veterinary surgeon has requested that the sample be tested for bacteria.

What laboratory test would need to be carried out to help identify the possible strain of bacteria?

1 mark

- c.** The test carried out in **part b.** is expected to provide one of two possible results.

Name the two possible results and give one characteristic that would help to identify each result.

2 marks

Result 1 _____

Characteristic _____

Result 2 _____

Characteristic _____

Question 2 (3 marks)

A laboratory technician suspects that the electronic balance being used in the laboratory is inaccurate.

- a. Suggest **one** action that the technician could take to support the laboratory's 'right first time' objective. 1 mark

- b. Identify two incidents of wastage that the inaccurate electronic balance could create within the company, if the technician did not act promptly to address the situation. 2 marks

1. _____

2. _____

Question 3 (3 marks)

From the following list, identify the most appropriate cleaning or disposal method for each of the laboratory items given in the table below.

biohazard waste bin

sharps container

1.0% hypochlorite solution

Laboratory item	Appropriate cleaning or disposal method
glass cell-counting chamber or haemocytometer	
plastic flask of cell culture media	
used scalpel blades from biological dissection	

Question 4 (5 marks)

Primary standard solutions are used extensively in analytical chemistry laboratories.

- a. Give **one** reason for using primary standard solutions in laboratory work. 1 mark

- b. What two steps should a technician take to make themselves familiar with a laboratory's protocol for preparing primary standard solutions? 2 marks

1. _____

2. _____

- c. The quantitative transfer of solids is a requirement when preparing primary standard solutions.

Explain what is meant by 'quantitative transfer of solids' and give **one** reason for its importance. 2 marks

Question 5 (7 marks)

A laboratory technician has been asked to prepare bacterial smears and to stain them using the Gram stain method for microscopic examination.

- a. Before beginning observation of the slides, what are two checks that should be carried out to ensure that the microscope is fit for purpose? 2 marks

1. _____
2. _____

- b. Identify the objective lens that should be used to observe the bacterial smears on the prepared slides. 1 mark

- c. Indicate which of the two diagrams of slides below shows the correct microscope set-up for magnification and for resolution of the image on a prepared Gram stain slide. Tick (✓) the box for your chosen slide, A or B.

Diagram of Slide A

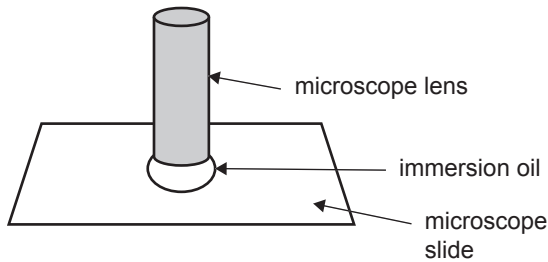
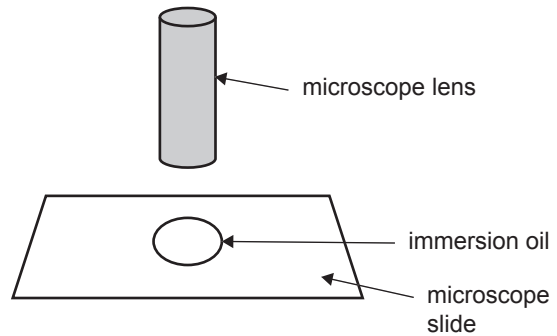


Diagram of Slide B



- Give two reasons for your choice of Slide A or Slide B. 2 marks

1. _____
2. _____

- d. Describe **two** advantages of using immersion oil on a slide. 2 marks

Question 6 (5 marks)

- a. Identify two laboratory work tasks that would be included in a National Association of Testing Authorities (NATA), Australia, audit on quality. 2 marks

1. _____

2. _____

- b. Give three reasons why quality audits should be carried out regularly. 3 marks

1. _____

2. _____

3. _____

Question 7 (4 marks)

The general duties of a laboratory technician include the preparation and pouring of nutrient agar stocks for general laboratory use.

What are two quality-control steps a laboratory technician could take to ensure that nutrient agar stocks are sterile? Give your reasons.

Step 1 _____

Reason _____

Step 2 _____

Reason _____

Question 8 (6 marks)

Working in the microbiology section of a laboratory to prepare agar streak plates is one of the responsibilities of a laboratory technician.

- a. Give two ways to identify contamination on agar plates that have been streaked for single colonies with pure cultures of bacteria. 2 marks

1. _____

2. _____

- b. Other than the use of personal protective equipment (PPE), give four approaches used to maintain hygiene when working in the microbiology section of a laboratory. 4 marks

1. _____

2. _____

3. _____

4. _____

Question 9 (5 marks)

A laboratory technician has been asked to prepare 250 mL of a protein solution of 2.0% w/v bovine serum albumin (BSA). The technician notices that the BSA protein is a very fine powder and easily becomes airborne.

- a. Give two actions that the technician must take in this situation to avoid possible safety hazards. 2 marks

1. _____

2. _____

- b. The standard operating procedure (SOP) to prepare a BSA protein solution specifies that its final pH must be 7.6

Identify **one** precaution that should be specified within the SOP for the process of dissolving and adjusting the pH of the solution. 1 mark

- c. BSA is a biological substance isolated from beef blood. This blood may not have been sourced locally but from countries that may have had outbreaks of notifiable diseases.

Identify one additional health risk that this substance may present and suggest what to avoid when handling BSA.

2 marks

Health risk _____

What to avoid _____

Question 10 (3 marks)

Identify one hazard of working with liquid nitrogen or dry ice in a laboratory and one item of PPE that would need to be worn. Describe the risk that may be present in the environment when working with these substances.

Hazard _____

Item of PPE _____

Risk _____

Question 11 (2 marks)

The biosafety cabinet in a laboratory has been decontaminated by contractors. The decontamination procedure involves using hazardous formaldehyde vapour and isolating the laboratory where the cabinet is located for several days. However, no notice of this procedure was posted at the entrance to the laboratory in this instance.

A technician has been assigned to perform a routine cell culture procedure in the laboratory the following day and notices that the cabinet has been sealed with tape.

Suggest two approaches the technician could take to deal with this situation.

1. _____

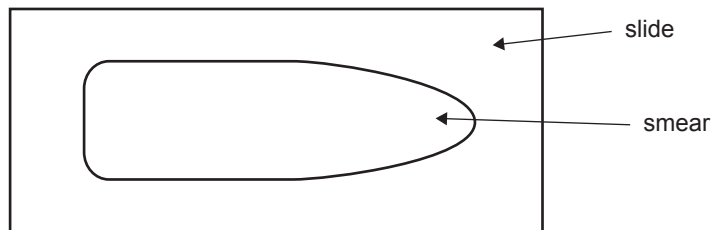
2. _____

Question 12 (5 marks)

- a. Figure 1 below shows a blood smear from a sample.

Circle the part of the blood smear that would identify separated blood cells when observing the slide with a microscope.

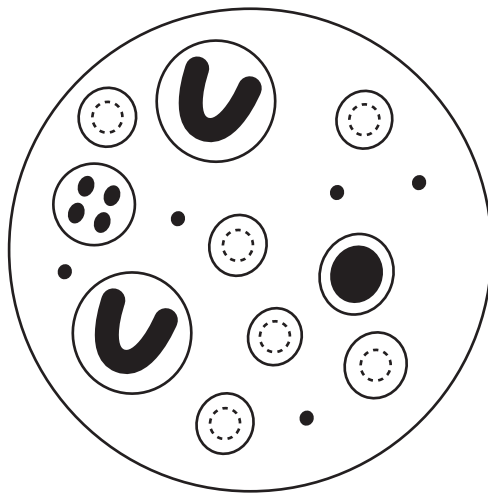
1 mark

**Figure 1**

- b. On Figure 2 below, draw a line to identify and label each of the following:

- a white blood cell
- a red blood cell
- a platelet

3 marks

**Figure 2**

- c. Suggest **one** method of checking that a blood-smear-stained slide will meet the quality-control standards required by a laboratory.

1 mark

Question 13 (7 marks)

A technician has been asked to restock a laboratory's solutions. This task involves making up some new solutions of calcium carbonate, CaCO_3 , and potassium chloride, KCl .

- a. Complete the table below by calculating the mass required to make each solution. Include the unit of measurement and show your working.

4 marks

Data

formula weight of CaCO_3	100 g/mol
formula weight of KCl	74 g/mol

Calculations for mass of CaCO_3

Calculations for mass of KCl

Chemical	Mass	Molarity	Volume
CaCO_3		0.4 M	350 mL
KCl		0.5 M	100 mL

- b. What is the most appropriate piece of equipment that should be used to store the CaCO_3 and KCl solutions?

1 mark

- c. The technician also makes up a 70% v/v ethanol solution. The labelled container has the following information: 70% v/v ethanol.

List two other pieces of information that will need to be included on this label.

2 marks

1. _____

2. _____

Question 14 (6 marks)

A technician using a 200–1000 μL variable pipette suspects that the pipette is not always delivering the correct volume. The technician decides to perform a calibration procedure.

- a. Give two reasons why calibration procedures are important in laboratories. 2 marks

1. _____

2. _____

- b. As the variable pipette is mostly used for delivering 1000 μL volumes, the technician performs the calibration at this setting, noting that the room temperature is 20 °C and measuring the individual masses of distilled water delivered by the pipette for 20 deliveries. The technician then converts the masses to volumes using the formula

$$\text{volume} = \frac{\text{mass}}{\text{density}}$$

If the density of pure water is assumed to be 1.0000 g/mL at 20 °C, calculate the actual volume delivered by the pipette for a delivered mass of 0.900 g.

2 marks

- c. The technician notes that most of the masses delivered by the variable pipette are close to the value of 0.900 g and fall within the range of 0.898 g to 0.906 g.

What delivered mass would the technician expect if the pipette was operating correctly at a setting of 1000 μL ?

2 marks

Question 15 (3 marks)

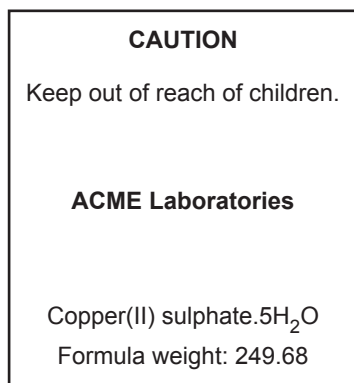
A laboratory technician has been asked to contribute to updating the laboratory's SOP for inoculating sterile nutrient broth (NB) from a culture growing on an agar plate. Several steps are required. The first four steps are given in the table below.

Complete the table by entering the remaining three steps of the procedure.

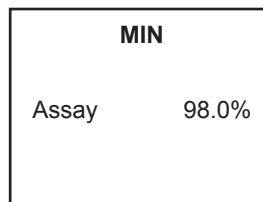
Step number	Procedure
1	Disinfect the bench with 70% v/v ethanol or similar.
2	Light the Bunsen burner.
3	Gather materials and ensure all materials are within reach.
4	Sterilise the inoculating loop.
5	
6	
7	

Question 16 (4 marks)

A laboratory technician is preparing 250 mL of a 0.10 M solution of copper sulphate, CuSO_4 , using a chemical bottle with labels as shown below.



Front label



Side label

- a. Calculate the mass of CuSO_4 that would be required to accurately prepare 250 mL of a 0.10 M solution of CuSO_4 . Show your working. 2 marks

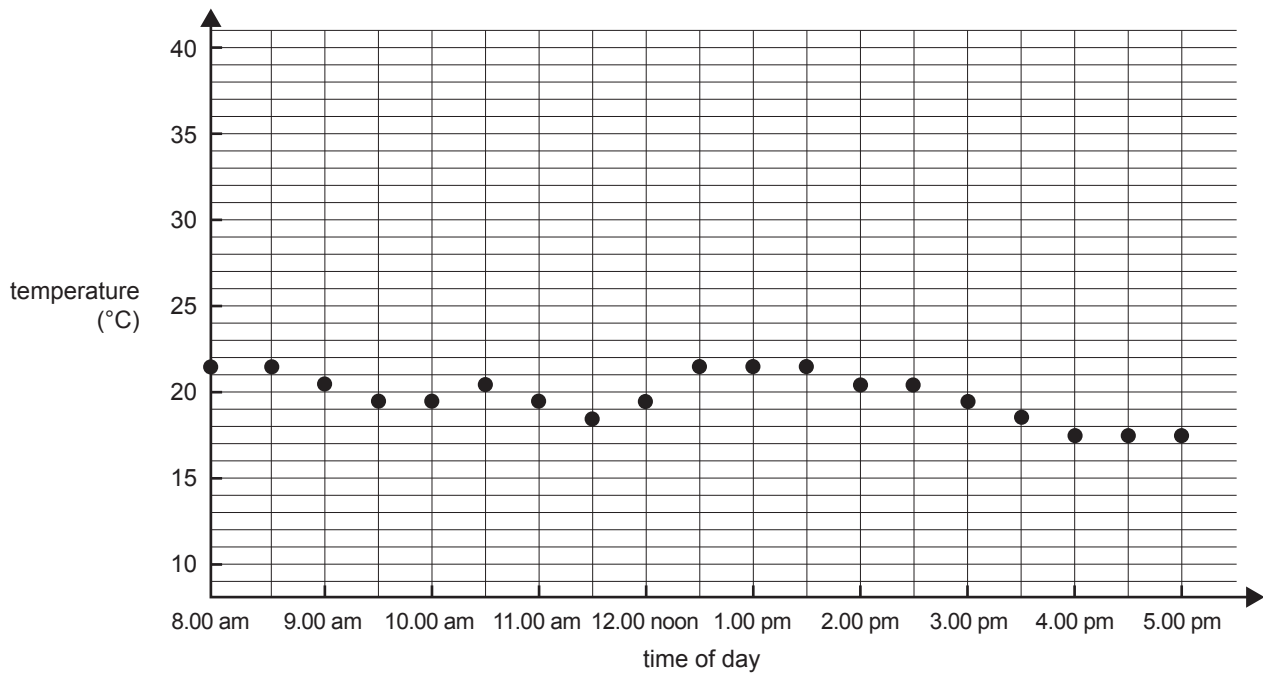
- b. The technician is required to use a bottle of anhydrous CuSO_4 to prepare a second 250 mL solution of 0.10 M CuSO_4 .

Would the mass of CuSO_4 calculated in **part a.** still be accurate? Give your reasoning. 2 marks

Question 17 (6 marks)

A pathology laboratory is investigating ways to improve its procedures and output. One of the areas being investigated is temperature regulation in the laboratory's incubator.

The temperature of the incubator is monitored and recorded throughout a normal working day. The results are shown in the graph below.



- a. Based on the graph, what operating temperature has the thermostat in the incubator been set to in order to optimise culture growth at the beginning of each day? Express your answer to one decimal place. 1 mark

- b. The growth rate of cultures is not affected by a temperature change of ± 2 °C. Using the information in the graph, give the two time periods when the temperature dropped below this optimum temperature range. 2 marks

- c. Suggest **one** reason for the temperature drop at the two time periods given in **part b**. 1 mark

- d. Using the information in the graph, give **one** reason, other than the temperature being outside of the normal range, for an observed reduction in the growth rate of the cultures and suggest a possible solution. 2 marks
