

SECTION 1 – Core units**Instructions for Section 1**

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

For Questions 1–10, write the letter of the correct alternative in the box provided.

Question 1

Which one of the following pieces of laboratory equipment does not need to be calibrated regularly?

- A. analytical balance
- B. digital thermometer
- C. magnetic stirrer
- D. pH meter

1 mark

Question 2

What would you use to calibrate a pH meter?

- A. a standard solution
- B. a buffer solution
- C. a salt solution
- D. water

1 mark

Question 3

Where would you expect to find the roles and responsibilities of laboratory technicians recorded?

- A. the quality manual
- B. a log book
- C. Material Safety Data Sheets
- D. the chemical register

1 mark

Question 4

Solubility data for a salt dissolving in a known volume of water at different temperatures is shown in the following table.

Temp (°C)	Salt dissolved (g)
20	34
30	34.5
40	35
50	36
60	36.5
70	37
80	38
90	39

Which of the following is a correct observation?

- A. The same amount of the salt dissolves at all temperatures.
- B. The cooler the water, the better the salt dissolves.
- C. Heating the water makes a huge difference to how much of the salt dissolves.
- D. The warmer the water, the more of the salt will dissolve.

1 mark

Question 5

Scientific observations

- A. are always made using our eyes.
- B. are often made using our sense of taste.
- C. often involve more than one of our senses.
- D. are never made using our ears.

1 mark

Question 6

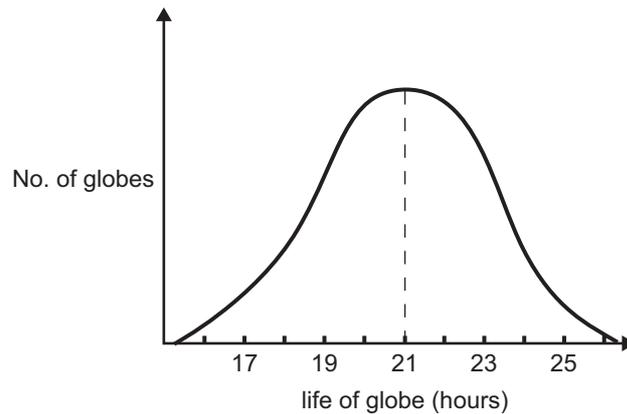
An example of a systematic error would be when

- A. calculating mass loss in a chemical experiment, Christine ignores a small amount which she had spilt on the bench.
- B. Ivanka uses a digital thermometer that has been calibrated incorrectly to measure the temperature of a water bath.
- C. Jodie always measures the volume of liquids in a measuring cylinder from the top of the meniscus, not the bottom.
- D. taking the time for an experiment, Tan and Rau sometimes use Tan's watch to take the starting and finishing times and sometimes Rau's.

1 mark

Question 7

Below is a graph showing the average length of time a torch globe lasts (in hours).



Which one of the following statements is correct?

- A. All globes last 21 hours.
- B. Most of the globes 'die' before 21 hours are up.
- C. Some batteries must be too strong for the globes.
- D. An average globe lasts for about 21 hours.

1 mark

Question 8

Valid conclusions can be made from scientific experiments when

- A. repeated trials provide the same or similar results.
- B. at least one trial provides the results suggesting the conclusion.
- C. you are sure the results are wrong because they are not what you expect.
- D. you obtain the expected results.

1 mark

Question 9

Employers favour working in teams mostly because

- A. it impresses the public, shareholders or competitors.
- B. it saves management time, and effort.
- C. teams achieve agreed outcomes, timelines and priorities more effectively.
- D. employees mostly prefer to work in a team environment.

1 mark

Question 10

Normal laws for occupational health and safety

- A. do apply to laboratories because they are places where employees or contractors work, or the public may visit.
- B. do apply to laboratories because employer bodies have agreed that their members will cooperate with governments.
- C. do not apply to laboratories because they are not typical workplaces.
- D. do not apply to laboratories because employers are required to make their own arrangements.

1 mark

Question 11

- a. List **three** work practices which might improve the sustainable energy principles within a laboratory.

3 marks

- b. Evaluate any **two** work practices in **part a.** above.

4 marks

Question 12

When working in a laboratory what is meant by the following terms or acronyms?

i. non-conformance

ii. compliance

iii. NATA

iv. QA

4 marks

Question 13

Chris is a technician working in a university laboratory. She is putting the equipment away after a practical session and finds that a student has allowed the cord of a hotplate to come in contact with the hot surface. What should Chris do?

3 marks

Question 14

A university research work group routinely performs a cell culture procedure using a rotating work team of three technicians. Each technician has their own research supervisor. The preparation of nerve cells is shared on the basis of the agreed needs of each researcher, as decided at regular weekly work group meetings.

When the produced cells unexpectedly begin to die prematurely, some informal meetings are called to discuss what to do, but often not all team members are present. Each of the technicians is instructed to change systematically some of the major materials used in the procedure to determine what is causing the cells to die. After three months there is little improvement and frustration begins to surface, with the younger supervisor most concerned about fixing the problem, while another established but casual supervisor shrugs off the problem with cynical comments about ‘... giving up and going home’.

Finally one of the technicians independently decides to change the brand of the cheap sterile gloves used in the procedure. The cells produced are again healthy and long lasting, and the work group continues its research experiments.

- a. Describe what type of work team you think best describes the university team.

2 marks

Group communication skills are part of how teams work. These rely on recognising people’s needs.

- b. Which of these skills was probably **most lacking** in the university team?

2 marks

- c. Which **two** communication strategies would you have adopted if you were part of the university team?

2 marks

Total 30 marks

SECTION 2 – Electives**Instructions for Section 2**

Complete **two** electives **only**. Answer **all** questions within the **two** chosen electives in the spaces provided.

ELECTIVE 1 – PMLTEST 300A Perform basic tests

For Questions 1–10, write the letter of the correct alternative in the box provided.

Question 1

To increase the speed of a chemical reaction we can

- A. increase the surface area of the reactants.
- B. apply heat.
- C. Both of the above.

1 mark

Question 2

To test if an unknown gas is carbon dioxide, you could connect a delivery tube to the test tube containing the unknown gas and channel it into a flask containing

- A. limewater.
- B. hydrogen peroxide.
- C. sulfuric acid.

1 mark

Question 3

The piece of equipment shown above is a

- A. round bottom flask.
- B. volumetric flask.
- C. conical flask.

1 mark

Question 4

The temperature of a bunsen burner blue flame is approximately

- A. 50°C
- B. 500°C
- C. 1500°C

1 mark

Question 5

Which piece of equipment would be most suitable to hold a liquid being titrated?

- A. conical flask
- B. beaker
- C. test tube

1 mark

Question 6

Distilled water is used to rinse glassware in a laboratory instead of tap water because

- A. it is more readily available and cheaper.
- B. it contains very few ions and impurities that can contaminate glassware.
- C. it cleans glassware more effectively.

1 mark

Question 7

Fire extinguishers that spray carbon dioxide on electrical fires work very effectively. This method works because carbon dioxide

- A. displaces the oxygen.
- B. makes the fire's fuel nonflammable.
- C. forms water vapour.

1 mark

Question 8

Smaller volumes of solution are accurately dispensed using the following instrument.

- A. burette
- B. pipette or automatic pipettor
- C. measuring cylinder

1 mark

Question 9

Gravimetric analysis involves measuring the _____ of a substance.

- A. density
- B. viscosity
- C. mass

1 mark

Question 10

A fume hood is used in a laboratory when handling volatile substances. Why?

- A. It prevents skin allergies.
- B. It prevents the inhalation of vapours.
- C. It prevents dangerous spills.

1 mark

Question 11

Several liquids are tested with universal indicator. The results are shown in the following table.

Liquid	pH
household bleach	10
dishwashing liquid	8
sugar solution	7
unknown	4
lemon juice	2
battery acid	0

- a. Which solution in the table is the most basic?

_____ 1 mark

- b. What colour would the indicator be in the sugar solution?

_____ 1 mark

- c. Which of the following solutions could possibly be the unknown solution: apple juice or drain cleaner?
Give a reason for your answer.

_____ 2 marks

- d. Write the equation that relates pH to the acid concentration.

_____ 1 mark

- e. Why is a buffer solution used when determining the pH of a solution?

_____ 1 mark

Question 12

Identify the following equipment and explain the function of each.



i. _____



ii. _____

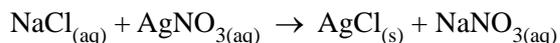


iii. _____

2 + 2 + 2 = 6 marks

Question 13

Brackish water, which is used for irrigation, is known to contain very high levels of chlorides (Cl) in the form of salt (NaCl). This can cause severe horticultural problems because plants and crops do not grow in the presence of such high salt levels. A laboratory technician determines the level of salt in a sample of brackish water. He chooses the precipitation reaction between salt and silver nitrate. The reaction is shown below.



- a. Explain what a precipitate is.

1 mark

- b. Give the name of the precipitate that forms in the above equation.

1 mark

- c. Clearly list the remaining steps involved in determining the level of salt (NaCl) in the brackish water. The first and final steps have been provided.

Step 1 – Accurately measure a known volume of brackish water and add excess AgNO₃.

Step 2 _____

Step 3 _____

Step 4 _____

Step 5 _____

Step 6 – Complete calculation to determine salt in the brackish water.

4 marks

- d. What table and data are needed to enable the technician to calculate the percentage (%) of AgCl in brackish water?

2 marks

Total 30 marks

ELECTIVE 2 – PMLTEST 301A Perform biological laboratory procedures

For Questions 1–10, write the letter of the correct alternative in the box provided.

Question 1

Rod-shaped bacteria are called

- A. bacilli.
- B. cocci.
- C. vibrios.

1 mark

Question 2

Which of the following definitions best describes osmosis?

- A. movement of dissolved salts from stronger to weaker solutions
- B. movement of dissolved salts from weaker to stronger solutions
- C. movement of water from dilute to concentrated solutions

1 mark

Question 3

Which of the following blood cells does not have a nucleus in a healthy adult?

- A. erythrocyte
- B. lymphocyte
- C. neutrophil

1 mark

Question 4

Which of the following usually carries blood away from the heart?

- A. arteries
- B. capillaries
- C. veins

1 mark

Question 5

Tissue fixation occurs best in _____ solutions.

- A. acidic
- B. alkaline
- C. neutral

1 mark

Question 6

_____ cannot reproduce outside host cells.

- A. Bacteria
- B. Fungi
- C. Viruses

1 mark

Question 7

Foreign substances which cause an immune response are called

- A. antibodies.
- B. antigens.
- C. antihistamines.

1 mark

Question 8

Red blood cells in healthy adults are produced in the

- A. bone marrow.
- B. liver.
- C. spleen.

1 mark

Question 9

Which best describes the function of platelets?

- A. assist blood clotting
- B. carry oxygen
- C. fight diseases

1 mark

Question 10

Bacteria are usually viewed under a microscope using a 100X objective

- A. including alcohol.
- B. including oil.
- C. including water.

1 mark

Question 11

- a. Provide **two** functions of a tissue fixative.

2 marks

- b. Name **two** solutions which can be used to fix tissue.

2 marks

- c. List **three** factors affecting tissue fixation.

3 marks

Question 12

Explain the function of each of the following parts of the microscope.

Eyepiece

Objective

Focus adjustment controls

3 marks

Question 13

- a. What is the difference between serum and plasma?

2 marks

- b. What is the function of an anticoagulant?

1 mark

- c. Name **two** anticoagulants.

2 marks

Question 14

- a. List **three** errors in technique that may cause an incorrect result in a gram stain.

3 marks

- b. Draw a streptococcus.

- c. Draw a sporing bacillus.

1 mark

1 mark

Total 30 marks
END OF ELECTIVE 2
SECTION 2 – continued

ELECTIVE 3 – PMLTEST 303A Prepare working solutions

For Questions 1–10, write the letter of the correct alternative in the box provided.

Question 1

When 1 mL of a thick viscous liquid such as glycerol is dissolved in 100 mL of water, the solute is

- A. the water.
- B. the glycerol.
- C. the liquid which is added last.

1 mark

Question 2

When preparing solutions it is best to

- A. add the solvent directly to the solute already in a beaker or similar container.
- B. add the solute gradually to prevent ‘clumping’ or frothing of the solute.
- C. rapidly add all the solute to the solvent.

1 mark

Question 3

When preparing solutions it is best to use volumetric or standard flasks

- A. all the time because these have the most accurate volumes engraved.
- B. only when necessary, since they are fragile, expensive if broken, and their accuracy is not required for some solutions.
- C. when a standard operating instruction or verbal instruction directs us to use them.

1 mark

Question 4

A standard solution

- A. contains a known substance.
- B. contains a known amount of a known substance dissolved in a known volume of solvent.
- C. contains a known amount of a substance which is used for estimation of other substances.

1 mark

Question 5

Aqueous-based sodium hydroxide solutions need to be regularly standardised because

- A. it is good laboratory practice to do so.
- B. carbon dioxide in the air slowly dissolves in the solution reacting with the sodium hydroxide, so lowering its concentration.
- C. the sodium hydroxide evaporates slowly if containers are continually left open.

1 mark

Question 6

When a concentrated solution is diluted with a solvent to prepare a number of solutions of lower concentration, the original concentrated solution is termed

- A. the 'stock solution'.
- B. the diluent.
- C. the 'working solution'.

1 mark

Question 7

When 10 cubic centimetres of hydrogen chloride gas is dissolved in 100 mL of water, the solvent is

- A. the water.
- B. the hydrogen chloride.
- C. Neither of the above.

1 mark

Question 8

When 5 grams of solid sodium chloride is dissolved in 100 mL of water, the solute is

- A. the water.
- B. the sodium chloride.
- C. Neither of the above.

1 mark

Question 9

When a concentrated solution is diluted with a solvent to prepare a number of other solutions of lower concentration for use, any of the diluted solutions is termed

- A. the 'stock solution'.
- B. the diluent.
- C. the 'working solution'.

1 mark

Question 10

When a concentrated solution is diluted with a solvent to prepare a number of other solutions of lower concentration for use, the solvent is termed

- A. the 'stock solution'.
- B. the diluent.
- C. the 'working solution'.

1 mark

Question 11

Gavin is a laboratory assistant in a food company and one of his tasks is to regularly adjust the pH of buffer solutions used in test procedures.

- a. What is meant by the term pH?

2 marks

- b. If Gavin is using a buffer that has a pH of 8.6, is the solution acidic or basic?

1 mark

- c. If Gavin is required to neutralise the buffer in his test procedure, what would be the pH of the final solution?

1 mark

Question 12

Snjezana is working as a technical assistant in a biochemistry hospital laboratory and has to prepare a standard solution of 0.100 M (molar) glucose for a blood glucose test procedure. She has to weigh 18.016 g of AR (pure) glucose and fully dissolve this in a small volume of water, then dilute this solution to 1.000 L in a standard flask, and mix all carefully.

- a. If Snjezana has the choice of a top-loading, triple beam, or analytical balance, what type of equipment is best to weigh the glucose in this solution?

1 mark

- b. Why is it important for her to first dissolve all the glucose, then dilute to the final 1.00 L?

2 mark

- c. What problem might occur if she does not properly mix the final diluted solution before using?

1 mark

Question 13

Sodium chloride has a molecular weight of 58.44 and can be used to estimate concentrations of silver ions in solution by first preparing a 0.100 M primary standard solution of sodium chloride.

- a. If 500 millilitres (500 mL) of 0.100 M sodium chloride solution is prepared, how many mole of sodium chloride is present?

3 marks

- b. To prepare the **standard** solution, what mass of sodium chloride must be weighed?

2 marks

- c. In what type of container should the standard solution be made up to its final volume?

1 mark

Solid sodium chloride can be provided as a technical grade, commercial grade, laboratory reagent, or analytical reagent.

- d. For the primary standard solution here, what form of the solid must be used?

1 mark

When the primary standard solution is finally prepared it needs to be stored in an appropriate container and labelled.

- e. If you were at all unsure or not instructed as to what to include on a label, what document could be used to provide information on sodium chloride?

1 mark

Question 14

Laboratories can contain a significant number of hazards. Place the following materials or items into the correct hazard classification category as shown for ethanol (ethyl alcohol).

(Note: not **all** cells need filling.)

- ethanol
- a concentrated sodium hydroxide solution
- a bacterial culture plate with colonies
- a working steam autoclave
- dry picric acid (related to TNT)

Hazard category	Material/Item
dangerous goods flammable class	ethanol
radiation hazard	
dangerous goods explosive class	
electrical hazard	
physical hazard	
dangerous goods corrosive class	
toxic substance	
biohazard	

4 marks

Total 30 marks