



Victorian Certificate of Education 2003

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Figures
Words

Letter

VCE VET LABORATORY SKILLS Written examination

Friday 31 October 2003

Reading time: 3.00 pm to 3.15 pm (15 minutes)

Writing time: 3.15 pm to 4.45 pm (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>
1 – Core	15	15	30
	<i>Number of electives</i>	<i>Number of electives to be answered</i>	
2 – Electives	3	2	60
			Total 90

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, an approved graphics calculator (memory cleared) and/or one scientific calculator.
 - Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- Materials supplied**
- Question and answer book of 25 pages.
- Instructions**
- Write your **student number** in the space provided above on this page.
 - All written responses must be in English.

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

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

‘Right first time’ means that when you are completing a task you

- A. never make a mistake.
- B. are allowed to make small mistakes.
- C. take care and minimise the chance of making a mistake.
- D. make mistakes and hope that your supervisor does not notice.

1 mark

Question 2

A special cause of variation

- A. is a normal, predictable part of a process.
- B. is an unusual event that occurs occasionally.
- C. accounts for most of the variation seen in a process.
- D. can be identified and fixed by changing the normal operating procedures.

1 mark

Question 3

The production of waste is a problem for all laboratories.

The amount of waste produced will increase if

- A. spillages are kept to a minimum.
- B. standard operating procedures are followed.
- C. poor quality materials are used that produce unreliable results.
- D. the correct quantity of chemicals is used when undertaking a task.

1 mark

Question 4

Team communication skills revolve around group interaction. Group members may not succeed in communicating because others do not or will not understand the message.

To communicate ideas successful team members should

- A. try to see the other point of view.
- B. display a certain degree of arrogance.
- C. only share information with those who need to know.
- D. gather all the 'gossip' before presenting a view to the team.

1 mark

Question 5

A group leader can be autocratic, democratic or laissez faire in leadership style.

Democratic leaders

- A. assume no commitment from members of the group.
- B. delegate rather than seek contributions from the group.
- C. seek consultation and discussion with members of the group.
- D. allow members to work independently without reporting back to the group.

1 mark

Question 6

When setting up an autoclave or steam steriliser for use you should

- A. check for bubbles in the column.
- B. inspect for dirt on the glassware.
- C. ensure the probe is plugged into the meter.
- D. check that the water level in the outer jacket is full.

1 mark

Question 7

If you find the electrical cable of a water bath is frayed, you should

- A. use it without touching the cable.
- B. repair the cable with tape and then use it.
- C. label the equipment as faulty and remove it.
- D. continue to use the cable but ensure that it does not come into contact with water.

1 mark

Question 8

The correct method for calibrating a pH meter uses two buffer solutions

- A. of identical pH.
- B. of unknown pH.
- C. of pH the same as that of the sample.
- D. with one lower than the expected pH of the sample and one of higher pH than that of the sample.

1 mark

Question 9

A piece of equipment that is not correctly calibrated would

- A. produce inaccurate results.
- B. become difficult to keep clean.
- C. be a danger to laboratory workers.
- D. be used if you knew how to adjust your results.

1 mark

Question 10

A basic maintenance schedule for an analytical balance in a laboratory would include

- A. washing it thoroughly in soapy water.
- B. changing the water in the outer jacket.
- C. removing spilt chemicals from the weighing tray with a brush.
- D. maintaining the probe using a special cleaning process, that is referred to in the instrument manual.

1 mark

Question 11

Peter, a laboratory technician, was measuring the moisture content of food samples. He had done this test many times before and knew that the limits for moisture content are between 5% and 10%. He followed the Standard Operating Procedures correctly and there was no problem with the equipment. He was required to complete some calculations to obtain his final moisture content.

The first sample that Peter tested gave a result of 70%. He knew that something was wrong.

- a. What was the most likely cause of error in his result?

1 mark

Later in the day Peter's supervisor requests that he checks both the accuracy and the precision of the machine used to measure moisture content.

Before checking for accuracy and precision his supervisor suggests that he places a blank sample in the machine.

- b. i. What is the purpose of the blank sample?

- ii. Describe how Peter would check for machine accuracy.

- iii. What is meant by precision?

1 + 2 + 2 = 5 marks

Question 12

Jean is working as a technician in the quality assurance (QA) laboratories of Slick Dispersals Petrochemicals Pty Ltd. Jean is expected to help QA testing staff when needed. The team in the QA laboratory often experience peaks in their workload when many tests have to be performed over a short period of time. This causes stocks of working solutions to run low. Jean also helps QA testing staff with calibrations during busy periods.

She is currently the only person responsible for the preparation of working solutions from stock solutions during less busy times. In addition Jean's supervisor has made her the only member of the team authorised for purchasing.

- a. Identify **one** point of potential conflict for Jean in the team's operations.

1 mark

- b. Jean is beginning to feel frustrated that she seems the only one under such constant pressure.

- i. What is the first step Jean must take to resolve her concerns?

- ii. What must Jean do to avoid conflict developing within the group?

2 marks

- c. Suggest **one** change in the team's operations which would improve Jean's load and resolve the potential conflict.

1 mark

Question 13

You have been asked to weigh out an amount of a chemical on an analytical balance. List three set-up and/or pre-use checks you should perform on the balance before you use it.

- i. _____
- ii. _____
- iii. _____

3 marks

Question 14

A laboratory assistant in the quality control laboratory of a fruit canning company is required to calibrate, maintain and operate a pH meter. While calibrating the pH meter the laboratory assistant cannot achieve stable pH readings.

- a. Give one possible reason for the pH meter's instability.

1 mark

- b. State one solution to the problem identified in part a.

1 mark

Question 15

One of the most important aspects of laboratory safety is to keep work areas clean.

- a. Give two reasons for maintaining a clean work area.

i. _____

ii. _____

2 marks

- b. Describe the basic cleaning tasks associated with the following.

- i. Glassware

- ii. Microscope

- iii. Bench tops

3 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 – PMLTEST300 Perform basic tests

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

Question 1

Standard operating procedures would contain

- A. a list of equipment needed for a particular test.
- B. a list of senior supervisors in the laboratory.
- C. the client's name and address.

1 mark

Question 2

A sample that has a uniform consistency is called

- A. homochromatic.
- B. heterogeneous.
- C. homogeneous.

1 mark

Question 3

Sample preservation is important.

Common preservation methods would include placing a sample

- A. in direct sunlight.
- B. on a laboratory bench.
- C. in a cold-storage room.

1 mark

Question 4

An example of a physical test on a sample may include determining the

- A. pH of an acid.
- B. level of bacteria in food.
- C. temperature of a piece of metal.

1 mark

Question 5

Corrosive chemicals should be stored

- A. in splash trays.
- B. on high shelves.
- C. in lockable cabinets.

1 mark

Question 6

The _____ point is the temperature where a solid turns into liquid.

- A. boiling
- B. melting
- C. sublimation

1 mark

Question 7

A pH reading of 5.5 indicates that the sample is a(an) _____ substance.

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

1 mark

Question 8

When lighting the gas from a Bunsen burner the gas should be turned on

- A. half way and the air-control sleeve fully open.
- B. half way and the air-control sleeve closed.
- C. fully and the air-control sleeve fully open.

1 mark

Question 9

The density of any solid is defined as the mass per unit volume.

If a solid has a mass of 10 grams and a volume of 2 cm³ it will have a density of

- A. 5 g/cm³
- B. 20 g/cm³
- C. 0.2 g/cm³

1 mark

Question 10

The density of a liquid can be measured using a

- A. refractometer.
- B. thermometer.
- C. hydrometer.

1 mark

Question 11

Eugene is working in the reception of the Sugar Mill laboratory. Part of his job is to fill in the sample labels that are placed on each sample container.

- a. Describe three items of information that are most likely to be included on the label.

i. _____

ii. _____

iii. _____

3 marks

When the samples reach the laboratory they are not suitable for direct laboratory testing. The individual samples are too bulky in size and each needs to be reduced in total size.

- b. Describe one way this could be done.

2 marks

Question 12

The left column of the following table shows a piece of equipment commonly found in a laboratory. In the right column, describe what each piece of equipment is used for.

Equipment	Description of what the equipment is used for
	
	
	
	

4 marks

Question 13

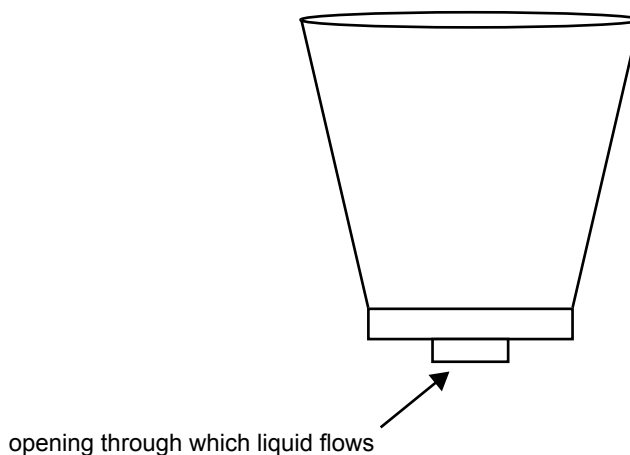
You are required to use a clean analytical balance. Place the following steps in their correct sequence for completion by writing a number (2–7) in the left column. The first step has already been numbered one.

Order	Steps
	Place weighing boat on the balance pan
	Record the weight of the chemical
	Remove weighing boat with added chemical
	Press the zero button to bring machine out of standby mode and tare the balance
1	Open the sliding balance door
	Press zero button to place balance back into standby mode
	Add the chemical to the weighing boat

3 marks

Question 14

The viscosity of a liquid can be measured using a Ford cup (see diagram below). A Ford cup has a set volume with an opening in the bottom through which the liquid flows.



a. What is meant by viscosity?

1 mark

After proper preparation of samples, the times taken for the liquid samples to pass through the Ford cup were measured and recorded.

Sample	Time taken (seconds)
A	100
B	55
C	75

- b. Which of the samples, A, B or C is the most viscous?

1 mark

The following day the same technician repeated the same viscosity tests using the same Ford cup and the same liquid samples. The Ford cup had been thoroughly cleaned and the proper preparation of the samples was carried out. The following results were obtained.

Sample	Time taken (seconds)
A	90
B	50
C	71

- c. What is the most likely cause for the different results obtained?

1 mark

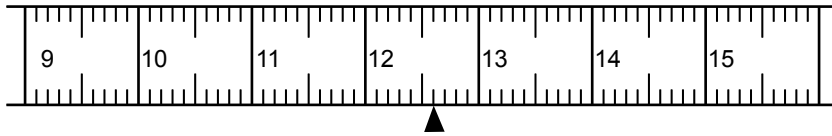
Sample preparation in viscosity measurements is very important. A sample needs to be well shaken for five minutes before being added to the Ford cup.

- d. Explain why this is necessary.

1 mark

Question 15

- a. You are required to read values from several scales while working in the laboratory. Read the correct values for the position of the pointer for each of the following scales.



i. _____ cm



ii. _____ mL

2 marks

- b. You are required to check particle size in a sample of table salt. Your supervisor has given you a sieve to complete the task. You weigh out 400 grams of the salt and place it in the sieve. After shaking the sample, 380 grams of salt passes through the sieve. No salt is lost in the shaking.

- i. What percentage of salt has passed through the sieve?

The particle size specification states that the salt is only acceptable if 98% of the salt passes through the sieve.

- ii. Would this sample meet specification?

2 marks

Total 30 marks

ELECTIVE 2 – PMLTEST301 Perform biological laboratory procedures

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

Question 1

A _____ separates the inside of the cell from the outside environment.

- A. vacuole
- B. cell membrane
- C. endoplasmic reticulum

1 mark

Question 2

The objective lens on an optical microscope is found

- A. closest to the eye.
- B. above the stage.
- C. under the stage.

1 mark

Question 3

The total magnification of the microscope when the objective lens is 10 X and the ocular lens is 4 X would be

- A. 14 X.
- B. 40 X.
- C. 400 X.

1 mark

Question 4

A _____ is used when preparing blood for examination under an optical microscope.

- A. thin film
- B. wet mount
- C. suspended drop

1 mark

Question 5

The first step when preparing material to be embedded in wax is to

- A. wash in distilled water.
- B. dehydrate in 100% ethanol.
- C. fix in a suitable fixative such as formalin.

1 mark

Question 6

To reduce the chance of artifacts on a microscope slide, you should

- A. wipe with alcohol and any clean cloth.
- B. clean by wiping with a lint-free tissue.
- C. wash in soapy water and rinse in distilled water.

1 mark

Question 7

When preparing tissue for sectioning it is immersed in molten paraffin.

The name of this process is

- A. clearing.
- B. infiltration.
- C. dehydration.

1 mark

Question 8

Before you commence work in a general microbiology laboratory you should put on

- A. a mask.
- B. a hard hat.
- C. covered-toe shoes.

1 mark

Question 9

If asked to count cells you would use a counting chamber or

- A. radiometer.
- B. gravimeter.
- C. haemocytometer.

1 mark

Question 10

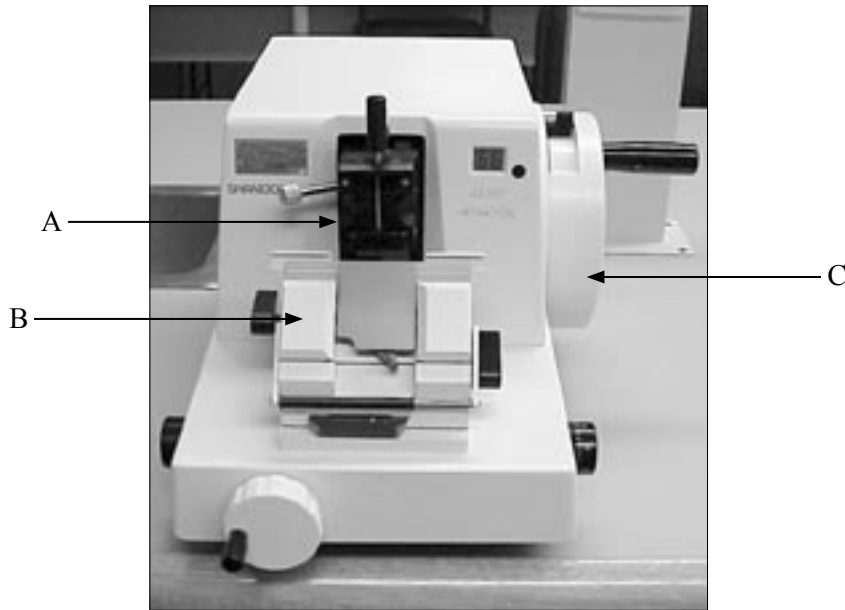
Stains are used to

- A. enhance the contrast of cells.
- B. separate the organelles of cells.
- C. attach cells to a microscope slide.

1 mark

Question 11

Below is a diagram of a microtome.



a. Name the three parts of the microtome labelled.

i. A _____

ii. B _____

iii. C _____

3 marks

b. Explain the function of each part in relation to the production of sections.

i. A _____

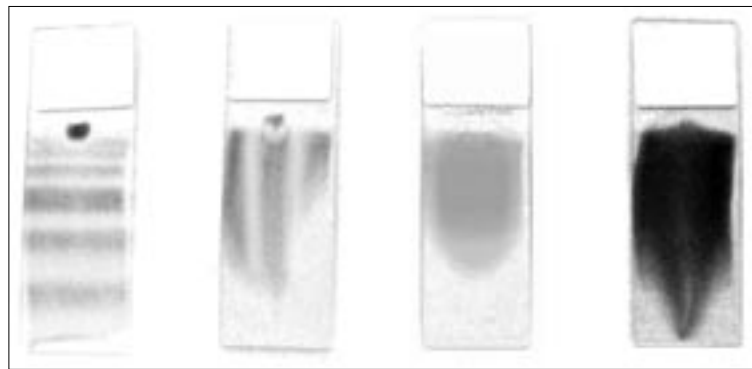
ii. B _____

iii. C _____

3 marks

Question 12

The blood films below (A.–D.) have been prepared in a haematology laboratory for examination under the optical microscope.



A. B. C. D.

a. Which is the best preparation of a blood film? Select one of the above.

1 mark

b. Give two criteria for an acceptable blood film.

i. _____

ii. _____

2 marks

Question 13

List two critical safety precautions you must take when handling blood, blood products, and equipment that has been contaminated with blood.

i. _____

ii. _____

2 marks

Question 14

Briefly describe the main function of each cell type.

i. erythrocyte

ii. leucocyte

2 marks

Question 15

Marika is a laboratory assistant in a large industrial laboratory at a factory which is involved in the routine examination and testing of food samples. Raw materials used by the factory are tested and also products from the 'line' are checked at various times during the production process. Bacteria are isolated from samples taken as part of a quality checking procedure and cultured on agar plates. Bacterial smears are then prepared and stained from these cultures.

One test Marika performs is the preparation of bacterial smears of cultures.

From your experience in the laboratory answer the following.

- a. Arrange in sequence the following list of steps for making a bacterial smear. Place a number (1–6) in the left column to show the order in which the step is taken.

Order	Steps
	Sterilise your loop in the Bunsen flame
	Carefully mix the bacteria with the water
	Place a small drop of water onto a labelled slide
	Touch the loop onto an isolated colony
	Fix the smear by passing three times through the Bunsen flame
	Air-dry the smear

3 marks

- b. i. Name a stain you would use to identify the bacteria.

- ii. Describe how this stain identifies different bacteria.

2 marks

- c. What special technique would you use to examine the stained bacteria under the optical microscope?

1 mark

- d. What is meant by the term 'aseptic technique' in reference to the preparation of bacterial smears?

1 mark

Total 30 marks

ELECTIVE 3 – PMLTEST303 Prepare working solutions

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

Question 1

The formula for the compound made from Li^+ and S^{2-} is

- A. 2LiS_2
- B. LiS_2
- C. Li_2S

1 mark

Question 2

Groups of atoms that behave as a unit and carry a charge are known as polyatomic ions. An example of a polyatomic ion is nitrate. An ion of calcium (Ca^{2+}) and the polyatomic ion nitrate (NO_3^-) combine as $\text{Ca}(\text{NO}_3)_2$.

The formula for potassium permanganate is $\text{K}^+ + \text{MnO}_4^- \rightarrow$

- A. $\text{K}(\text{MnO}_4)_2$
- B. KMnO_4
- C. K_2MnO_4
- D. 2KMnO_4

1 mark

Question 3

A mole is expressed as the formula mass in grams (g) of any pure substance. A mole of any pure substance is _____ representative particles, which is called Avogadro's number.

- A. 3.142
- B. 6.02×10^{23}
- C. an infinite number of

1 mark

Question 4

Acids and bases are defined by the different properties they exhibit.

Bases

- A. are in alkaline cleaners which give off hydrogen ions when dissolved in water.
- B. are found in common foods such as vinegar and citrus fruits and are identified by their bitter taste.
- C. produce hydroxide ions when dissolved in water.

1 mark

Question 5

A sheet that, by law, must be provided by the manufacturer of hazardous substances is known as a

- A. PPE.
- B. SOP.
- C. MSDS.

1 mark

Question 6

Recommended practice for storage and handling of laboratory glassware includes

- A. storage of burettes and pipettes in drawers.
- B. disposal of broken but clean glassware from a laboratory with normal garbage.
- C. the use of cracked beakers only for non-microbial work or where accurate concentrations are not an issue.

1 mark

Question 7

When making up a working solution of 0.1 M NaOH, a laboratory technician should

- A. use primary stock solutions.
- B. dilute a 0.5 M working solution, where possible, to avoid costly waste of stock solutions.
- C. dilute a fraction of a pre-measured ampoule of 1 M NaOH and store the remainder according to laboratory guidelines.

1 mark

Question 8

A solution of concentration (%V/V) is prepared by

- A. measuring the volume of a liquid solute and adding solvent to a predetermined volume.
- B. measuring the mass of a liquid solute and adding solvent to a predetermined volume.
- C. measuring the mass of a liquid solute and adding a predetermined mass of solvent.

1 mark

Question 9

The glassware with the highest degree of accuracy, commonly used in a laboratory, is a

- A. volumetric flask.
- B. measuring cylinder.
- C. beaker.

1 mark

Question 10

Shelf life of media and stains is given on any product supplied by a manufacturer. The shelf life is calculated assuming correct storage and handling of the product.

Correct storage for iodine solution includes

- A. clear glass or plastic.
- B. dark glass in a darkened cupboard.
- C. sterilisation in a clear glass bottle and storage in the dark.

1 mark

Question 11

Lucy has been working at HealthLAB Pty Ltd for several years and usually works without supervision in the laboratory. When she arrives for work at 8.30 am on Monday morning, she discovers the night-shift staff have left a backlog of work. Reagent bottles are left uncapped and an organic solvent has been left beside a hotplate. The sodium hydroxide (NaOH) stock solution is also on the bench with a note asking Lucy to make a working solution, for use in the QA laboratory, before 9.00 am. The branch supervisor is due in at 9.15 am and Lucy is always keen to show she is in control. In preparation for later work, Lucy turns on the hotplate to have it warm up while she cleans the benches and wipes up spills. Lucy pipettes out the required amount of NaOH solution where the stock bottle has been left on the bench. She grabs a lab coat from the cupboard on her way back from returning other stock bottles to storage.

Name **two** errors Lucy makes during the first hour of her shift, identifying the hazard associated with each.

i. Error _____

Hazard _____

ii. Error _____

Hazard _____

2 + 2 = 4 marks

Question 12

Use the extract from a material safety data sheet for SODIUM HYDROXIDE below to answer this question.

Date of Issue: September, 2003		
Material Safety Data Sheet		
Hazardous according to criteria of Worksafe Australia		
Product Code: xxxx		
Sodium hydroxide 0.1mol/l (0.1N) ConvoL		
Identification		
Product Name:	Sodium hydroxide 0.1mol/l (0.1N) ConvoL	
Other Names:	SODIUM HYDROXIDE SOLUTION Solution in water	
Product Code:	18043	
UN Number:	1824	
Dangerous Goods Class & Subsidiary Risk:	8	
Packaging Group:	II	
Hazchem Code:	2R	
Poisons Schedule Number:	S5	
Use:	General Laboratory reagent	
Solubility in water:	Miscible in all proportions	
pH:	14	
Other information:	Non-combustible Sensitive to air. Unsuitable working materials: various metals.	
Conditions / Substances to be avoided:	Substances to be avoided: aluminium, zinc, tin (Formation of hydrogen); acids, ammonium compounds.	
Ingredients		
Chemical Name	CAS Number	Proportion
Sodium Hydroxide	1310-73-2	4%
Water	7732-18-5	to 100%
First Aid Information		
Skin contact:	Drench the skin thoroughly with water. Dab with vinegar. Remove contaminated clothing and wash before re-use. Unless contact has been slight, OBTAIN MEDICAL ATTENTION.	
First Aid Facilities:	Safety shower. Eyewash facilities.	

- a. Is the pH of sodium hydroxide acidic or alkaline?

1 mark

b. List **two** properties of a substance with the pH of the sodium hydroxide listed.

i. _____

ii. _____

2 marks

c. Are additional precautions required when working with sodium hydroxide near a naked flame?

1 mark

d. What is meant by the term 'reagent'?

1 mark

e. What is meant by the term 'miscible'?

1 mark

A technician working with sodium hydroxide solution splashed the solution on the back of his hand and sleeve of his lab coat.

f. List **two** steps the technician should undertake following the spillage described above.

i. _____

ii. _____

2 marks

g. What is the purpose of vinegar?

1 mark

Question 13

Sodium hydroxide (NaOH) is commonly used in the preparation of standard solutions because it is cheap. The standard solution cannot be made by dissolving a known weight of NaOH in water because NaOH cannot be obtained in pure form. A 4 g/L solution will be about 0.1 M. The precise concentration of the diluted solution can be determined by performing an acid-base titration against a previously standardised hydrochloric acid solution.

Hydrochloric acid (HCl) reacts quantitatively with sodium hydroxide (NaOH) in equimolar amounts.

- a. Describe, with the use of a balanced equation, what is meant by 'reacts in equimolar amounts' in the case of HCl and NaOH.

2 marks

- b. Draw a labelled diagram to show the set-up of the equipment for a titration.

4 marks

- c. What is an end-point?

1 mark

Total 30 marks