VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2004

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

										Letter
Figures										
Words										

VCE VET LABORATORY SKILLS

Written examination

Monday 1 November 2004

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

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
1 – Core	14	14	30
	Number of electives	*Number of electives to be answered*	
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 27 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

Laboratories routinely calibrate pH meters using

A. litmus paper.

B. universal indicator paper.

C. standard pH solutions.

D. standard electrodes.

1 mark

Question 2

Heating baths in laboratories are calibrated mainly because

A. Australian standards, operating procedures or other important documents say they should be.

B. people in laboratories often change the thermostat settings.

C. the water quality in the baths can vary between laboratories.

D. there can be a difference between the manufacturer's numbers on a thermostat, and the actual temperature of the heated water.

1 mark

Question 3

Safety filling devices for manual pipettes are used

A. only when the liquid is harmful in some way.

B. only when the standard operating procedure or other instruction directs that they should be used.

C. at all times to ensure workers are protected.

D. only when a busy and very experienced laboratory worker has time.

1 mark

Question 4

It is important to ensure centrifuges are properly balanced because

A. they can make odd, annoying noises if they are not balanced.

B. they can vibrate if unbalanced.

C. it ensures the instrument will not be damaged or cause an accident.

D. the calibration settings may be affected.

☐

1 mark

Question 5

For a team to work efficiently it is best to

A. know the likes and dislikes of other team members.

B. elect the most popular member as team leader.

C. meet socially out of work.

D. work in a similar environment, allocate work properly and identify and resolve problems.

☐

1 mark

Question 6

Cooperation with other members in a team environment should

A. reduce the tension between members of the team.

B. impress the team leader and other managers.

C. achieve agreed outcomes, timelines and priorities.

D. improve how it feels to be a member of the team.

☐

1 mark

Question 7

Who is responsible for the correct labelling of hazardous substances used in the workplace?

A. the owner or employer

B. the cleaning staff

C. the office manager

D. the occupational health and safety officer

☐

1 mark

Question 8

Before handling a hazardous substance the laboratory worker should

A. wash their hands.

B. wear safety glasses.

C. carefully read the Material Safety Data Sheet (MSDS) for the substance to be used.

D. wear a mask.

1 mark

Question 9

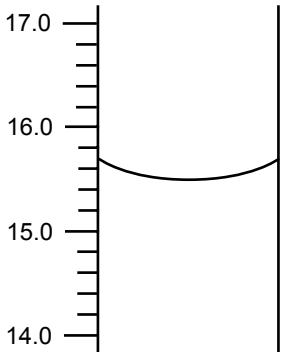
How much liquid is in the measuring cylinder below?

A. 16.0 mL

B. 17.0 mL

C. 15.5 mL

D. 15.7 mL



1 mark

Question 10

When sugar is dissolved in a cup of coffee, sugar is the

A. solute.

B. solvent.

C. solution.

D. suspension.

1 mark

Question 11

Study the illustration of the laboratory shown below. List five safety hazards that appear in the picture.

1. _____

2. _____

3. _____

4. _____

5. _____

5 marks

Question 12

Edwina is a hospital laboratory manager supervising a team of five technicians that service five different laboratory areas. She has been instructed to cut one staff, meaning now the workload must be divided between the remaining four technicians. In the past each technician has been responsible for a particular laboratory area, which have regular weekly peaks and lows of work that usually happen at different times in the five different areas.

The laboratory work group decides that each technician must now be prepared to work in all laboratory areas and move between areas as demand requires. Some staff have been working in their areas for several years and are reluctant to cooperate, while others are anxious to learn more of the other laboratory areas.

a. Discuss whether you believe it was better for the laboratory work group, and not Edwina, to make this decision.

2 marks

b. **i.** List two possible advantages of the decision.

ii. List two possible disadvantages of the decision.

2 + 2 = 4 marks

Question 13

Cleaning glassware and the correct disposal of wastes are important laboratory tasks.

a. How are strong acids and bases disposed of?

_____

_____

1 mark

Glassware is usually rinsed in de-ionised water rather than tap water.

b. Explain why this is necessary.

_____

_____

1 mark

c. How would you dispose of a broken burette?

_____

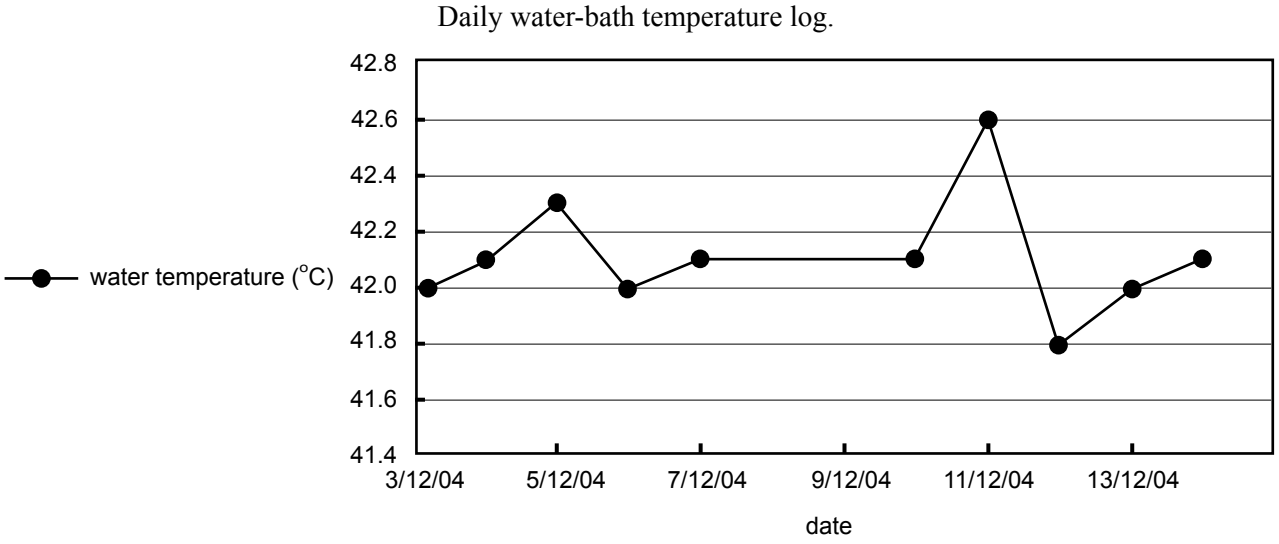
_____

1 mark

Question 14

Mary is a technician in a laboratory in northern Queensland. Bacterial counts are one of the tests she performs daily. For the test to be valid the bacterial cultures must be incubated in a water-bath and the temperature must be 42.0°C. If the temperature of the water-bath varies by more than 0.5°C the test becomes invalid. Mary measures the water temperature using a digital thermometer each morning before counting.

The water temperature for the last 10 working days is displayed graphically below.



a. Draw upper and lower control limits on the chart.

1 mark

b. List the date(s) of any invalid tests.

_____

1 mark

c. List two possible reasons for invalid results.

_____

_____

_____

_____

2 marks

d. What equipment would need to be calibrated on a regular basis for this testing to be valid?

_____

_____

_____

_____

2 marks

Total 30 marks

END OF SECTION 1

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

Volumetric analysis is a process used to determine

A. the concentration of an unknown solution.

B. the volume of an unknown solution.

C. the pH of an unknown solution.

1 mark

Question 2

Gravimetric tests involve determining the _____of a substance.

A. volume

B. weight

C. colour

1 mark

Question 3

When equal amounts of acids and bases are mixed together, the type of reaction is

A. a titration reaction.

B. a combustion reaction.

C. a neutralisation reaction.

1 mark

Question 4

Most plants prefer soil with a pH between 6 and 8. Soil from an area where lime-loving plants are common was mixed with universal indicator solution.

What colour would you expect the solution to become?

A. yellow, pH = 6

B. blue, pH = 7

C. indigo, pH > 9

1 mark

Question 5

Which one of the following always happens when an acidic solution is neutralised with a base?

A. a colourless solution forms

B. a gas is produced

C. there is an increase in pH

1 mark

Question 6

The indicator phenolphthalein is colourless in acid solution and _____in a base solution.

A. blue

B. yellow

C. pink

1 mark

Question 7

When using a 'graduated to the tip' glass pipette it is important to check the tip because

A. it may be chipped and so deliver incorrect volume.

B. it may be blocked.

C. it may be too small and too slow to use.

1 mark

Question 8

An insoluble substance formed by mixing two solutions is called

A. a solution.

B. a precipitate.

C. lead iodide.

1 mark

Question 9

Two students were doing an experiment where they added one teaspoon of potassium sulfate to water, stirred it and all the powder dissolved.

Potassium sulfate

A. is an insoluble substance.

B. is a soluble substance.

C. is an unstable substance.

1 mark

Question 10

The correct way to light a Bunsen burner is to

A. turn on the gas just before you light a match.

B. ensure the air hole is fully open before you light a match.

C. ensure the air hole is fully closed before you light a match.

☐

1 mark

Question 11

A volumetric acid/base titration was performed by a laboratory technician. The following titres were obtained and no further acid was available.

27.40 mL 27.80 mL 27.60 mL 27.45 mL 27.55 mL

a. What titre is probably an overtitration?

_____

1 mark

b. What is the average result of this titration?

_____

_____

2 marks

Question 12

List three features Materials Safety Data Sheets should contain.

1. _____

2. _____

3. _____

3 marks

Question 13

Explain why adding powdered calcium carbonate instead of marble chips to hydrochloric acid will result in much faster production of carbon dioxide gas.

_____

_____

_____

1 mark

Question 14

Five substances were dissolved in water and the pH of each solution was measured. The results are given in the following table.

Substance	**pH**
baking soda	8.5
lemon juice	2.3
salt	7.0
sugar	7.0
tomato juice	4.2

a. Which of the substances formed acidic solutions?

1 mark

b. Which of the substances formed neutral solutions?

1 mark

c. Which solution could be added to lemon juice to produce a neutral solution?

1 mark

Question 15

In chemical storage areas HAZCHEM signs must be displayed, together with other easily recognisable symbols, alerting people to the particular type of danger that the chemicals pose. Place the following chemicals in the correct boxes in the table below.

- sulfuric acid
- uranium
- petrol
- hydrogen gas
- lead nitrate
- mercury
- sodium hydroxide
- alcohol

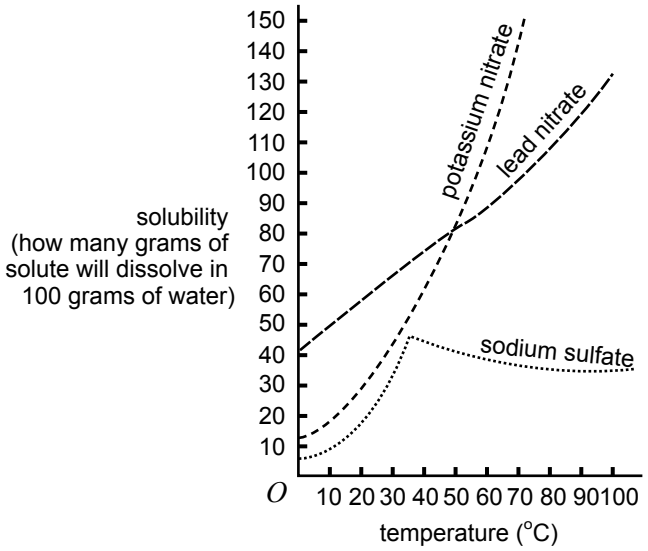
Toxic	Corrosive	Flammable	Radioactive	Explosive

4 marks

Question 16

The graph below shows the solubility of three different substances at different temperatures. The vertical scale shows how much of the substance will dissolve in 100 grams of water and the horizontal scale shows the water temperature. Use the graph and your own knowledge to answer the following questions.

Effect of temperature on solubility



a. How much potassium nitrate would you expect to dissolve in 100 grams of water at 60°C?

1 mark

b. Which of the three substances is most soluble at 20°C?

1 mark

c. **i**. At what temperature is the solubility of potassium nitrate and lead nitrate the same?

ii. How much lead nitrate would dissolve in 100 grams of water at this temperature?

1 + 1 = 2 marks

Two students wanted to see how much sodium sulfate would dissolve in 100 grams of water. After adding three teaspoons, no more would dissolve. The students decided to heat the water to dissolve more sodium sulfate.

d. What advice could you give them after looking at the graph?

2 marks

Total 30 marks

END OF ELECTIVE 1
SECTION 2 – continued
TURN OVER

ELECTIVE 2 – PMLTEST301A Perform biological laboratory procedures

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

Question 1

The stain used to show nuclei and cytoplasm in tissue sections is

A. gram.

B. haematoxalin and eosin.

C. Leishman.

☐

1 mark

Question 2

Red blood cells are also called

A. neutrophils.

B. eosinophils.

C. erythrocytes.

☐

1 mark

Question 3

Petri dishes should always be labelled on the

A. lid.

B. base.

C. rim.

☐

1 mark

Question 4

When preparing a tissue for sectioning it is immersed in 100% alcohol.

This process is called

A. clearing.

B. dehydration.

C. infiltration.

☐

1 mark

Question 5

Which one of the following items of equipment is used to sterilise instruments?

A. incubator

B. autoclave

C. water-bath

☐

1 mark

Question 6

When preparing blood films the technician should use

A. latex gloves.

B. cotton gloves.

C. a respirator.

1 mark

Question 7

Microscope slides should be cleaned with _____ before preparing blood films.

A. distilled water

B. alcohol

C. xylene

1 mark

Question 8

Before you commence any kind of work in a histology laboratory you should put on

A. goggles.

B. covered-toe shoes.

C. a mask.

1 mark

Question 9

Someone who studies blood cells is called a

A. histologist.

B. microbiologist.

C. haematologist.

1 mark

Question 10

Incubators used for growing bacteria which cause human disease are usually set at

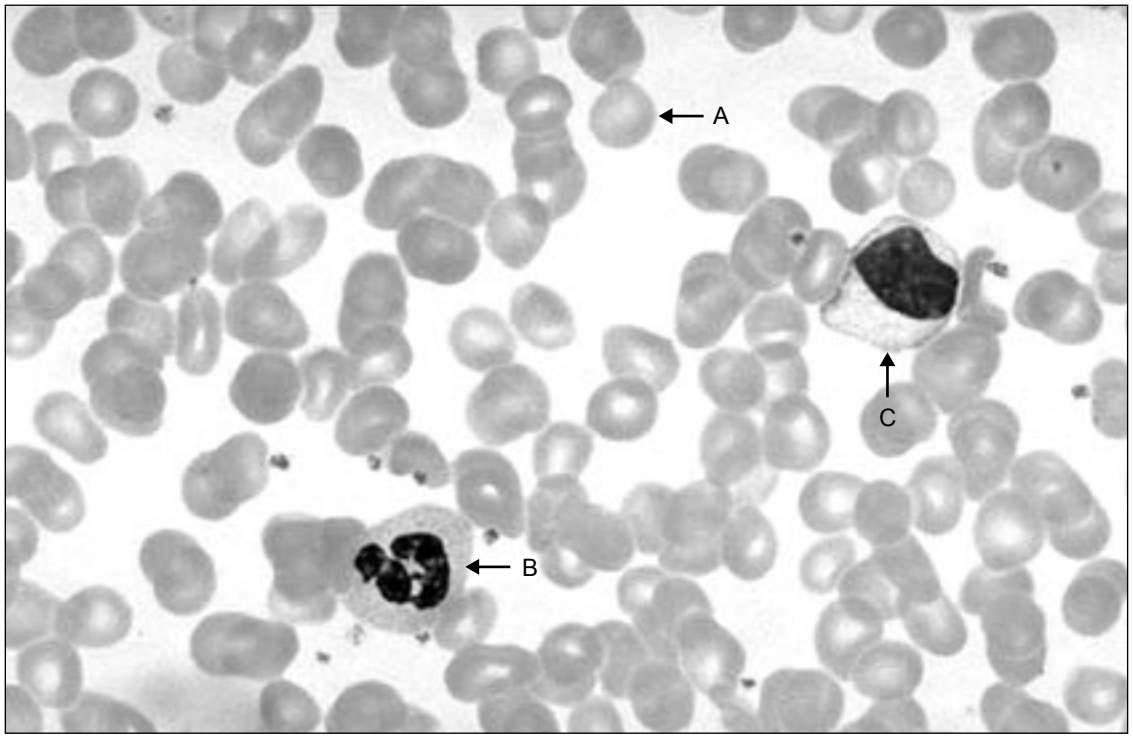
A. 0°C.

B. 37°C.

C. 100°C.

1 mark

Question 11



The blood smear in the above figure is from a normal healthy adult. Three different blood cells have been labelled.

a. Enter the letter which corresponds to the blood cell in the table below.

Cell	**Letter**
neutrophil	
lymphocyte	
erythrocyte	

3 marks

b. What is the main function of each of these cells?

i. neutrophil _____

_____

ii. lymphocyte _____

_____

iii. erythrocyte _____

_____

3 marks

c. List two precautions which need to be taken when handling human blood.

i. _____

_____

ii. _____

_____

2 marks

Question 12

Ann is a technician in a food laboratory. She has been asked to prepare some culture medium plates for bacterial testing.

a. Arrange in sequence the following steps for preparing culture plates. Place a number (1–8) in the left column to show the order in which the steps are performed.

Order	Steps
	check pH
	heat to dissolve
	pour into sterile Petri dishes
	allow to set
	weigh dry ingredients
	sterilise
	cool to 50°C
	add water

4 marks

b. For sterilisation in an autoclave to be effective, name two factors which need to be controlled.

i. _____

_____

ii. _____

_____

2 marks

c. List two items of personal protective equipment you would need to wear to remove the culture medium from an autoclave.

i. _____

_____

ii. _____

_____

2 marks

Question 13

Medical pathologists examine tissue sections under the microscope for evidence of disease. Arrange in sequence the following steps for tissue processing in a histology laboratory. Place a number (1–8) in the left column to show the order in which the steps are performed.

Order	Steps
	microsopy
	dehydration
	cutting sections
	clearing
	mounting
	staining
	embedding
	fixation

4 marks

Total 30 marks

END OF ELECTIVE 2
SECTION 2 – continued
TURN OVER

ELECTIVE 3 – PMLTEST303A Prepare working solutions

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

Question 1

Standard solutions should be prepared using the

A. safest chemical.

B. most soluble chemical.

C. highest purity of the chemical that is soluble.

1 mark

Question 2

A standard solution is

A. a solution of known concentration.

B. a solution of known pH.

C. a solution of known temperature.

1 mark

Question 3

5 ml of a 10 g/L solution is diluted to 100 ml.

What is the concentration of the final solution?

A. 0.5 g/L

B. 0.05 g/L

C. 5.0 g/L

1 mark

Question 4

Sodium is stored only under which liquid in a laboratory, and for what reason?

A. oil because water evaporates too quickly

B. oil because sodium reacts violently with water

C. alcohol because oil is too hard to remove

1 mark

Question 5

A laboratory assistant is required to prepare 100 mL of a 10 mg/mL protein standard solution for an assay using a finely powdered solid protein.

Select the correct mass that should be weighed out.

A. 100 mg

B. 1 000 mg

C. 100 000 mg

☐

1 mark

Question 6

Firdez is a busy technical assistant in a university laboratory and routinely prepares solutions of specified pH value. She notices that one of the normally clear pH standard calibration solutions for the pH meter has some floating material in it.

What steps should she take?

A. filter the solution to remove the contaminant and so conserve expensive standards

B. dispose of all the standards because they were all made up at the same time

C. dispose of the contaminated solution and check the others for any contaminants

☐

1 mark

Question 7

If a standard operating procedure specified that 12.005 g be dissolved and brought to 1.00 L, what would be the most appropriate piece of equipment to use?

A. plastic graduated measuring cylinder

B. graduated beaker

C. a volumetric or standard flask

☐

1 mark

Question 8

When using a chemical for the first time you should do one of the following.

A. check that the formula or molecular weight is available

B. obtain the Material Safety Data Sheet

C. check with your supervisor

☐

1 mark

Question 9

A 'physiological saline solution' is specified as being aqueous 0.9% w/ v sodium chloride.

This means that to prepare 1L of the solution, 9 g of pure sodium chloride would be dissolved in

A. 1L of ethanol.

B. a small volume of water, then made up to 1L.

C. a small volume of water, then made up to 100 mL.

☐

1 mark

Question 10

If you were preparing 500 ml of a physiological saline solution, it would be best to weigh 4.5 g of sodium chloride on

A. kitchen scales.

B. a top loading balance.

C. an analytical balance.

☐

1 mark

Question 11

Bassam is a technician in a university research laboratory and, as one of his duties, has to prepare buffer solutions for researchers in the laboratory group. Following the laboratory's written procedures, he is required to weigh out or measure the chemical reagents for a buffer, dissolve these, and sometimes adjust the pH of the solution to the value specified, make the solution to the volume, then finally label and store it as directed.

a. What is meant by the term pH?

_____

1 mark

b. What instrument in laboratories is very commonly used to measure and monitor changes in pH?

_____

1 mark

c. Write down clearly the basic equation that relates a pH value to a concentration term.

_____

_____

2 marks

Question 12

Jodie has a partly made up buffer solution at a pH of 8.2, which she must now adjust to the 6.8 value stated on her procedure sheet.

a. Which of the following solutions would be appropriate for her to add to the buffer to alter the pH to the correct value?

- 0.1M hydrochloric acid
- distilled water
- 0.1M sodium hydroxide

1 mark

b. Provide one reason for your choice.

1 mark

Question 13

Harshani is a laboratory assistant in a large chemical-based processing company, where her work duties require her to routinely perform titrations using standardised solutions.

a. What is a primary standard solution?

1 mark

b. What is a standardised solution?

1 mark

c. Titrations often use indicators in the procedure. What is the purpose of indicators in titrations?

2 marks

Question 14

Solid sodium hydroxide is often seen as pellets of a whitish colour and a translucent solid, since it gradually absorbs carbon dioxide from the atmosphere to form sodium carbonate. Using this information, is sodium hydroxide a suitable primary standard? Explain your answer.

_____

_____

_____

_____

2 marks

Question 15

Label the following items of chemical laboratory equipment.

_____

1 mark

_____

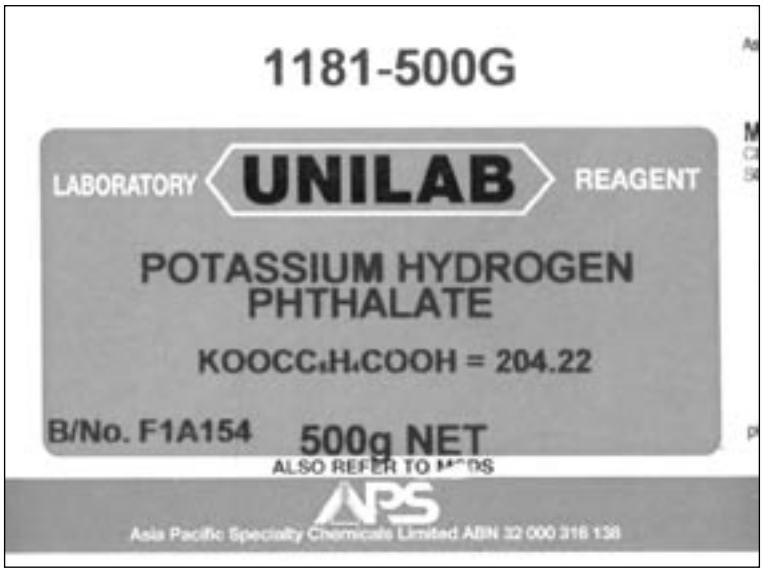
1 mark

_____

1 mark

Question 16

Potassium hydrogen phthalate is a primary standard, and is often used at 0.1 M concentrations. Displayed below is the label from a manufacturer's bottle of potassium hydrogen phthalate, with the important information that is needed to prepare a solution.



a. Reproduce from the label the chemical formula for potassium hydrogen phthalate.

1 mark

b. Is the substance a salt, an acid, or a base?

1 mark

c. Is the substance hydrated or anhydrous?

1 mark

d. What is the molecular weight of the potassium hydrogen phthalate?

1 mark

e. What is the stated formula weight of the potassium hydrogen phthalate?

1 mark

Total 30 marks

END OF QUESTION AND ANSWER BOOK