Marine Environment Students Manual

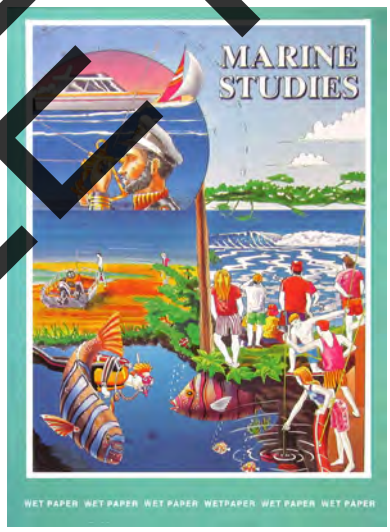
Suitable for syllabus in

Marine Studies and Marine Education (Queensland)
Marine Studies (New South Wales)
Maritime Studies (South Australia)
Environmental Education (Victoria and Northern Territory)
Senior Science Marine Studies and Nautical Studies (Western Australia)

and
companion to the textbook

Marine Studies

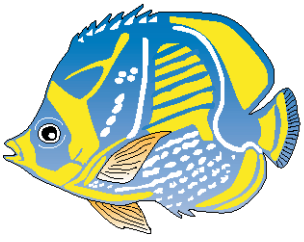
A course for senior students



by

Bob Moffatt
B Sc, Dip Ed, Grad Dip.Ed Admin, MACE

SAMPLE PAGE



Wet Paper

Copyright www.wetpaper.com.au

QUALITY ASSURANCE

Wet Paper is committed to total quality management and the implementation of a quality system throughout each project undertaken, to ensure the highest standards of professionalism, ethical practice and client and customer satisfaction.

Quality assurance is the responsibility of the manager who has the authority to manage all functions to quality, and is the nominated Quality Assurance Manager as defined in AS 3901/ISO 9001.

To ensure the best possible use of this book for quality education, Wet Paper offers the following services.

1. For schools who purchase single copies, a free telephone support service is available in office hours by simply telephoning Wet Paper on (07) 55 972 806 or by faxing your request or leaving a message on our answering machine on (07) 55 39 4187 any time.

2. For schools who use class sets of the book, an in-service program is available for staff wishing to implement any of the activities. A program can be arranged by contacting the manager.

   Wet Paper also has a commitment to actively support teacher associations and conservation groups with an interest in marine studies education.

3. Schools or teachers can write for our complimentary newsletter which outlines conference dates and other seminars where free workshop sessions are held explaining any activities in this book.

4. Equipment used in this book is available for training purposes at our Wet Paper Laboratory and Classroom during office hours. Our address is 14 Milbong Terrace, Ashmore, Queensland, 4214.

5. If we cannot answer your questions, Wet Paper has a team of highly qualified consultants who are willing to assist.

6. As this is the first edition, we welcome comments on any of the activities. In time, workbooks will be written to indicate the time each activity takes, its sequence and core questions relevant to national syllabus. As many exercises could take more than two hours, some selection of questions may be necessary before setting students homework.

BEST ENVIRONMENTAL PRACTICE

Each school should develop a best environmental practice statement for marine studies. To help schools do this, Exercise 141 has been prepared as a 'discussion starter'.

In Sections 1 and 2 it is a requirement of some activities to collect specimens of sand, live animals or plants or travel on an excursion into the marine environment.

It is pointless teaching conservation in Section 4 if practical aspects of it are not demonstrated. The following points are worth considering in your school's conservation code:

1. Can a photograph substitute for the collection of a live specimen?

2. Is all waste collected and taken back to school? Encourage students not to use rubbish bins at the seaside as these are often tipped over or scrounged through by animals looking for a feed.

3. Take home bottles and cans that can be recycled at school and if chemicals are used, bring home all waste in slop bottles.

4. Wet Paper encourages students to study live specimens so that a deep love can be generated for life on earth. However the following considerations are recommended:

   - Avoid collecting yourself until trained. Consider buying from a collector who has a permit and is restricted to numbers and can be managed. Most collectors are skilled in the handling of live animals and know about stress and mortality rates. Use an aquarium shop to obtain specimens and find out what conditions would give the specimens the greatest chance of survival.
   - Use hardy freshwater species to illustrate marine examples. Many principles of life in water are the same in both fresh and marine environments.
   - In the activities selected, it is hoped we have chosen the toughest of animals and plants.
   - The aim of students working with live animals and plants is to instil a love of the animals and plants of the sea. Consider buying fish and prawns from a fish shop and avoid any other dissections unless you are specifically researching that animal.

SAMPLE PAGE

Copyright www.wetpaper.com.au

Consultants

Dave Claridge
Marine Education Consultant, Maryborough

Graham Anderton
South Fremantle Senior High School

Gwen Connolly
St. Augustine's College, Cairns

Sue Cerato
Benowa State High School

Len Couzins
Benowa State High School

Peter Hamlyn
North Mackay State High School

Lindsay Holthouse
Senior Secondary Assessment Board, SA

Tony Isaacson
Hallett Cove High School, SA

Geoff Jensen
Innisfail State High School

Phil King
Coffs Harbour High School

Kym McKauge
Department of Primary Industries

Ken Maclean
Babinda State High School

John Maloney
St. Augustine's College, Cairns

Greg McGarvie
Pioneer SHS College, Mackay

Mick O'Connor
Ballina State High School

Mark Rickard
Benowa State High School

Pamela Rutledge
St. Hilda's School, Perth

Kathy Steggles
Whitsunday Anglican School, Mackay

John Smith
Environmental Education Consultant, SA

Jan Thornton
Sea World

Tim Ryan
Maryborough State High School

Alan Wolfe
South Fremantle Senior High School

SAMPLE PAGE

Copyright www.wetpaper.com.au

Acknowledgements

Permissions

Thanks to the following for giving permission to Wet Paper to reproduce their works

Australian Maritime Safety Authority, Australian Fisheries Management Authority, Great Barrier Reef Marine Park Authority, Sea World, MESA Gold Coast, Surfrider Foundation, Queensland Transport

Principal photographer

Bob Moffatt

Other photographs

Geoff Jensen, Tim Ryan, Australian Fisheries Management Authority

Principal illustrator

Mark Moffatt

Other illustrations

David Tulip, Bernie Cook, Jack Marsh, Tony Edwardson, Jan Thornton, Sue Oats, Steven Byers, Brady Moffatt, Bob Moffatt, Queensland Transport, Great Barrier Reef Marine Park Authority (Project Reef Ed)

Additional advice and assistance

Thelma Moffatt, John Maloney, Tony Failes, Damian Klarwein, Roger Nicoll, Geoff Jensen, Alan Wolfe, Paul Sumpter, Jan Thornton, Kym McKauge, Peter Hamlyn, Tina Redden, Annaliese Caston, John Foss, Greg McGarvie, Phil King, Len Couzins, Ward Nicholas, Malcom Turner, John Foss, Matt Keys, Michael Leggi Wilkinson, Tom Alletson, Ian Tibbets, Nick McMorrow, Bill Fowles, Norman Lopez, Erna Walraven and Derek Spielman

Teachers and lecturers

Jack Marsh, David Tulip, Cam McRobbie, Tom Hailstone, Prof Stephenson, Jack Greenwood. Don Fielder, Don Griffiths, Keith Tronc

Supporters and advisors

Barbara Clem, Carol Fortino, Warren Beezley, Ann Coopersmith, Peter Stannard, Bill Stapp, Alastair Mitchell, Paul Threlfall, Jill Green, Mark Snartt, Derek Foster, Richard Harris, Dawn Couchman, Geoff Mercer, Len Zell, Rob Heaney, Shirley Heaney, Don Alcock, Don Fee, Alan Perry, Angus Jackson, Sam Smith, Dawn Couchman, Bob Critchley, Graham Nash, Dave Olreichs, Phil Bishop, Al Greenfiel, Kathy Steggels, John Maloney, Paul Sumpter, Dave Mitchell, John and Meg Kennedy, Michael Michie, Keith Enchielmier, Malcom Turner, Neville Coleman, Neil Solomons, Bill Templeman, Jan and Barry Alty, Greg Smith, Noel Gillin, John Brown, Peter Stevens, Ian Neil, James Young, Mel Phillips, Bob Ellis, Martin Tellermans, John Broadfoot, Jan Thornton, Kelvin Rodgers, Tertius DeKluyver, Perry Kaigan, Ian Gibbs, Trevor Long, Terry Balsom, Dennis Bridger, Steven Byers, Carol Clavery, Cyril Connell, Tony Failes, Mark Warne, Rod Waldon, Jan Oliver, Bill Dobbie, Sue Cerato, Ann Summers, David Kopelke, Marg Evans, Ann Kenny, Graham Mitchell, Greg Martin, Steve Hall, Peter Holm, Rod Waldon, Dave Reid, Jim Redfield, John Howard, Vera Weitsz, David Gorwin, Stana Hodge, Meran Kilgour and Carol Clavery, John Quinlan, Judy Zolecki, Ken Gilbert, Bill Dobbie, Sue Oats, Kelvin Rodgers, Carol Clavery, Jill Agnew and Gwen Lane, Ann Summers, Margaret Evans, Len Couzins, Bill Baumann, Peter Stannard, Fabian Fay, Col Reinhardt and Mike Julian

Mentors

Jack Marsh, Cyril Connell, Ken Gilbert, Dave Tulip

Schools equipment and students

Grateful acknowledgement is made of the following schools who assisted with photographic shoots, equipment and advice: Innisfail State High School, Pioneer State High School, Benowa State High School, South Fremantle Senior High School, Mackay North State High School and Sea World Project Neptune

Cover

Merv Smith Studio Designs

SAMPLE PAGE

Copyright www.wetpaper.com.au

Contents

Section 1 Non – living aspects of the sea

SAMPLE PAGE

Copyright www.wetpaper.com.au

Section 2 Living aspects of the sea

SAMPLE PAGE

Copyright www.wetpaper.com.au

Section 3 Commercial uses

SAMPLE PAGE

Copyright www.wetpaper.com.au

Management and conservation

SAMPLE PAGE

Copyright www.wetpaper.com.au

SECTION 1
NON - LIVING ASPECTS

EXERCISE 1 SEA WATER SALTS

METHOD

1. Measure out half a teaspoon of salt and empty it into the conical flask.
2. Now add enough water to cover and dissolve the salt.
3. Set up the equipment as shown in Figure 1.1. Now light the spirit burner by using the manufacturers instructions and adjust the burner to produce a gentle flame under the flask.
4. Put on the safety goggles and keep them on until all the salt has evaporated (see safety warning).
5. When the water has nearly all evaporated, extinguish the burner and let the flask cool.
6. Take the stirring rod and scrape the salt out and onto a piece of filter paper.

QUESTIONS

1. Describe what happens to the water as it heats up.
2. What happens when salt water evaporates?
3. What happened when almost all the water was gone?
4. Did you get the same amount of salt back?
5. Use your textbook page 352 to define the following terms:

   a. Solute.

   b. Solvent.

   c. Solution.

Research

1. Find out how salt is made commercially.
2. http://seawifs.gsfc.nasa.gov/ocean_planet.html

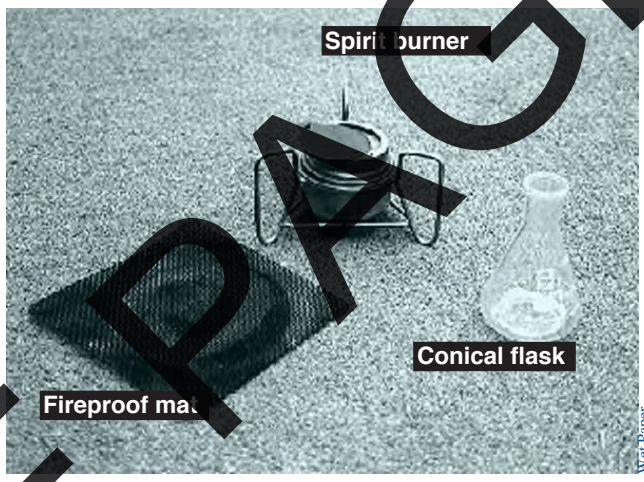


Figure 2.1 Experimental equipment

MATERIALS AND EQUIPMENT (PER GROUP)

- methylated spirits burner
- safety goggles
- table salt
- fireproof mat, matches, oven mitts
- very clean 50 mL conical flask and glass stirring rod
- filter paper
- tap water
- tea spoon

SAFETY WARNING

1. When the sea water solution has nearly all evaporated, it may "spit" up. To stop this remove the flame and let the remainder evaproate under its own heat.
2. All equipment will get very hot after a short time, so make sure you let it cool before touching it.

SAMPLE PAGE

Exercise 2
Salinity

Method

1. Divide up the class into six groups so that each group will work on a different gm/Litre saltwater solutions.
2. Collect 20 drops of your gm/Litre saltwater solution and add this carefully to the 50 mL conical flask.
3. Now add 3 drops of potassium dichromate indicator so as to just turn the sea water yellow as shown in Figure 2.1.
4. Add the silver nitrate drop by drop giving the conical flask a swirl after each drop as shown in Figure 2.2. Make sure someone counts each drop.
5. You will notice that a colour change appears under the drop as it falls into the sea water solution.

   When these dark red patches hang around for an increasingly longer time, start swirling after each drop.
6. When one drop turns all the sea water a reddish brown, you have reached what we call the end point.
7. Record the number of drops to end point in data table 1, in Figure 2.4 beside the g/L entry.
8. Now collect the results from the other groups noting the number of drops to end point for each.
9. Use your class results from data table 1 to draw a calibration graph in the space provided in Figure 2.5 for the determination of salinity using the eye dropper technique. Your graph should look something like Figure 2.3. Extrapolate the graph to predict 35 000 and 40 000 mg/L.
10. Now use an unknown sample to determine its salinity and record your results in table 2 Figure 2.4.

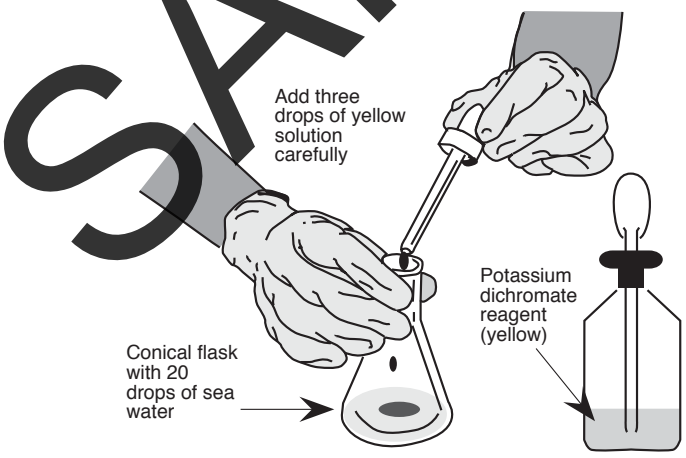


Figure 2.1 Use gloves to add the drops
Wet Paper

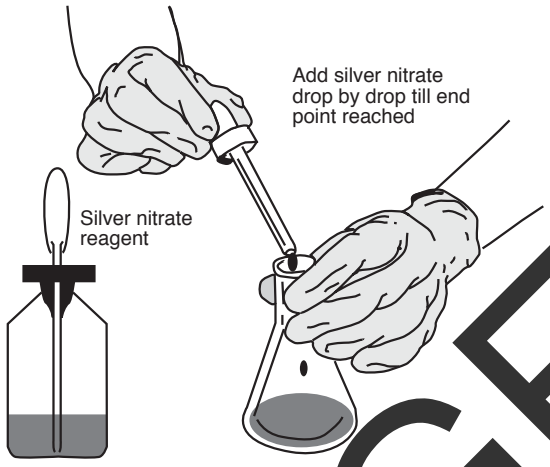


Figure 2.2 Adding silver nitrate solution
Wet Paper

Materials and Equipment (per group)

Note keep the 10, 20, 30 g/L solutions for the next exercise.

Equipment required

- 10 mLs of six saltwater standard solutions
- 5, 10, 15, 20, 25, 30, grams per litre
- 10 mLs of 0.5M Silver Nitrate solution
- salt water samples (various locations)
- potassium dichromate indicator solution
- 50 mL conical flask
- gloves
- two eye droppers — one marked salt, the other $AgNO_3$

Notes

1. Because eye droppers vary from manufacturer to manufacturer, you will need to keep the same sized eye droppers for future tests.
2. The eye dropper needs to deliver about .1mL.
3. Potassium dichromate is poisonous (see safety warning below).

Safety Warning

1. Potassium dichromate is a health risk and should be used carefully and in drops only from a well marked bottle.
2. Silver nitrate is hazardous and causes staining of the hands.
3. **Gloves must be worn during this experiment.**

SAMPLE PAGE

Copyright Wet Paper Publications

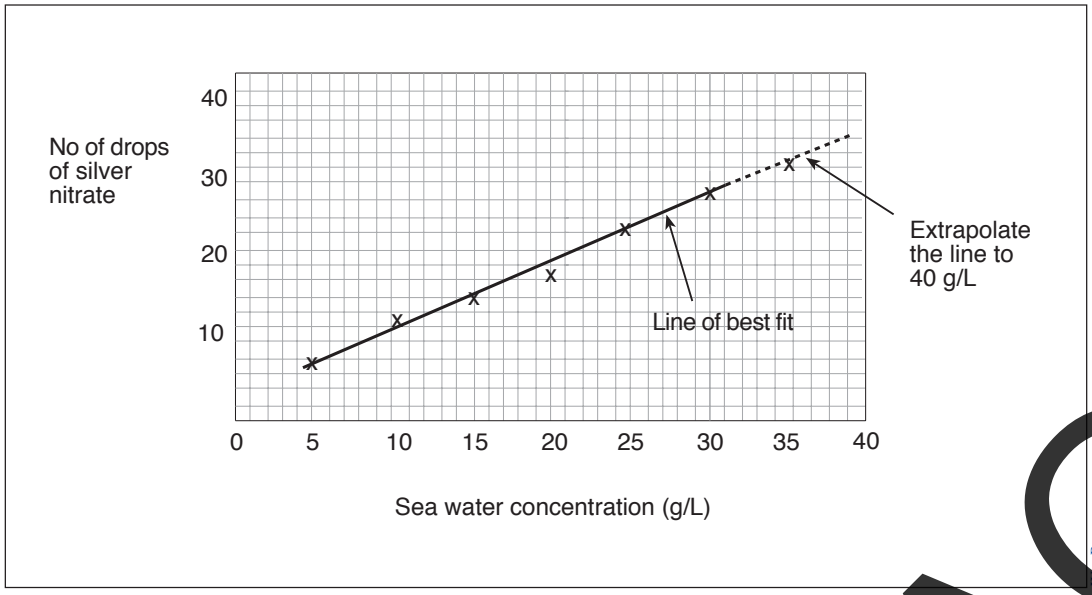


Figure 2.3 Sample calibration graph and safety warning

Data table 1

Standard solution	Number of drops of silver nitrate to end point
5 g/L	
10 g/L	
15 g/L	
20 g/L	
25 g/L	
30 /L	

Data table 2

Sample site (e.g. boat harbour near ramp)	Number of drops of silver nitrate to end point	Salinity in mg/L

Figure 2.4 Results

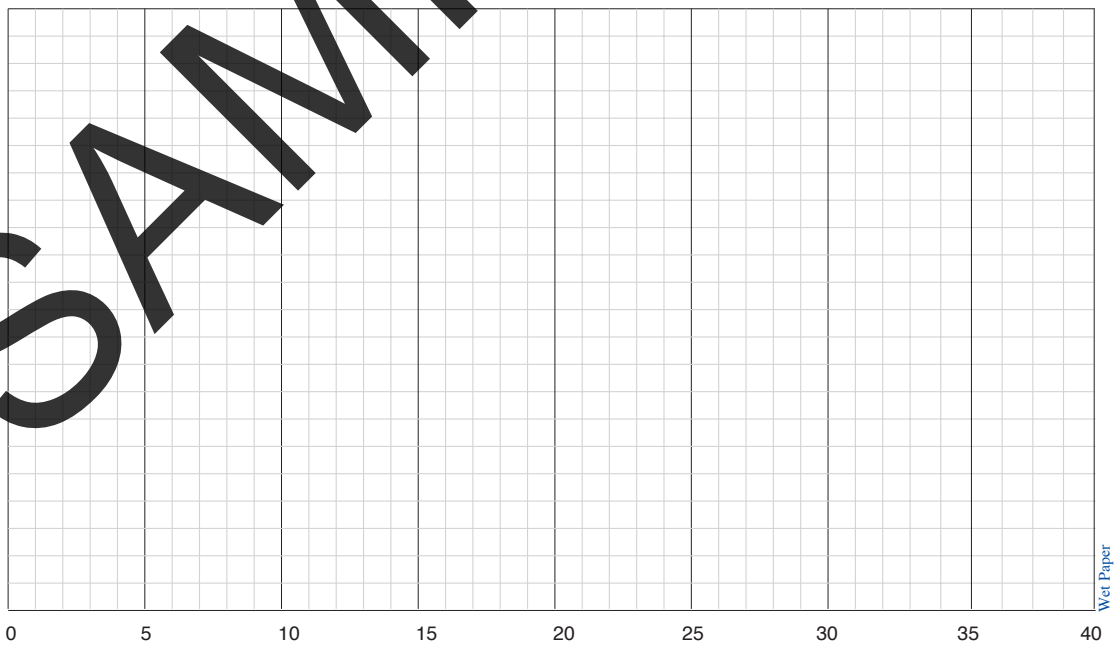


Figure 2.5 Calibration graph drawn from class results.

SAMPLE PAGE

Exercise 3 Sea Water Density

Method

Part A

1. Sharpen two pencils to exactly the same length.
2. Now dissolve a teaspoon of salt in 100 mLs of water.
3. Place the two test tubes in the rack provided and 3/4 fill one with fresh water and the other with salt water.
4. Now place the pencils in each.
   - Can you see a difference? Which is higher? Record your results in Figure 3.1 under Part A.

Part B

5. Now take out one of the pencils and use a pen and ruler to mark down 0.5 cm intervals as shown in Figure 3.1.
   - We will call this your hydrometer.
6. Fill each of the 5 test tubes with the solutions labelled 0, 10, 20, 30, and 40 grams per litre.
7. Now carefully drop the pencil into each test tube as shown in the photograph.
   - Read the scale and record your results in the Table in Figure 3.2.
8. Now repeat the experiment with the other test tubes.
   - Record each of the results in the table as before.

Questions

1. Now plot a graph of the standard solution (x axis) versus the hydrometer reading (y axis).

   Describe how the graph changes.
2. What does a hydrometer measure?
3. Which is more dense, salt water of fresh water?
4. If the tide was coming into a river, would the sea water be found on the top of the fresh water or the bottom?
5. What do you think a salt water wedge is in an estuary?

Materials and equipment (per group)

Part A

- 100 mL beaker
- 5 test tubes (equal size)
- 2 pencils
- test tube rack
- 100 mL beaker
- teaspoon and salt

Part B

- 5 test tubes (equal size)
- pen and ruler
- 10 mLs of 5 saltwater standard solutions labelled 0, 10, 20, 30 and 40 grams per litre

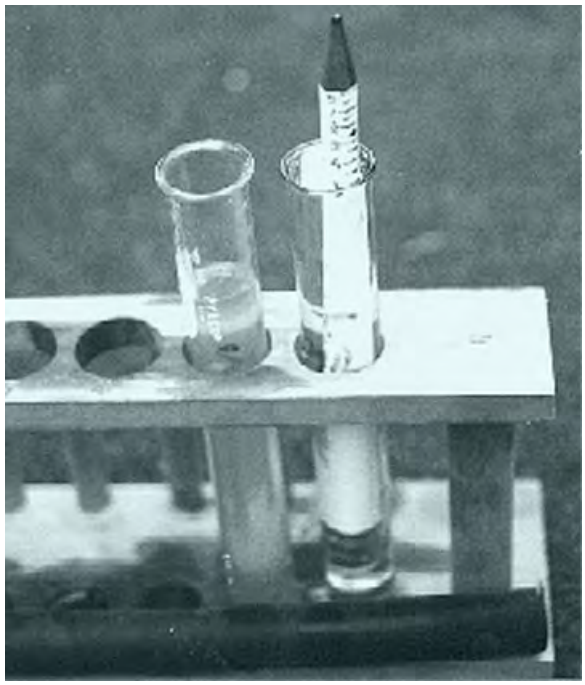


Figure 3.1 Experimental set up for Part B

SAMPLE PAGE

Copyright Wet Paper Publications

Results

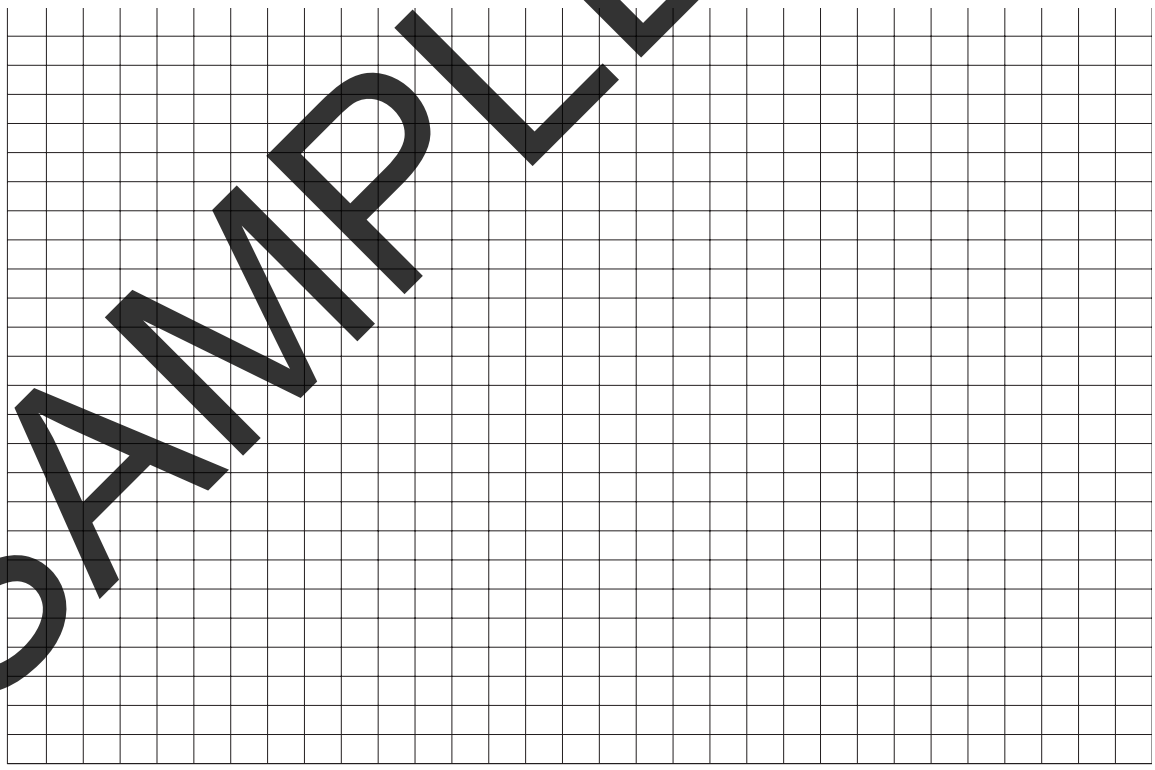
Part A

Which pencil floated higher? _____

Part B

Data table

Standard solution	Hydrometer reading
0 g/L	
10 g/L	
20 g/L	
30 /L	
35 /L	



SAMPLE PAGE

Wet Paper

Figure 3.2 Results and questions