the floor.

Again the children 'ould take care that the height of the holes above the floor is the same and that the depth of water in the containers is the same. This means the depth of water above the holes is the same.

This unit ends up with the following question

Q: Does the shape of the container affect the distance from the container at which the water jet hits the floor?
Answer: No.

Explain your answer:
Answer: The distances are the same.

It is important to make the height of water and the height of the holes the same in the containers. See the note at the bottom of unit 2b in the teachers' guide.

5.6.6 Unit 4

The word 'identical'

The word means the objects should look alike in all respects. You can check the students' knowledge by showing them objects that look alike but having different sizes. Ask them if these are identical.

You can tell them that when objects are identical, even their colour must be the same. However they should not worry about the colour here because it will not affect their results.

The word 'stack'

If you put many objects on top of one another they form a stack. You can make drawings to show what a 'stack' looks like.

You will realise that in order to keep the holes at the same height above the floor (as we have done in this experiment), we had to lift the containers to different heights. Some children may think that by lifting the containers we have affected the distance at which the water jets will hit the floor.

You can address this by putting the containers at the same height from the floor (the holes will now be at different heights). Even in this form the results will not be affected.
The containers should however be lifted from the floor. This allows all the water jets to complete their curves.

Questions from pupil worksheets

At this stage the pupils may have started suspecting that the depth of water above a hole affects the distance at which the water jets hit the floor.

We ask the following questions in this unit.

Q1: Are the distances at which the water jets hit the floor the same? Yes/No

Answer: No

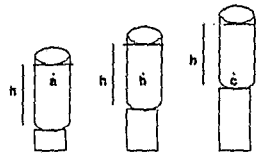
Explain your answer

The water jet from the hole that has the greatest depth of water above it hit the floor furthest from the container.

or

The water jet from container C hit the floor furthest, followed by the water jet from container B. The water jet from container A hit the floor nearest to the container.

Q2: Draw a sketch of the water jets



Q3: Does the depth of the water above the holes affect the distance at which the water jets hit the floor?

Yes/No

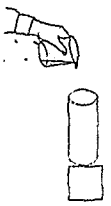
Answer: Yes

Explain your answer

The water jet from the hole that has the largest depth of water above it hit the floor furthest from the container.

The following question finds out if they can relate their observations to holes that are in one container.

Q4: The diagram below shows a container with three holes. The container is filled with water.



Draw the water jets to complete the diagram.

Note that the water jet from the middle hole and the water jet from the bottom hole cross.

We suggest that you finish this unit by asking questions that put the children 's focus on all the things we have investigated. Through questions you should remind them of the things they have looked at that were found not to affect the distance at which the water jets hit the floor.

The following is an example of a typical line of questioning you can follow. You can use a chalk board for this section.

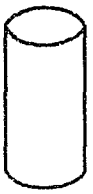
We have looked at lots of things that may affect the distance at which the water jets hit the floor.

Why does the distance change?

Is it the cross sectional area? Yes/No

Answer: No

The following sketch illustrates the cross sectional area of a cold drink can



Some people think it is the cross sectional area that affects the distance at which the water hits the floor. Let us look at this further.

a) Did the water jets from the wide and narrow containers hit the floor at the same distances from the container? Yes/No

Answer: Yes

Check your answer by looking at unit 2a

b) Does this show that the cross sectional area affects the distance from the container at which the water jets hit the floor? Yes/No

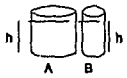
Answer: No

Explain your answer
The water jets from containers hit the floor at same distance from the containers even when the containers have different cross sectional areas.

Is it the quantity of water that affects the distance from the container at which the water hits the floor?

Some people think it is the quantity of water. Let us look at this further.

The depth of water in the two containers A and B below is the same.



When the holes are at the same height, what do you notice about the distances at which the water jets hit the floor?

Check your answer by looking at unit 2.

The quantity of water tells us about the amount of water there in a container. Scientists call the **quantity** of water, its **volume**.

Which of the two containers has a larger volume of water?

Is it the volume of water that affects the distance at which the water jets hit the floor? Yes/No

Is it the depth of the water above a hole that affects the distance at which the water jets hit the floor? Yes/No

Give reasons for your answers.

By this time the children will have realised that the depth of water above the holes affects the distance at which the water jets hit the floor. This is where you need to discuss the depth. The question should now be **'what is it about the depth that affects the distance at which the water jets hit the floor?'**

In order to prepare them for an answer to this question you will need to revise the pressure as $P = F/A$ and relate F to the weight of water.

You can do this by reminding them that weight is a force. Ask them 'Where have you seen this formula before?' What was it used for? Does water have weight? Does a container have a cross sectional area? Can we use the cross sectional area of the container to estimate the cross sectional area of water?

We have asked the above questions to show the pupils that some of their ideas about what affects the distance at which the water jets hit the floor are not correct. We also need to look at the depth further.

The discussion below summarises what the questions were addressing. It may be useful to read through it. However the above section is more relevant to addressing the pupils directly.

'What causes the water to hit the floor at a certain distance from the container?

Is it the area?

If you think it is the cross sectional area (that is the width) of the container that causes the water to hit the floor at a certain distance from the tin, remember that when the water was added to the same level in the narrow and the wide tin, and holes made at the same level, then the water from the two holes hit the floor at the same distance from the holes. Therefore it can not be

the area. It is something else.

Is it the total volume?

If you think it is the total volume of the water above the bottom hole that causes the water from the bottom hole to hit the floor further away from the container than the water from the top hole, think again about a wide container and a narrow container.

When the two holes were at the same height from the floor, and both containers were filled with water to the same level with water, the water from the two containers hit the floor at the same distance from the container. However the volume of the water in the wide container was greater than the volume of the water in the narrow container. Why did this happen? It can not be the volume.

Is it the depth of the water above the hole?

Remember that when we had two holes, one above the other, water from the bottom hole hit the floor further than the water from the top hole. The depth of the water above the bottom hole is bigger than the depth of water above the top hole.

> What is it about the depth of the water above the hole that causes the water jet to hit the floor at a certain distance from the container?'

You can see that the above discussion ends with an unanswered question. We address this question in unit 5a.

Again there are questions pupils should answer to come to the final answer, namely that it is the pressure that causes water to hit the floor at a certain distance from the container. This will happen in unit 5.

We have seen that the cross sectional area and the shape of a container does not affect the distance at which the water jets hit the floor. In addition the volume of water due to its increase horizontally does not affect the distance. It is therefore only the depth of the water above the hole that affects the distance. Remember that both the surface area of the water and its depth above a hole have an effect of increasing the volume of the water. It is therefore important to note that an increase in volume does not necessarily result in an increase in the distance. It is for this reason that we can not accept the 'volume' as affecting the distance at which the water jets hit the floor.

We can change the depth of water above a hole by pouring more in or pouring some out. When we do this, we change the weight of the water, 'F' above a hole. However we can not change the cross sectional area, 'A'. This means everytime we increase the depth of water above a hole, we increase the ratio F/A at that hole (Remember that for containers of certain shapes 'F' is not the total weight of water above the hole, see p. 16). We have defined this ratio as 'pressure'. We can therefore see that it is the pressure that affects the distance at which the water jets hit the floor.

In the next unit we shall lead the pupils to discover that it is only the pressure that affects the distance at which the water jets hit the floor.

5.6.7 Unit 5a

The purpose of this uni is to finally show the children that it is the pressure that affects the distance at which the water jets hit the floor. We do this by looking at the following problem:

Problem: What is it about the depth of water that affects the distance at which the water jets hit the floor?

We start by reminding the children about the following facts.

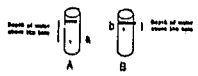
1. a water jet from a hole that has the greatest depth of water above it hits the floor furthest from the container (Unit 4).

2. the greater the depth of water above a hole, the further the water jet went (Unit 4).

3.the cross sectional area has no effect on where the water jet hits the floor (Unit 2).

After the reminder, we ask the following questions.

Look at the depth of water above the holes in the following sketch.



Now answer the following questions.

1. Which hole has a greater depth of water above it? a or b.
Answer: a

2. Which water jet goes further?
Answer: b

3. Which hole has greater weight of water above it? a or b.
Answer: a

4. Is the cross sectional areas of the containers the same? Yes/No
Answer: Yes.

5. What is the formula for calculating the pressure?

Pressure = ...

Answer: P = F/A

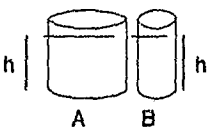
5. At which hole is the pressure greater? a or b?

Answer: a

Explain your answer:

There is a larger force (the weight of the water) on a cross sectional area of the same size to that in container B.

7. The height of water in containers A and B is the same. The cross-sectional area of B is twice that of A.



- Answer the following questions.

Which container has a greater volume of water? A or B?

Answer: B

Which container has a greater cross sectional area? A or B?

B

Is the pressure the same in the two containers? Yes/No

Yes

Explain your answer

The depth/height of water in the two containers is the same. Pressure depends on the

depth of water and not its volume.

- Complete the following statements

1. When the depth of water above a hole increases, the distance at which the water jets hit the floor --- (increases/decreases)
Answer: increases
2. When the depth of water above a hole increases, the pressure _____ (increases/decreases).
Answer: increases
3. When the pressure at a hole increases, the distance at which the water jets hit the floor _____ (increases/decreases).
Answer: increases

5.6.8 Unit 5b

Q1: What do you notice about the height to which the water rises in the two containers?
Answer: The height is the same

Q2: What do you think the reason is?
Water in the two containers rise until the pressure at the bottom is the same in the two containers.

5.6.9 Unit 6

This unit teaches the children to make a manometer and use it to compare the pressure at different depths in a liquid. This is necessary because we can not use water jets to

compare the pressure in different liquids. This is because some liquids are more 'sticky' than others. We call this property of liquids their 'viscosity'. In solids this property is called 'friction'.

Start unit 6 by explaining how the manometer works. Ask the pupils to be very careful when they use the manometer. If there are air bubbles in the manometer they should remove the manometer from the container and remove the bubbles. If they have not done this the difference in the liquid levels may appear less than it should be because of the presence of air bubbles. This happens because air is compressible. As a result the pressure exerted can not be transmitted properly through air. This can be a problem when you want to compare the difference in liquid levels that different liquids cause.

Questions from the unit

Q: How can we use the manometer to compare the pressure?
Answer: Dip the extension of the manometer at a point where you want to measure the pressure. Note the difference in the liquid levels in the U tube. Repeat the activity at a point where you want to compare the pressure.

Q1: What happens to the liquid levels in the U tube?

Answer: The liquid rises higher in one.

Q2: Dip it deeper in the liquid.
Now what happens to the liquid levels in the U tube?

Answer: The difference in the height of the liquid in the two arms increase

Q3: Why does this happen?

Answer Water exert pressure on the extension of the manometer which is in the water. The water in one arm must therefore rise until it balances the pressure by the water.

Q4: Can you use the manometer to find out if the pressure in different liquids is the same?

Yes/No

Answer: Yes

Explain your answer

By dipping the extension of the manometer to the same depth in the two liquids.

5.6.10 Unit 7

The word 'tilt'

You can contrast this word with the word 'upright' if they remember that. The word 'tilt' will then mean 'not upright'.

In this unit we compare the effect of density on pressure in liquids. We do this by comparing the difference in liquid levels in a tube when its extension is dipped in water and when it is dipped in paraffin. You can also use petrol but you must be careful because petrol can easily catch fire.

We ask the following questions at the end of the unit:

Q1: Were the liquid levels in the U tube when using water the same as the liquid levels when using paraffin? Yes/No

Answer: No

Explain your answer

Answer: The difference in liquid levels for water was greater than that of paraffin.

Q2: What do you think the reason is.

At the same depth water exerts greater pressure than paraffin.

Q3: When we use a liquid with a greater density than water will the difference in the liquid levels in the U tube increase/decrease?

Answer: Increase

Complete the following statement.

Q4: When the density of a liquid increases, the pressure _____

(increases/decreases)

Answer: increase.

5.6.11 Unit 8a

The word 'squeeze'

You can make a demonstration of what to squeeze is.

The word 'enclose'

The word means totally surrounded

You can then draw different containers with water. Some of them should be closed and others not closed. You can then ask them to identify containers in which the liquid

is enclosed.

The word 'confirm'

This means to make sure that what you have said or done earlier is true.

It is important to hold the plastic bag tightly. If this is not done, no water jets will go in the upward direction. This in turn may lead the children to conclude that the pressure acts in all directions except upward.

When there are no water jets in the upward direction, it is because the force with which the water jets are pushed upwards is equal to gravity. In order to show that gravity has an influence on the water jets, show them that the water jets from the holes facing downwards hit the floor directly under the holes. Water jets from holes that are on the sides make curves downwards as the force of gravity pulls them.

Questions from the unit

Q1: What do you <u>see</u> about the directions of the water jets?
Answer: The water jets go in all directions (Depending on what has been observed).

Q2: Did you expect this result? Yes/No

Explain your answer

_____

_____

Discuss with other students to see if they got the same answer.

Q: What can you say about the direction(s) of the water jets?

Answer: The water jets go in all directions.

Q4: What does your answer tell you about pressure in liquids?

_____

_____

Q3: How can you use a manometer to confirm your answer?

_____

_____

_____

5.6.12 Unit 8b

The worksheets require the children to bend straws in different directions to demonstrate that the pressure is the same in all directions. The children do not all have to bend the straws in exactly the same directions. We have specified directions in the worksheets to make instructions easy Should you notice that the children are using directions other than those we have mentioned, do not discourage them. Rather encourage them to remember the directions they have used. They can then let other children know their findings even if they have used different directions.

Questions from the unit

Q1: What can you say about the level of water in the arms of the U tube before you put the straw into a beaker of water?

Answer: The level in the two arms is the same.

Q2: What can you say about the level of water in the arms of the U tube after you

have put the straw in a beaker of water.

Answer: The level is different in the two arms.

Q3: a) Does the manometer show that water exerts pressure in all those directions? Yes? No

Answer: Yes

b) Explain your answer.

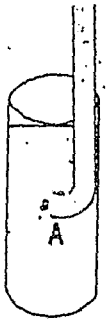
We can see a difference in the level in the two arms of the manometer for all direction we point the end of the straws

5. Now repeat the experiment but each time make sure that the tip of the tube is at the same depth of water.

Q2: Is the pressure the same in all directions? Yes? No

Answer: Yes.

Q3: Look at the diagram below. Use arrows to indicate directions in which water exert pressure on the opening of a tube that is in water.



Discuss with other students to see if your answers are the same.

5.6.13 Unit 9

This unit demonstrates Pascal's Principle.

Pascal' principle states that 'Pressure in an enclosed liquid is transmitted undiminished to all parts of the liquid'.

The word 'enclosed' in this statement means the liquid totally fills a container and the container is tightly closed. We must therefore make sure that we have met this condition when we demonstrate the principle. This is why we close the straws at the bottom. We also tightly close the openings through which the straws enter the bottle. This ensures that the water in the bottle is not open to the atmosphere. Only the water in the straws is open to the atmosphere. However this does not matter because we are looking at the pressure that is being exerted in the liquid in the bottle.

The openings where the manometers enter the containers should be air tight. They must carefully seal the openings with prestik.

The container must be full to the brim with water.

Questions from the unit.

Q1: Is the amount by which the water level in the straws change the same? Yes/No

Answer: Yes.

Q2: How can you tell from the amounts by which the liquid levels in the two straws change that the pressure you exert by squeezing

a: increases with depth?

Answer: The amount by which the water level in the straws increase would be greater for a straw that is deeper in the water.

b: decreases with depth?

Answer: The amount by which the water level in the straws increase would be less for a straw that is deeper in the water.

c: the pressure stays the same throughout the liquid?

Answer: The amount by which the water level in the straws increase would be the same even if the bottom parts of the straws are at different levels.

8. Gently squeeze the bottom part of the bottle

Q3: What is your conclusion about the change in pressure at different parts of the liquid when you squeezed the bottle?

The change in pressure is the same at different parts of the liquid.

This finding is known as Pascal 's Principle. We state the principle in the following way: If you exert an extra pressure on a liquid that is enclosed, then you increase the pressure everywhere in the liquid by that extra amount you have exerted.

6. What have we learned?

Let us try to answer the following questions. Correct answers are indicated in bold.

Solids exert **pressure**. We can calculate the pressure by dividing **force** by **area**. As the force increases, the **pressure** also increases. When the area increases the pressure **decreases**. When the area decreases the pressure **increases**.

The direction of pressure in solids is **downwards**. Liquids exert pressure in **all** directions(s). The pressure increases/decreases when the depth of the liquid increases. The pressure on two places that are at the same level in a liquid is **the same**/different.

Two things that affect the pressure in liquids are **the density** and **the depth**. The pressure increases when **density/depth** increases. The pressure decreases when **depth/density** decreases. The pressure also increases when **depth/density** increases. It also decreases when the **density/depth** decreases.

Pascal's principle states

that_____

_____

_____

_____

We use this principle when (give an example)_____

7. How can you help in pupil discussions?

- Please see that the children form discussion groups. The children should decide who

they want to form groups with but if they are undecided you can use your own criterion, which you should please let us know (for example you may group the children by ability or put them into mixed ability groups - you want to make sure that all children take part in the discussions.

- Walk around to see if the discussions do in fact take place.
- Do not discourage the children speaking in N. Sotho if they so wish. If in the past you have not allowed discussion in the vernacular to take place, please tell them that for this section of the syllabus only, you are going to allow them to use any language or a mixture of any languages they prefer. Should you notice a discussion in the vernacular, if possible please note the child's name, and whether the child comes from an urban or rural area. When you take these particulars do not let the child notice it, otherwise he/she might think she has committed an offence for which he/she is going to face punishment.

As the activities progress, please note down what you think are good points and bad points about these activities. You will not be held responsible for any comment you have put down.

8. Conclusion

We hope this guide has been helpful. If not directly so, we hope you will still be able to use some of the hints and experiments with some modification. When that has happened this guide will have made a contribution.

In th section we are going to do experiments using different kinds of objects. An object is anything that has a shape that does not change and is not alive.

Solid Pressure

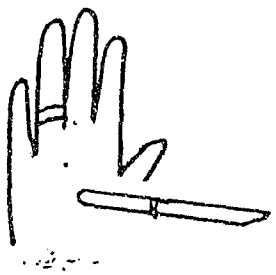
Problem: Why is the pain you feel when you push a sharp object against your hand different from the pain you feel when the object is flat?

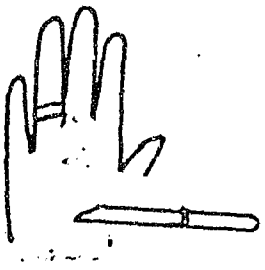
Unit 1

Problem: To find out what affects the pain when you push one side of an object against your hand.

New words: - sharp
- flat

Apparatus: You need
- a drawing pin
- ball point pen
- a knife





Procedure:

- Push the flat side of the drawing pin against your hand.
- Push as hard as you can
- Now push the sharp side of the drawing pin against your hand
- Push as hard as you can.
- Repeat the activity with the ball point pen
- Now repeat the activity with a knife

Q1: Which side hurts most (Which side makes you feel greater pain)?
Show your answer by making a tick in the right box.

Object	Sharp side	Flat side
Drawing pin		
Ball point pen		
Knife		

In general which hurts most, a sharp (pointed) object or a flat object?

Why do you think this is?
/ What do you think the reason is?

Unit 2

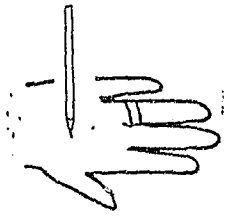
In this unit you can work in groups of three.

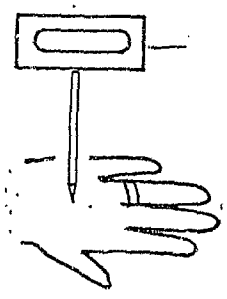
Is it the force?

Problem: Does the force applied explain why it hurts (you feel pain) when you push an object against your hand.

New words:
- upright
- apply

Apparatus: You need
- a ball point pen.
- a brick.





Procedure:
- Open your hand
- Put your open hand flat on the table
- A friend must put the sharp end of the ball point pen on your hand.
- He/she must now support the ball point pen so that it is upright.

Q1: Does it hurt?/ Do you feel pain? Yes/No

- Let a friend support the ball point pen upright.
- Now another friend should support the brick on top of the ball point pen.

(The brick increases the force acting on your hand. The other force comes from the ball point pen)

- Does it hurt now? Yes?/No.

- When did it hurt most?/ When was the pain the greatest?

Q2: Does the force applied explain why some objects hurt when pushed against your hand? Yes/No

- Now let the friend put the flat side of the ball point pen on your hand
- Does it hurt? Yes/No
- Now let the friend support the brick again on top of the pen.

Does it hurt? Yes/No

Q3: Does the force explain why obje ts hurt when pushed against your hand? Yes/No

If your answer is yes, answer the following.
Q4: Is it only the force?
Yes/No

If your answer is no, explain

Unit 3

Is it the area?

Note: When objects touch, we say they are in contact. We call the part of their areas which touch, contact areas.

Problem

Does the area of an object that touches your hand explain why it hurts when that part of an object is pushed against your hand?

New word: - contact

Procedure: - It is not necessary to repeat this experiment. Think about what you have done in unit 2. Read again what you have written there and answer the following questions.

Q1: Did you feel pain when a friend put the flat end of the ball point pen on your hand without the brick on top? Yes/No

Q2: Did you feel pain when a friend put the sharp end of the ball point pen on your hand without the brick on top?

Q3: In which case did you feel pain most (In which case did you feel greater pain)?

Q4: Does the contact area alone explain why you feel pain when an object is pushed against you? Yes/No

Q5: In the experiment you had a brick on top of a ball point pen for the flat and for the sharp side.

Was the pain the same?
Yes/No

Explain.

Q6: Name two things that you can do if you want to increase the pain.

a)

b)

Discussion of units 2 and 3

You must work with two other students in this section. Think about the activities you have done. Discuss with your friends and help each other to answer the questions.

a) Is the force alone enough to explain why you feel the pain? Yes/No

Explain

b) Is the contact area alone enough to explain why you feel the pain?
Yes/No

Explain

c) Complete the following sentences.

1) When the sharpness does not change the pain gets bigger when the force .....
2) When the force does not change the pain gets bigger when the area .....
3) The pain gets bigger when the force ..... and the area .....
4) The pain gets smaller when the force ..... and the area .....
5) The pain gets bigger when the ratio Force/Area gets bigger/smaller. This ratio is called the pressure.
6) The pain will always increase when the ..... increases.

You can see from the activities above that the force alone is not enough to explain why you feel pain. Also the sharpness alone is not enough to explain why you feel the pain. Pain is caused by the force and the sharpness together. This sharpness is called area.

Your teacher will explain to you why we call this sharpness area.

The pain increases (gets bigger) when the force increases. It also increases when the area decreases (becomes smaller). When this happens you get a large force on a small area. This means the quotient Force/Area increases. This quotient is called the pressure.

Unit 4

Can we compare the pressure?

Problem: How can you compare pressure?

New word: dent

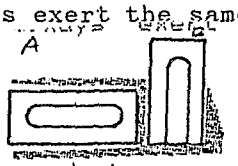
Remember:
- We said that the pressure is equal to Force/Area.
- Weight is a force.
- We can measure the force and the area. Therefore we can measure the pressure.

Before you do the experiment answer the following questions:

Q1: Does an object exert the same pressure no matter on which side we put it upright?

Explain .....

Q2: Do different objects always exert the same pressure? Yes/No



Apparatus: You need:

- Two bricks
- Sponge (large enough to carry the two bricks). The bricks must be the same size and made of the same material.

Procedure:
- Put one brick (brick A onto the sponge with its largest side.
- Put the other brick (brick B) onto the sponge with its shortest side.

Q1:
- Which brick makes a larger dent on the sponge? A or B?

Are the dents the same size?/ Is the size of the dents the same? Yes/No

Explain

Does this explain why you feel pain when you push the sharp side of the pin against your body? Yes/No
Explain.....

Unit 5

Problem: How do we measure the pressure?

Apparatus: You need
- a ruler
- two bricks
- spring balance

Procedure:
As you do the experiment, you must write the measurements you take in the table
- Use the spring balance to find the weight of the brick.
  Measure the length and breadth of the shortest side.
- Calculate the area of this side.
- Measure the length and breadth of the largest side.
- Calculate the area of this side.
- Calculate the pressure which the brick exerts on the sponge when on the shortest side.
- Calculate the pressure which the brick exerts when it is lying on the largest side.

- Calculate the pressu which the bricks will exert if one is put on of the other?

Complete the table below

	Length	Breath	Area	Pressure
Shortest side				
Largest side				

Q1: Is the pressure which one brick exerts the same at all times?

Q2: Does this explain why the short side always made a big dent?

Q3: Will the dent increase when one brick is put on top of another one?

Try this and see if your answer was correct

What is the unit of pressure?

To get the unit of pressure, answer the following questions:

Q1: What is the definition of pressure?

Q2: What is the unit of force?

Q3: What is the unit of area?

Q4: Now use your answers to the three questions above to find the unit of pressure.

The unit of pressure is .../...

This unit is also called the pascal.
Remember pressure is force/area and force is measured in newton while area is measured in m^2. The unit it therefore N/m^2. This unit is called the pascal.

One pascal is therefore the pressure when a force of 1 N is applied over an area of 1 m^2. An object that has a mass of 100 g (0,1 kg) weighs nearly 1 N (If you like ask your teacher why we can not be sure that the object will have a weight of 1 N.

To find out how large a pascal is, you can use a card whose length is 1 m and the breadth is also 1 m. One pupil can hold two ends while another pupil holds the other two ends. The third

pupil should now weigh 100 g of sand and spread it over the paper. The sand now exerts a pressure of 1 pascal on each bit of the card.

'Hydrostatic Pressure

We are going to look at the pressure in a liquid. There are several things which we need to look at to see what causes changes in pressure. In all the experiments, try to make all the holes in a container the same size.

Remember Pressure = Force/Area

The meanings of new words are given at the back of the worksheets. If you do not understand a word, you can look there to find out what it means. If you still do not understand what the word means, please ask your teacher.

Unit 1

Note: In this experiment you should work in groups of three. We shall call you Thabo, Mpho and Tau. Decide who is going to be Thabo, who is going to be Mpho, and who is going to be Tau.

Problem: What causes a water jet coming out of an opening from a container to hit the floor at a certain distance from the container?

New words:

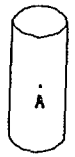
- Width: distance from one side of a container to the other
- Spot. small place.
- Water jet: a thin stream of water.
- Quantity: How much water there is.

New phrase - Hit the floor: touch the floor.

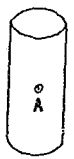
What you need: You need the following things
A large basin
Water
A jug with water
A narrow container (eg. A small juice bottle).
A nail/Sharp wire
Some prestik/ You can also chew a bubble gum

('chappies') and use it afterwards.

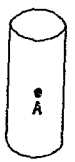
What you should do:



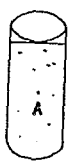
1. Choose a spot, A, in the middle of the container as in the diagram.



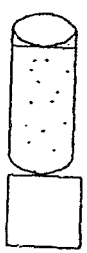
2. Make a hole at A.



3. Close the hole with prestik or bubble gum.



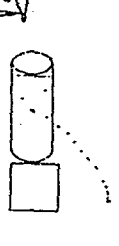
4. Fill the container with water.



5. Put the container on a stand. (You can make a stand by puting bricks on top of one another)

6. Thabo must hold the jug with water, ready to pour water into the container to make sure the container is always full.

7. Tau must open the hole.



8. Thabo must keep adding water to the container so that it remains full with water.

9. Tau must *mark the spot* where the water jet hits the floor.

Question: What causes the water jet to hit the floor where it does?

Is it the quantity of the water in the container?
Is it the width of the container?
Is it the shape of the container?
Is it the depth of the water above the hole?
Is it the height of the hole above the floor?
Is it something else?
We shall look at each of these one at a time

Unit 2a

Let us look at the quantity of water

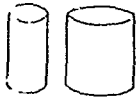
Problem: Does the quantity of water in a container affect the distance from the container at which the water jet will hit the floor?

New words: - *affect:* make the result different from the way it would have been.
- *narrow:* having a short distance from one side to the other.

What you need:

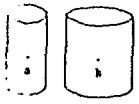
Wide container that is the same height (as tall) as the narrow container.
All other equipment you have used in unit 1.

What you should do:

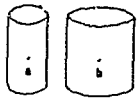


1. Put a wide container next to your narrow container as in the diagram.

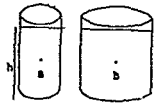
2. Choose a spot (b) on the wide container which is at the same height above the bottom of the container as the hole in the narrow container.



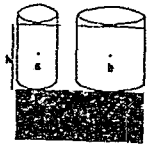
3. Make a hole on this spot (b).



4. Close the hole with prestik.

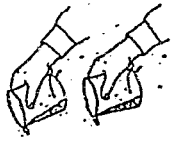


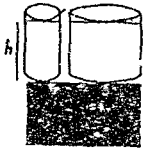
5. Fill the containers to the same height, h, with water.



6. Put the containers on a stand as in the diagram.

7. Tau must open the holes and mark the spots where the water jets hit the floor.





8. Keep adding water to the container so that the height of the water remains 'h'.

Unit 3

To look at the shape

Problem: Does the shape of a container affect the distance from the container at which the water jet will hit the floor?

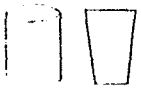
New words: - shape: What the object looks like (eg. round, shape of V etc.)

- horizontal: parallel to the floor.

What you need: - Two containers of different shapes.

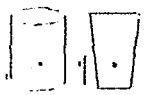
- All the equipment you have used in units 1 and 2.

What you should do:



1. Put the containers next to each other.

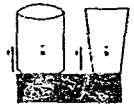
2. Choose spots at the same height, h, from the bottom of the containers in both containers as the diagram shows.



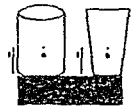
3. Make one hole in each container in the spots you have chosen. The holes must point in the same direction.

4. [illegible] work in groups of three as you have done in unit 1.

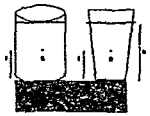
5. Pour water into the containers so that the height h, of the water from the bottom of the containers is the same, as the diagram shows.



6. Put the containers on a stand.



7. Open the holes.



8. Keep adding water so that the height of the water in the containers remain 'h'.

9. Make a mark for example by putting a stone at the spots where the water jets hits the floor. Do this for each of the containers.

Unit 4

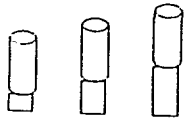
To look at the depth of water above the hole

Problem: Does the depth of the water above the hole affect the distance at which the water will hit the ground?

New words:
- identical
- stack

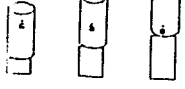
What you need:
- Three identical containers
- bricks
- three jugs of water

What you should do:

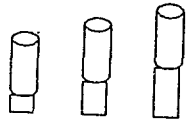


1. Arrange the containers on stands as in the diagram.

2. Choose spots a, b, and c at the same height above the floor as shown as the diagram shows.

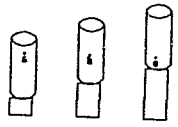


3. Make holes of the same size at spots a, b and c as the diagram shows.



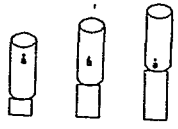
4. Close the holes with prestik.

5. Now each one of you must choose a container he/she is going to work with.



6. Fill the three containers to the same height 'h' with water as the diagram shows.

7. Open the hole in your container.



Unit 5a

Let us look at the pressure.

Problem: What is it about the depth of water that affects the distance at which the water jets hit the floor?

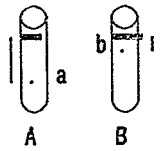
You have seen that:

1. a water jet from a hole that has the greatest depth of water above it hits the floor furthest from the container.

2. the greater the depth of water above a hole, the further the water jet went.

3.the cross sectional area has no effect on where the water jet hits the floor.

Look at the depth of water above the holes in the following sketch.



Now answer the following questions.

1. Which hole has a greater depth of water above it? a or b.

2. Which water jet goes further?

3. Which hole has greater weight of water above it? a or b.

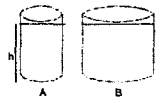
4. Is the cross sectional areas of the containers the same? Yes/No

5. What is the formula for calculating the pressure?
Pressure = ...

5. At which hole is the pressure greater? a or b?

Explain your answer:

7. The height of water in containers A and B is the same. The cross-sectional area of B is twice that of A.



- Answer the following questions.

Which container has a greater volume of water? A or B?

Which container has a greater cross sectional area? A or B?

Is the pressure the same in the two containers? Yes/No

Explain your answer

- Complete the following statements

1. When the depth of water above a hole increases, the distance at which the water jets hit the floor _____ (increases/decreases)

2. When the depth of water above a hole increases, the pressure _____ (increases/decreases).

3. When the pressure at a hole increases, the distance at which the water jets hit the floor _____ (increases/decreases).

Unit 5b

The hydrostatic paradox

A paradox is something that we can not explain. You will see why some people call this experiment a 'paradox'. When you have finished you will see that it is not a paradox because you will be able to explain it.

Problem: Will water levels in containers that have different shapes rise to the same level when they are connected to each other?

New word: Secure:

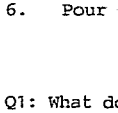
What you need: - Two different shapes of containers.
- All the equipment you have used in unit 1.
- One straw

What you should do:

1. Make holes at the same height above the floor, at A and B in both containers.

2. Arrange the containers as in the diagram.

3. Use prestik to connect a straw tightly to both holes.



6. Pour water into one of the container.

Q1: What do you notice about the height to which the water rise in the two containers?

Q2: What do you think the reason is?

Q3: Look at the diagram below and answer the question that follow.

Thabo pours water into container A until the height of the water is 'h'. What will the height of the water be in containers B and C? Show what your answer by making marks on the diagram.

*Answer the following questions only when you have answered all questions in this unit.

Q4: Explain in your own words the answer you gave in Q3.

Q5: Imagine three containers connected like the two containers above. Will the water level be the same in the all the containers? Yes/No.

Explain your answer.

Unit 6

Q: How can we use the manometer to compare the pressure?

Now we know that it is the pressure in a liquid that causes the liquid to hit the floor at a certain distance from the container. This means the activity in unit 5 showed us that the pressure increases with depth.

Now I ... use a different experiment to show the same thing. To say ... epth of water above a point has increased is the same ... hat the *point* is now deeper in ... water.

... nometer to do this experiment. It is easy to make ... ter.

... bending straws
... ky tape

What ... do: 1. Bend one straw A as in the diagram.

2. Bend straw B as in the diagram

3. Use sticky tape to join the straws as in the diagram.

When you have made the manometer

you can proceed with the experiment

You need:

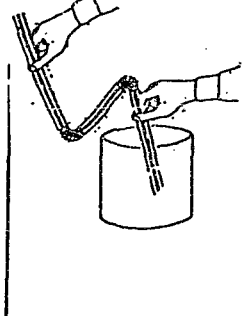
container with water
manometer

New word: tilt: Not horizontal (→) and not vertical (↑) but ↗

What you should do

1. Pour a coloured liquid like tea to the U tube.
2. Add the liquid until its level is about half the height of the U tube.

3. Mark the level of the liquid in the tube. (eg. with a marking pen).



5. Without tilting the U tube dip one end of the straws into the container with water.

Q1: What happens to the liquid levels in the U tube?

_____

Q2: Dip it deeper in the liquid. Now what happens to the liquid levels in the U tube?

_____

Q3: Why does this happen?

_____
_____
_____

Q4: How can you use the manometer to find out if the pressure in different liquids is the same?
Yes/No

Explain your answer

In the next unit we shall see how the density of a liquid affects the pressure.

Unit 7

WARNING: -In this unit you will be using paraffin. Paraffin can easily catch fire.
- You must not light any match while doing this experiment.

To look at the density.

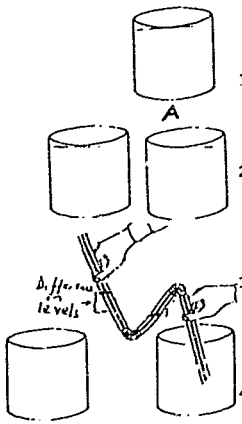
The density of a liquid is the mass of a unit volume of the liquid. When two liquids have equal volumes, the one with higher density will feel heavier to lift than the one with lower density.

Water has greater density than paraffin.

Problem: Does the density of a liquid affect the pressure in the liquid?

What you need: Water
Paraffin
Two identical containers
manometer with coloured liquid

What you should do:



1. Pour water into container A.
2. Pour paraffin in container B to the same height as the water in container A.
3. Now dip one end of the manometer to the bottom of the container with water.
4. Mark the difference in the liquid levels in the U tube.
5. Remove the manometer from the water.

6. Use the same manometer to repeat the activity with container B.

Q1: Were the liquid levels in the U tube when using water the same the same as the liquid levels when using paraffin? Yes/No

Explain your answer

Q2: What do you think the reason is.

_____

Q3: When we use a liquid with a greater density than water will the difference in the liquid levels in the U tube increase/decrease?

Q4: When the density of a liquid increases, the pressure _____ (increases/decreases)

Q5: When the density of a liquid decreases, the pressure _____ (increases/decreases)

Unit 8a

Problem: What are the directions of water jets from this container?

New words: confirm: check
surface: The outside of an object

(Choose the answer you think is correct)

Answer: a) Upwards
b) Downwards.
c) Sideways.
d) All directions.
e) All directions except upwards.
f) (Write your answer here if you think all the answers above are wrong).

Let us see if you are right.

What you need: A plastic bag
A thin sharp object.

What you should do:

1. Pour water into the plastic bag.

2. Hold the plastic bag with the water in it tightly closed.

3. Make holes in all directions in the plastic bag.

Q1: What do you see about the directions of the water jets?
Q2: Did you expect this result? Yes/No

Discuss with other students to see if they got the same answer as you.

Q2: What can you say about the direction(s) of the water jets?

Q3: What does your answer tell you about pressure in liquids?

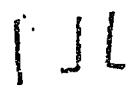
Q3: How can you use a manometer to confirm your answer?

Unit 8b

Problem: To show that water exerts pressure in all directions using the manometer.

What you need: A U tube made from straws
4 straws

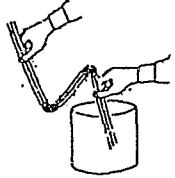
What you should do:



1. Bend the end of the straws in different directions.

2. Connect one of the straws to the U tube as in the diagram.

3. Half fill the U tube with water.



4. Dip the straw into a beaker of water.

5. Repeat with the other straws.

Q1: What can you say about the level of water in the arms of the U tube before the straw is put into a beaker of water?

Unit 9

To look at Pascal's Principle

Problem: Does the change in pressure at a point in an enclosed liquid depend on the depth of water above the point?

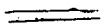
What you need:
- A plastic juice bottle
- 2 straws
- sticky tape
- thin piece of wire

What you should do:

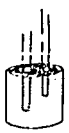
1. Fill the bottle with water until it overflows.

2. Tightly close the bottle with a piece of plastic.

3. Make two holes that tightly fit a straw on the plastic.

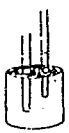


4. Close one end of each straw tightly using a piece of plastic and sticky tape.

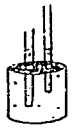


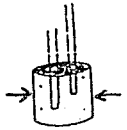
5. Insert a straw in each hole with the closed end in the water.

6. The end of one straw should be near the top of the bottle while the end of the other straw should be near the bottom of the bottle.



7. Pour water into the straws until you can see the water in the straws outside the bottle.





8. Close the openings where the straws fit into the plastic tightly with prestik.

9. Squeeze the middle part of the bottle.

Q1: Is the amount by which the water level in the straws change the same? Yes/No

Q2: How can you tell from the amounts by which the liquid levels in the two straws change that the pressure you exert by squeezing

a: increases with depth?

b: decreases with depth?

c: the pressure stays the same throughout the liquid?

8. Gently squeeze the bottom part of the bottle

Q3: What is your conclusion about the change in pressure at different parts of the liquid when you squeezed the bottle?

This finding is known as Pascal 's Principle.

We state the principle in the following way: If you exert an extra pressure on a liquid which is enclosed, then you increase the pressure everywhere in the liquid by that extra pressure you have exerted.

What have we learned?

Let us try to complete the following sentences.

Solids exert _____. We can calculate the pressure by dividing _____ by _____ . As the force increases, the ____ also increases. When the ____ decreases, the ____ also decreases. When the area increases the pressure _____. When the area decreases the pressure _____.

The direction of pressure in solids is _____. Liquids exert

GLOSSARY

Affect - To make the result different from the way it would have been (to change)
Apply - To use./put onto.
Compare: To look for things that are alike and things that are different.
Confirm - Check
Contact - To touch
Decrease - Make smaller.
Flat - having a side that or end that is difficult to cut with./ Large flat surface area
Hit the floor - To touch the floor while moving at high speed.
Horizontal - parallel to the floor.
Identical - being exactly equal and alike
Increase - Make bigger.
Lift - To take the container from where it is to a higher place.
Narrow - having little space inside./Having a short distance from one end to the other.
Water jet - A thin liquid forced out of a container through a small hole./ A thin line of water.
Tilt - Not horizontal and not vetical (somewhere in between)
Shape - What the container looks like eg. round or V shaped (if it looks like a V etc.)
Sharp - having a side or end that is able to cut easily./Having a very thin side or edge.
Stack - When you put the bricks, one on top of the other
Surface - The outside of a thing.
Quantity - How much liquid there is.
Upright - being straight upwards, not leaning and not lying down.
Wide - having a large space inside.
Width - Having a long distance from one end to the other.

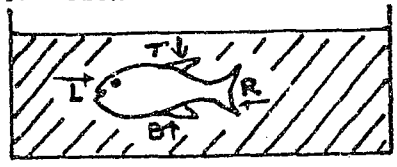
APPENDIX B: DIAGNOSTIC TESTS

(a) Open conceptual test
(b) Multiple choice conceptual test
(c) Language tests

TEST ON PRESSURE NAME: _____

Question 1

1.1 The diagram below, there is a stationery fish in a container of water. L, B, R and T are points on the fish. Answer the questions that follow:



Is pressure being exerted on the fish? Yes/No _____

If your answer is No, give reasons for this answer.

If your answer is Yes, answer the following questions:

(a) How does the pressure at L compare with the pressure at R?

(b) How does the pressure at T compare with the pressure at B?

(c) How does the pressure at T compare with the pressure at R?

(d) How does the pressure at T compare with the pressure at L?

(e) How does the pressure at L compare with the pressure at B?

(f) How does the pressure at B compare with the pressure at R?

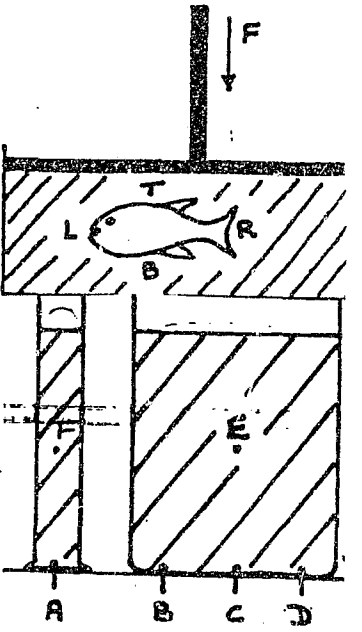
(g) In which direction(s) is pressure at points L and R exerted?

(h) In which directions is pressure at points T and B exerted?

1.2 If the fish was replaced with a stone suspended by means of a string, would any of your responses above alter? Why?

Question 2

A cork which just fits is used to close the container with the fish, as shown in the diagram opposite. A force F is exerted on the cork. If the cross-sectional area of the cork is A, what is the effect of the force on the liquid, and the fish at points L, R, T and B?



Question 3

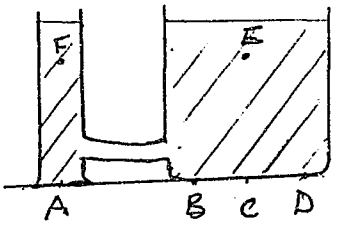
In the situation indicated in the diagram, compare the pressures at points A, B, C, D, E and F. (Both vessels are filled with water)

The water is now replaced with mercury.

(a) How will the pressure at points A, B, C, D, E and F now compare with each other?

(b) How will the pressures at these points compare with the pressures when the containers were filled with water?

3.2 The situation above is modified as in the diagram opposite.



(a) Compare the pressures at points A, B, C, D, E and F (Both vessels filled with water)

(b) The water is now replaced with paraffin. How will the pressure at points A, B, C, and D now compare with each other?

How will the pressure at points A, B, C, and D now compare with each other?

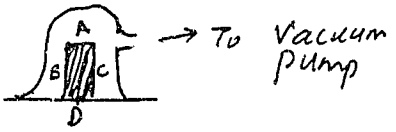
(b) How will the pressures at these points compare with the pressures when water was used?

Question 4

The diagrams opposite show two different designs of a dam wall. If the same amount of material is available for the construction of the walls, which design will you prefer? Explain.

Question 5

The diagram below shows an object in an evacuated jar. Answer questions that follow:



(a) At which point(s) (if any) is pressure exerted?

(b) Give direction of pressure at the point(s) mentioned.

5.2 How would solid pressure on earth compare with that on the moon? explain.

5.3 The diagram opposite shows two different types of shoes. Which type will you prefer when taking a walk on the sand? Explain?

KNOWLEDGE SURVEY ON PRESSURE

SURNAME	:.....
NAME	:.....
HOME LANGUAGE	:.....
URBAN/RURAL	:.....
FATHER'S OCCUPATION	:.....
MOTHER'S OCCUPATION	:.....
EDUCATION DEPT.	:.....
SCHOOL	:.....
STANDARD THIS YEAR	:.....
STANDARD LAST YEAR	:.....
AGE	:.....
GENDER	:.....

NOTE: This is not a test. We want to see what you know so that we can write better learning material for you.

INSTRUCTIONS

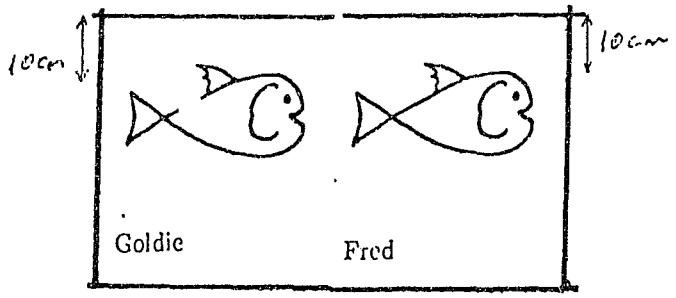
Answer **ALL** questions

Please do not guess.

Put a ring around the letter next to the correct answer.

1.

The diagram shows two fish, Goldie and Fred in a tank of water.



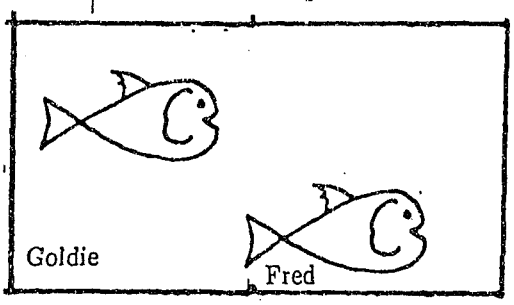
Compare the pressure on the two fish.

(a) The pressure on Goldie is greater than the pressure on Fred.
(b) The pressure on Goldie and Fred is the same.
(c) The pressure on Goldie is lower than the pressure on Fred.
(d) I do not know

Reason for my answer:

2.

Fred has now moved deeper in the tank.

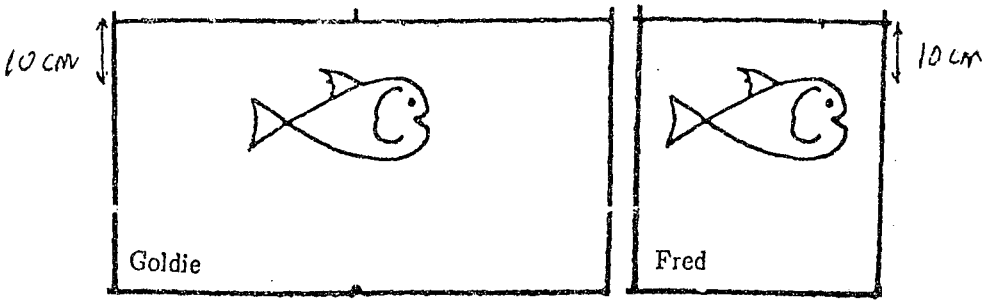


Compare the pressure on the two fish now.

(a) The pressure on Goldie is greater than the pressure on Fred.
(b) The pressure on Goldie and Fred is the same.
(c) The pressure on Goldie is lower than the pressure on Fred.
(d) I do not know

Reason for my answer:

3. Goldie and Fred are now in different tanks.

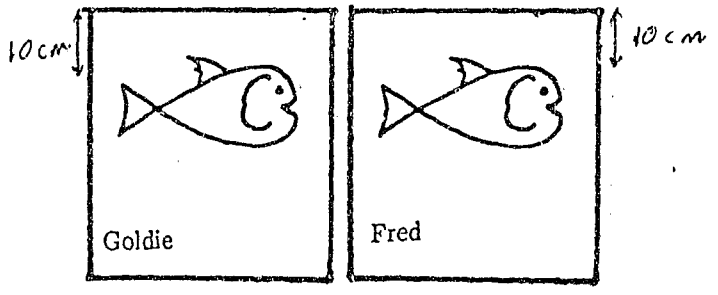


Compare the pressure on the two fish.

(a) The pressure on Goldie is greater than the pressure on Fred.
(b) The pressure on Goldie and Fred is the same.
(c) The pressure on Goldie is lower than the pressure on Fred.
(d) I do not know

Reason for my answer:

4. The sketch below shows Goldie in fresh water and Fred in salt water. The density of salt water is greater than the density of fresh water.

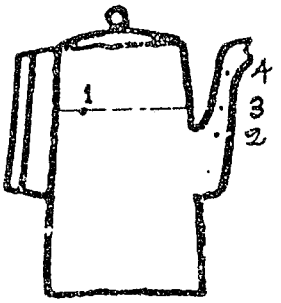


Compare the pressure on the two fish.

(a) The pressure on Goldie is greater than the pressure on Fred
(b) The pressure on Goldie and Fred is the same.
(c) The pressure on Goldie is lower than the pressure on Fred.
(d) I do not know.

Reason for my answer:

5. Water is poured into the kettle below until it reaches level 1.

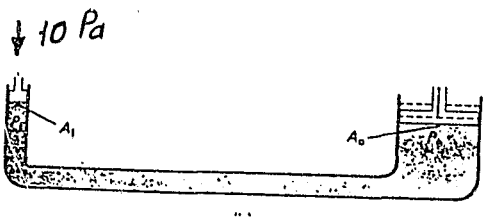


Where would the level be in the spout?

a) 2
b) 3
c) 4
d) I do not know

Reason for my answer:

6. Below is a sketch of a hydraulic jack.

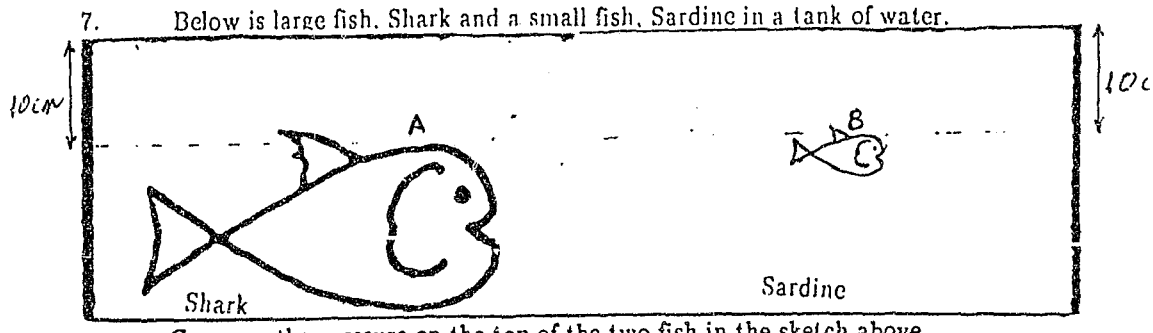


A pressure of 10 Pa is applied on the narrow end. The pressure on the wide end is

a. greater than 10 Pa
b. equal to 10 Pa
c. less than 10 Pa
d. I do not know.

Reason for my answer.

7. Below is large fish, Shark and a small fish, Sardine in a tank of water.

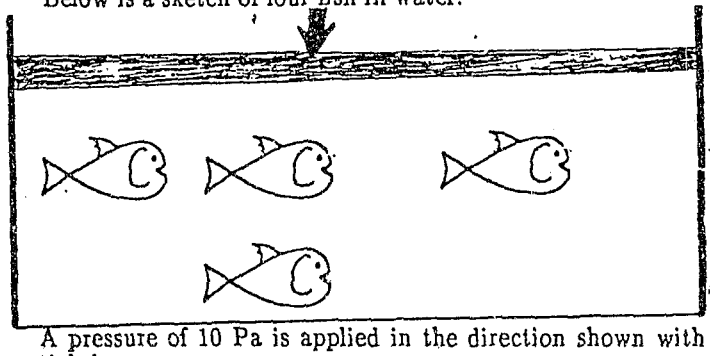


Compare the pressure on the top of the two fish in the sketch above

(a) The pressure on Shark at A is greater than the pressure on Sardine at B.
(b) The pressure on Shark at A is the same as the pressure on Sardine at B.
(c) The pressure on Shark at A is lower than the pressure on Sardine at B.
(d) I do not know

Reason for my answer.

8. Below is a sketch of four fish in water.



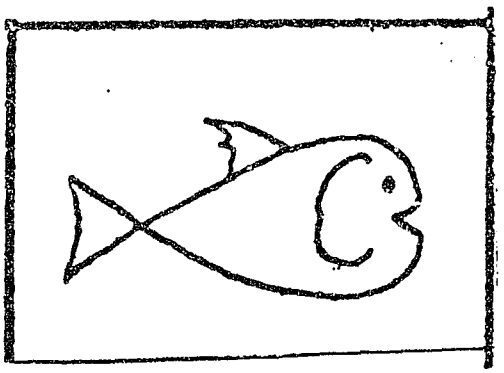
A pressure of 10 Pa is applied in the direction shown with a piston that fits tightly.

What is the change in pressure on the fish Joe, Fred, Goldie and Jes?

a) The change in pressure is greater than 10 Pa for all fish.
b) The change in pressure increases with depth.
c) The change in pressure is equal to 10 Pa for all fish.
d) The change in pressure decreases with depth
e) I do not know

Reason for my answer.

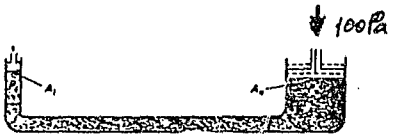
9. Draw arrows to show direction(s) in which pressure is acting on the fish.



(f) I do not know

Reason for my answer.

10. Below is a sketch of a hydraulic jack which can be used to lift a car



A pressure of 100 Pa is applied on the wide end. The pressure on the narrow end is

a. greater than 100 Pa
b. equal to 100 Pa
c. less than 100 Pa
d. I do not know.

Reason for my answer.

11. Read the following statement carefully.

"Pressure applied to an enclosed liquid is transmitted equally throughout the liquid".

Now explain in your own words what the following words mean.

a) applied
b) enclosed
c) transmit
d) throughout

Give examples of sentences where the words are used with the same meaning.
(You may show the meanings by a sketch if you wish)

Green - word synonym without context

LANGUAGE SURVEY

SURNAME :.....

NAME :.....

HOME LANGUAGE :.....

FATHER'S OCCUPATION :.....

MOTHER'S OCCUPATION :.....

AGE :.....

GENDER :.....

STANDARD THIS YEAR :.....

STANDARD LAST YEAR :.....

SCHOOL :.....

HOME :.....

INSTRUCTIONS

- Attempt all questions.
- If you do not know the correct answer, choose an answer that looks correct.
- Put a ring next to the answer you choose.

1. The exam mark was a percentage. This means it was

   (a) given to all pupils
   (b) a large number
   (c) the average of the class
   (d) out of a hundred

2. 'Illustrate' can mean

   (a) gloss over (treat as unimportant)
   (b) light up
   (c) leave out
   (d) make clear

3. The rainfall was average for May. This means it was

(a) the highest ever for May.
(b) about normal for May.
(c) the lowest ever for May.
(d) higher than any other month.

4. 'Exert' can mean

(a) use.
(b) expect.
(c) urge.
(d) measure.

5. Effect can mean

(a) attack.
(b) result.
(c) frequent.
(d) change.

6. 'Standard' can mean

(a) the thing by which the qualities of something may be tested.
(b) the position or point of view from which matter may be tested.
(c) established reputation.
(d) similar position.

7. 'Influence' can mean

(a) imply.
(b) affect.
(c) conclude.
(d) take in.

8. 'Evacuate' can mean

(a) empty
(b) blow up.
(c) escape.
(d) give out.

9. 'Excess' can mean

(a) very good.
(b) more than.
(c) less than.
(d) not including.

10. 'Displace' can mean

(a) position
(b) break up
(c) spread out
(d) shift

11. 'External' can mean

(a) ever lasting.
(b) outside.
(c) inside.
(d) thing that has died out.

12. 'Efficient' can mean

(a) incapable.
(b) flowing.
(c) able.
(d) producing.

13. 'Immerse' can mean

(a) make large.
(b) strike hard.
(c) rest.
(d) plunge.

14. 'Tabulate' can mean

(a) multiply.
(b) construct a report.
(c) arrange in columns.
(d) solve.

Blue - the word is used in a science contex

LANGUAGE SURVEY

SURNAME

NAME

HOME LANGUAGE

AGE

GENDER

STANDARD

SCHOOL

HOME

INSTRUCTIONS

Attempt all questions
If you do not know the correct answer, choose an answer that looks correct.

1. The exam mark was a percentage. This means it was

   (a) given to all pupils
   (b) a large number
   (c) the average of the class
   (d) out of a hundred

2. The scientists collected the data and tabulated it. This means they

   (a) decided on the next experiment
   (b) allocated the correct interpretation to it
   (c) arranged the results in columns
   (d) constructed a complete report

3. The rainfall was average for May. This means it was

   (a) the highest ever for May.
   (b) about normal for May.
   (c) the lowest ever for May.
   (d) higher than any other month.

4. If you were asked to find the effect of adding acid to a metal, this means you would try to find

   (a) the reason for adding the acid.
   (b) what happened
   (c) how long the reaction took
   (d) the quantity (amount) of acid used

5. The temperature has an influence on the speed of a chemical reaction. This means temperature

   (a) increases it.
   (b) affects it.
   (c) slows it down.
   (d) stops it.

6. The demonstration was designed to illustrate the uses of copper. This means that

   (a) there were pictures of copper mining.
   (b) the importance of copper was stressed.
   (c) the uses of copper were related to cost.
   (d) the uses of copper were made clearer.

7. In order to conclude the experiment satisfactorily, they had to exert a large force. This means they had to

   (a) apply the force.
   (b) stop the force.
   (c) collect the force.
   (d) measure the force.

8. Some animals have an external skeleton. This means their skeleton is

   (a) hard.
   (b) outside.
   (c) inside.
   (d) soft.

9. Your science teacher said that he was going to evacuate the flask. This means that the teacher will

   (a) empty the flask.
   (b) close the flask.
   (c) clean the flask.
   (d) cool it in a vacuum flask.

10. The final instruction in the experiment was to immerse the flask of reacting chemicals in cold water. This means the final instruction was to

    (a) add cold water to the flask.
    (b) splash the flask with cold water.
    (c) float the flask with cold water.
    (d) completely cover the flask with cold water.

11. The instruction in the experiment said that you had to make sure that the acid was in excess. This means you would have to

(a) make sure all the acid was used up.
(b) make sure some acid is left out at the end.
(c) put the acid in a special container.
(d) dilute the acid to the correct concentration.

12. The scientist did not feel that the bottle of chemical was up to the usual standard. This means the scientist felt it was

(a) reduced in quality.
(b) reduced in price.
(c) not yet ready to use.
(d) not in the usual container.

13. Zinc displaces copper from a solution of copper salt. This means zinc

(a) reacts with water.
(b) is insoluble.
(c) bonds with the copper.
(d) ousts (drives out) the copper from its solution.

14. A pupil was trying to find out the most efficient way of reducing a metal oxide. This means the poupil is trying to find the

(a) easiest way.
(b) most impressive.
(c) best.
(d) commonest.

Yellow - the word is used in a non-science context

LANGUAGE SURVEY

SURNAME :.....

NAME :.....

HOME LANGUAGE :.....

FATHER'S OCCUPATION :.....

MOTHER'S OCCUPATION :.....

AGE :.....

GENDER :.....

STANDARD THIS YEAR :.....

STANDARD LAST YEAR :.....

SCHOOL :.....

HOME :.....

INSTRUCTIONS

- Attempt all questions.
- If you do not know the correct answer, choose an answer that looks correct.
- Put a ring next to the answer you choose.

1. The exam mark was a percentage. This means it was

   (a) given to all pupils
   (b) a large number
   (c) the average of the class
   (d) out of a hundred

2. When you climb the stairs you exert yourself. This means you

   (a) use your strength
   (b) make yourself tired
   (c) remove yourself from ground level
   (d) raise yourself

3. The rainfall was <u>average</u> for May. This means it was

   (a) the highest ever for May.
   (b) about normal for May.
   (c) the lowest ever for May.
   (d) higher than any other month.

4. Putting the car brakes on had no <u>effect</u>. This means the car

   (a) stopped
   (b) did not stop
   (c) went faster
   (d) skidded

5. The <u>external</u> TV aerial was placed on the roof. This means the aerial was

   (a) everlasting.
   (b) outside.
   (c) high.
   (d) for colour reception.

6. The girl used <u>excess</u> jam on her sandwich. This means she put on

   (a) just the right amount.
   (b) too much.
   (c) the very best.
   (d) hardly any.

7. The football league collects the results of all matches and <u>tabulates</u> them. This means it

   (a) decides on the next fixture.
   (b) allocates the correct number of points.
   (c) arranges the results in columns.
   (d) constructs a complete report.

8. He did not feel that the can of fruit juice was up to the usual <u>standard</u>. This means he felt it was

   (a) reduced in quality.
   (b) reduced in price.
   (c) not yet ready to drink.
   (d) not in the usual container.

9. Large brooms are more efficient than small brooms for sweeping the school yard. This means the large ones are more

(a) difficult to use.
(b) flowing.
(c) able
(d) commonly used.

10. The president was displaced during the revolution. This means the president was

(a) put in control.
(b) annoyed.
(c) encouraged.
(d) removed from power.

11. When the fire alarm goes off, we evacuate the school. This means we

(a) empty the school.
(b) close the school.
(c) escape the school.
(d) run from the school.

12. This chapter will illustrate the point made in the last chapter. This means it will

(a) treat the point as unimportant.
(b) contain more photographs.
(c) leave out the point.
(d) make the point clearer.

13. The old principal had a considerable influence on the young teacher. This means the principal had

(a) an interest in the teacher.
(b) power over the teacher.
(c) gathered facts for the teacher.
(d) more experience than the teacher.

14. To clean the bicycle chain she needed to immerse it in paraffin. This means she needed to

(a) coat the chain with paraffin.
(b) wipe the chain with a paraffin rag.
(c) splash the paraffin onto the chain.
(d) plunge the chain into a jar of paraffin.

Pink - the word is used in four everyday situations only one of which is correct

LANGUAGE SURVEY

SURNAME :.....

NAME :.....

HOME LANGUAGE :.....

FATHER'S OCCUPATION :.....

MOTHER'S OCCUPATION :.....

AGE :.....

GENDER :.....

STANDARD THIS YEAR :.....

STANDARD LAST YEAR :.....

SCHOOL :.....

HOME :.....

INSTRUCTIONS

- Attempt all questions.
- If you do not know the correct answer, choose an answer that looks correct.
- Put a ring next to the answer you choose.

1. The exam mark was a percentage. This means it was

   (a) given to all pupils
   (b) a large number
   (c) the average of the class
   (d) out of a hundred

2. When you climb the stairs you exert yourself. This means you

   (a) use your strength
   (b) make yourself tired
   (c) remove yourself from ground level
   (d) raise yourself

3. Which sentence uses the word external correctly?

(a) The Greek gods thought they were external.
(b) The external TV aerial was placed on the roof.
(c) The heart and lungs are external organs
(d) The dinosaurs (hottentots) are now external

4. The rainfall was average for May. This means it was

(a) the highest ever for May.
(b) about normal for May.
(c) the lowest ever for May.
(d) higher than any other month.

5. Which sentence uses the word standard correctly?

(a) All the pupils who passed the exam had reached the required standard.
(b) The distance round the rectangle) is called the standard.
(c) No amount of discussion could persuade him to alter his standard on the merit of capital punishment
(d) The water in the motionless pool was standard

6. Which sentence uses the word tabulate correctly?

(a) The joiner was able to tabulate the flat piece of wood.
(b) The silent pupils was described as tabulate
(c) The teacher was able to tabulate the test results
(d) The play finished with a tabulate

7. Which sentence uses the word efficient correctly?

(a) Children need to eat efficient food to grow strong and healthy.
(b) The sick boy did not eat fresh fruit and vegetables and was efficient in vitamins as a result.
(c) Large brooms are more efficient than small brooms for sweeping the school yard.
(d) The boy did not have efficient qualifications for the job.

8. Which sentence uses the word illustrate correctly?

(a) A lamp can illustrate a street.
(b) The boy was offended that his friend said he was illustrate.
(c) The girl was illustrate when her team won the cup.
(d) This chapter will illustrate the point made in the last chapter.

9. Which sentence uses the word evacuate correctly?

(a) When the fire alarm sounds off, we evacuate the school.
(b) The boxer knocked down his opponent with an evacuate punch.
(c) In a war the army fights to evacuate the enemy.
(d) You will evacuate your friend with all this teasing.

10. Which sentence uses the word exert correctly?

(a) When you climb the stairs you exert yourself.
(b) It is felt that dinosaurs no longer exert.
(c) By living abroad the actor hoped to be exert from paying tax.
(d) At the end of the scene the actor had to exert on the left.

11. Which sentence uses the word influence correctly?

(a) His new gained influence meant that he could now afford to live a life of complete leisure.
(b) The principal had a considerable influence on the teacher.
(c) In the first influence she decided to go abroad but later she changed her mind.
(d) At the influence of the two rivers the current was dangerous.

12. Which sentence uses the word displaced correctly?

(a) My bother was displaced because he could not go to the match.
(b) The flowers were displaced in the window.
(c) The girl had displaced her pen and did not have it for the lesson.
(d) The president was displaced during the revolution.

13. Which sentence uses the word immerse correctly?

(a) By blowing hard into the balloon he made it immerse.
(b) The steam roller was able to immerse the soft soil.
(c) By tempting the cat with nuts he was able to get it to immerse from the house.
(d) To clean the bicycle chain she needed to immerse it in paraffin.

14. Which sentence uses the word excess correctly?

(a) The sign above the door indicated that it was the excess.
(b) The girl used excess jam on her sandwich.
(c) Her homework was well done - in fact it was excess.
(d) It is excess to wear safety glasses when welding.

APPENDIX C: Teachers' workshop

(a) Agenda
(b) Evaluation of the worksheets

A workshop for teachers at Turfloop

Agenda

9h00-9h20 Completion for language questionnaire by individuals
9h20-9h45 Group discussion of the questionnaire. The group should come to a consensus on correct answers. Individuals should retain their answers on the questionnaires.
9h45-10h00 Report back.
10h00-10h20 Completion of a conceptual questionnaire.
10h20-10h45 Group discussion of the questionnaire. The group should come to a consensus on correct answers.
10h45-11h00 Tea
11h05-11h10 Constructivism and misconceptions
11h10-12h20 The worksheets and the teachers' guide.
- Purpose
- How to use
- Going through the worksheets

12h20-13h20 Making some equipment
13h20-13h30 Evaluation of the workshop
13h30- Tea

Evaluation of the worksheets

Please complete the questionnaire. You may use the back of the questionnaire if you need additional space.

a) I am interested
b) I may be interested
c) I do not think I will be interested.
d) I am not interested.

1. Would you like to use the worksheets with your pupils?

2. Would you like to have a copy of the worksheet and the teachers' guide when ready?

3. Would you like to be involved in this project?

4. Complete this part only if you wish.

a) Name:
b: School:
c: Academic qualifications:
d: Professional qualifications:
e) Teaching experience:
f) How long have you been teaching science?
g) How long have you been teaching physical science in standard 7?>

APPENDIX D

Solid pressure

Evaluation of the worksheets by the students.

We are going to ask you questions about the experiments you have done on solid and liquid pressure. You can answer the questions in English or Northern Sotho.

- The experiments were interesting
  1. I agree
  2. I am not sure
  3. I do not agree

Give details

- It was difficult to do the experiments.
  1. I agree
  2. I am not sure
  3. I do not agree

Give details

- It was easy to follow the instructions from the worksheets.

1. I agree
2. I am not sure
3. I do not agree

Give details

- I needed the teacher's help in order to understand the worksheets.

1. I agree
2. I am not sure
3. I do not agree

Give details

- The teacher used a simpler language when using these worksheets than on other days.

1. I agree
2. I am not sure
3. I do not agree

Give details

- We regularly do experiments in our school.

1. I agree
2. I am not sure
3. I do not agree

Give details

- We have done experiments on solid pressure before.

1. I agree
2. I am not sure
3. I do not agree

Give details

- I understand solid pressure better now.

1. I agree
2. I am not sure
3. I do not agree

Give details

Liquid pressure

Evaluation of the worksheets by the students.

We are going to ask you questions about the experiments you have done on solid and liquid pressure. You can answer the questions in English or Northern Sotho.

- The experiments were interesting
  1. I agree
  2. I am not sure
  3. I do not agree

  Give details

- It was difficult to do the experiments.
  1. I agree
  2. I am not sure
  3. I do not agree

  Give details

- It was easy to follow the instructions from the worksheets.

1. I agree
2. I am not sure
3. I do not agree

Give details

- I needed the teacher's help in order to understand the worksheets.

1. I agree
2. I am not sure
3. I do not agree

Give details

- The teacher used a simpler language when using these worksheets than on other days.

1. I agree
2. I am not sure
3. I do not agree

Give details

- We regularly do experiments in our school.

1. I agree
2. I am not sure
3. I do not agree

Give details

- We have done experiments on liquid pressure before.

1. I agree
2. I am not sure
3. I do not agree

Give details

- I understand liquid pressure better now.

1. I agree
2. I am not sure
3. I do not agree

Give details

APPENDIX E Classification of occupations .

1. Medical doctor, Engineer (Professional), Lawyer, Vice Secretary for education department, School inspector, University lecturer, Vice principal, Magistrate, Chemist, Accountant, Newspaper editor.

2. TV Personality, Radio D. J., Teacher (Secondary school), Liaison officer (education), Social worker, Personnel officer, Nurse, Nursing sister, Principal (primary school).

3. Shopowner, Farmer, Manager, Insurance broker, Principal (pre-school), Policeman, Sales person, Builder (Trained), Priest, Carpenter, Electrician, Tailer, Plumber, Assistant nurse, Panel beater, Teacher (Primary school).

4. Chef, Hostel supervisor, Jockey, Barber, Engineer (Non-professional), Welder, Typist, Teacher (Cretch), Clerk, Secretary.

5. Builder (Backdoor), Traditional healer, Tailor (back door), Driver, Cashier, Petrol attendant, Mechanic (backdoor), Domestic worker, Painter, Security officer, cobbler.

6. Farm worker, Hard labourer, Job unclassified.

7. Unemployed

APPENDIX F

14/03

MMUSO WA LEBOWA/LEBOWA-REGERINGSDIENS/GOVERNMENT SERVICE

No. ya Tshupetso
Verw. Nr./Ref. No. 2/2/2/2/

DINY AKISISO
NAVRAE/ENQUIRIES: C.M. Kekana

No. ya Thelefomo
Tel. Nr./No. 01529-37130

Telex. Nr./No.

OFISI YA/KANTOOR VAN DIE/OFFICE OF THE

Department of Education
Private Bag X03
CHUENESPOORT
0745

Mr. Nkopodi Nkopodi
65 Basswood Place
81 Quartz St.
HILLBROW
2001

APPLICATION TO CONDUCT RESEARCH IN THE DEPARTMENT

RESEARCH TOPIC : LANGUAGE STRATEGIES AND CONCEPTUAL CHANGE STRATEGIES IN THE TEACHING OF SCIENCE

University : Wits

Degree : PhD

1. Your application dated 26 April 1991 to conduct research on the above topic has been approved.

2. The following have been informed to assist you accordingly:-

   2.1 Circuit Inspector of:

      2.1.1 Mogodumo

      2.1.2 Bohlabela

      2.1.3 Polokwane

      2.1.4 Sekhukhune

      2.1.5 Konekwena

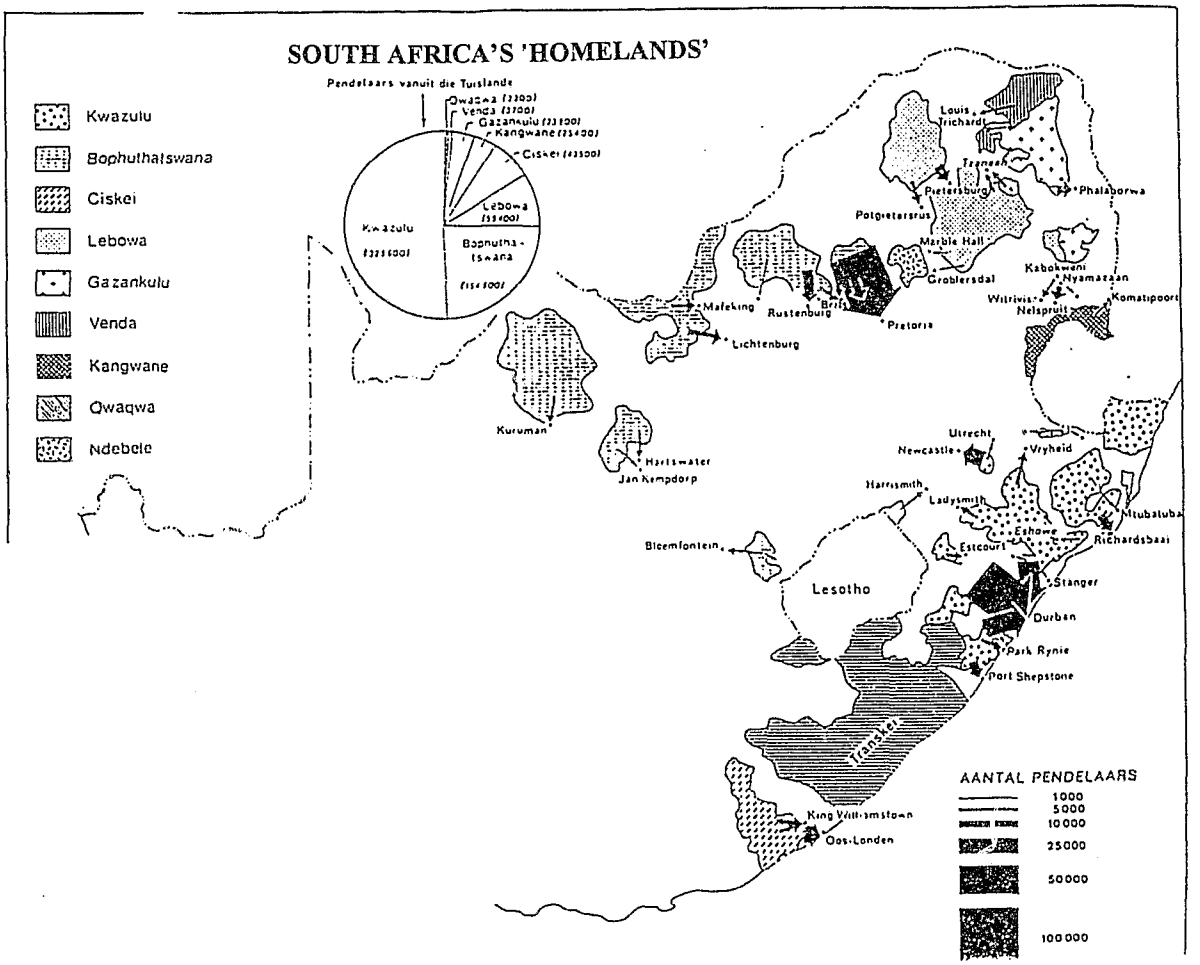
      2.1.6 Mankweng

3. Information/Documents required by the department.

3.1 One copy of the research report/dissertation/thesis on completion of the project.

SECRETARY FOR EDUCATION
CMK/mmt

APPENDIX G


SOUTH AFRICA'S 'HOMELANDS'
Kwazulu
Bophuthatswana
Ciskei
Lebowa
Gazankulu
Venda
Kangwane
Qwaqwa
Ndebele
Pendelaars vanuit die Tuislande
Qwaqwa
Venda
Gazankulu
Kangwane
Ciskei
Lebowa
Kwazulu
Bophutha-tswana
Louis Trichardt
Tzaneen
Pietersburg
Phalaborwa
Potgietersrus
Marble Hall
Groblersdal
Kabokweni
Nyamazaan
Witrivier
Nelspruit
Komatipoort
Mafeking
Rustenburg
Brits
Pretoria
Lichtenburg
Kuruman
Hartswater
Jan Kempdorp
Utrecht
Newcastle
Vryheid
Harrismith
Ladysmith
Mtubatuba
Ezakawe
Richardsbaai
Estcourt
Bloemfontein
Lesotho
Stanger
Durban
Park Rynie
Port Shepstone
Transkei
King Williamstown
Oos-Londen
AANTAL PENDELAARS
1000
5000
10000
25000
50000
100000