

Grade 7 Natural Science Worksheet

Assessment Task: Environment: pollution, plastic

Plastics

Part One: What do you know about plastics?

Fill in the gaps in the notes by choosing words from the box below:

Plastics are not (a)_____ substances. They are (b)_____, which means they are made by humans. The word 'plastic' comes from the (c)_____ word *plastikos* which means that the substance can be moulded or shaped into a variety of different forms. The first plastics were made over (d)_____ years ago. (e)_____ was the first plastic substance that was manufactured. It was invented in (f)_____ by John Hyatt who was trying to win a \$10 000 prize by finding a substitute for (g)_____ in the making of billiard balls. Hyatt did not win the prize, but his invention made him a great deal of money. Even today, (h)_____ and buttons are often made from (i)_____. Leo Baekeland invented the synthetic (j)_____ later known as bakelite in (k)_____. Bakelite was used to make radios and (l)_____. It is a very heavy plastic and many lighter plastics have since been invented to take its place. Polyvinyl, (m)_____, polystyrene, (n)_____ and (o)_____ are some of the more modern plastics that have been invented.

perspex	celluloid	synthetic	teflon	telephones	ivory	natural
resin	celluloid	1906	combs	150	polythene	Greek
						1870

[15 marks]

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Part Two: More about plastics

Read the following information and then answer the questions that follow.

Polythene is one of the most common plastics used in your home and in industry today. It is made from ethene gas. Under normal conditions, ethene is an unreactive and stable gas. It is made up of two atoms of carbon bonded together. The ethene molecules do not normally interact with each other. However, if the gas is heated and placed under high pressure, then the ethene molecules react with each other by forming long chains. This is called polymerisation. The long chains of polythene attract each other and become tangled and twisted to form a solid – polythene plastic. When the polythene is heated again, the plastic can be shaped and moulded. It can have colour pigments added to it. It can also have other substances added that lubricate it, or make it flame resistant. When

the plastic cools, it becomes hard. Polythene is made from ethene gas, but other plastics can be manufactured from oils, resins and even coal. All plastics, no matter what they are made from, are formed by long polymers. Because of the size of the plastic molecules, plastics do not rot or degrade. They are not broken down by decomposers in the environment. So the disposal of plastic is an environmental problem.

1. What do we mean when we say that ethene is an unreactive and stable gas? [2]
2. How can ethene molecules be made to react with each other? [2]
3. What do we mean by “polymerisation”? [2]
4. How do polymerised ethene molecules become polythene plastic? [2]
5. In what ways can the basic polythene plastic be changed? [4]
6. Is ethene gas the only source of plastic? Explain. [4]
7. What do all plastics have in common in terms of their structure? [2]
8. What is a disadvantage of plastic polymers? [2]

[20 marks]

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Part Three: Practical work

You can make a polymer!

Put a tablespoon of water in a cup.

Add a teaspoon of egg white and a teaspoon of baking soda.

Mix well.

Now sprinkle a teaspoon of citric acid into the mixture and swirl it around.

What do you notice? Write down your observations.

(CAUTION: DO NOT EAT YOUR POLYMER – IT CAN UPSET YOUR STOMACH.)

[10 marks]

Part Four: An environmental problem

Plastic polymers do not rot and degrade so they are an environmental problem. Can we then say that plastics are bad? Write a paragraph in which you express your opinion on this matter. You must provide evidence for the claims you make.

[15 marks]

Part Five: Plastic shopping bags

A few years ago, the government decided to take a stand against the plastic shopping bags that littered our environment.

1. Find out what changes came into being as a result of their action. [6]
2. How tough are plastic bags? Design an experiment to test the durability of a plastic shopping bag. [24]

[30 marks]

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Rubric to assess practical investigation

Criteria	Level 4 [4]	Level 3 [3]	Level [2]	Level 1 [1]
Test validity	Test is innovative and creative in design and definitely tests the durability of plastic bags, therefore it is completely valid.	Test is soundly designed and tests the durability of plastic bags, therefore it is valid.	Test is fair in design and does test the durability of plastic bags, although in a limited fashion, therefore it is mostly valid.	Test is not creatively designed and dubiously tests the durability of plastic bags, validity is questionable.
Report layout	Report is completely in line with a scientific investigation; the headings are correct and the report is comprehensive and well constructed.	Report is largely in line with a scientific investigation; the headings are generally correct and the report is well constructed.	Report is limited in terms of being a scientific investigation; the headings are fairly correct and the report is fairly well constructed.	Report is not in line with a scientific investigation; the headings are incorrect and the report is not well constructed.
Hypothesis and conclusion	These are well stated and a definite link exists between the two.	These are fairly well stated and a link exists between the two.	These are stated, but with errors; a tenuous link exists between the two.	These are not well stated and a no link exists between the two.
Methods	Methods are correctly described in a format that is easy to follow or repeat.	Methods are generally correctly described in a format that is fairly easy to follow or repeat.	Methods are described in a limited fashion.	Methods are not well described at all.
Results	Results are presented in an easy to read format, observations well communicated in the most	Results are presented in a fairly easy to read format, observations communicated in an acceptable means (e.g.	Results are incompletely presented, observations need to be better communicated.	Results are presented in a poor format.

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	appropriate means (e.g. diagrams, tables, graphs).	diagrams, tables, graphs).		
Actual test	Evidence exists to prove that test was actually carried out; excellent practical work completed.	Evidence exists to prove that test was actually carried out; good practical work completed.	Little evidence exists to prove that test was actually carried out; fair practical work completed.	Doubtful as to whether practical was indeed carried out.

Part Six: A recycling project

This is a recycling project that you will do over a period of a week, both at home and in your classroom at school. Once you see the results after just a week, maybe you will think about doing this as a long-term project and changing the way your family and your school deals with rubbish.

1. Find a big black plastic bag or a large bin. Put it in your classroom or in your yard at home.
2. Tell everyone that all rubbish that is plastic must be thrown away in your special bag or bin.
3. After a week, weigh the bag or bin to determine how much plastic you are throwing away.
4. Contact your municipal rubbish collectors and find out if they have a special plastic recycling programme.
5. Take your plastic to the recyclers.
6. Are you surprised at the amount of plastic you throw away every week? Have you made a difference to the environment?
7. Write a report on your participation in this project. Record the details of how you participated and what you think of recycling. Your teacher will assess your report.

[12 marks]

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Rubric to assess report on project

Criteria	Level 4 [4]	Level 3 [3]	Level [2]	Level 1 [1]
Report is well written and well structured. Learner has taken into account presentation, grammar and style of writing.	Outstanding.	Good.	Fair.	Poor.
Report contains detailed account of the individual's participation in the project.	Outstanding.	Good.	Fair.	Poor.
Learner did ACTUALLY participate in the way he/she described; i.e. there is documented evidence to prove participation.	Outstanding.	Good.	Fair.	Poor.

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Suggested Solutions

Question number	Possible marks	Solution
1	15	<p>Plastics are not natural substances. They are synthetic, which means they are made by humans. The word 'plastic' comes from the Greek word <i>plastikos</i> which means that the substance can be moulded or shaped into a variety of different forms.</p> <p>The first plastics were made over 150 years ago. Celluloid was the first plastic substance that was manufactured. It was invented in 1870 by John Hyatt who was trying to win a \$10 000 prize by finding a substitute for ivory in the making of billiard balls. Hyatt did not win the prize, but his invention celluloid made him a great deal of money. Even today, combs and buttons are often made from celluloid.</p> <p>Leo Baekeland invented the synthetic resin later known as bakelite in 1906. Bakelite was used to make radios and telephones. It is a very heavy plastic and many lighter plastics have since been invented to take its place.</p> <p>Polyvinyl, polythene, polystyrene, teflon and perspex are some of the more modern plastics that have been invented.</p>
2	20	<ol style="list-style-type: none"> 1. The ethene molecules do not normally interact with each other or with other chemicals. [2] 2. If the ethene gas is heated and placed under high pressure, then the ethene molecules react with each other. [2] 3. When molecules react with each other by forming long chains. [2] 4. The long chains of polythene attract each other and become tangled and twisted to form a solid – polythene plastic. [2] 5. Heated - then shaped and moulded; colour pigments added; substances added to lubricate it, or make it flame resistant. [4] 6. No. Other plastics can be manufactured from oils, resins and even coal. [4] 7. They are all formed by long polymers. [2] 8. Plastics do not rot or degrade. They are not broken down by decomposers in the environment. [2]
3	10	<p>This is what happens on a chemical level:</p> <p>The baking soda reacts with the citric acid ✓ producing bubbles ✓ of carbon dioxide gas ✓, turning the mixture into foam. ✓ As this happens, monomers in the egg white bond together to form a polymer. ✓</p> <p>Learners may describe that they saw white foam forming and that the mixture "stuck together" in strands. Lead them from this basic (but correct) observation, to the more detailed note above.</p> <p>Award up to 5 marks for the way in which the learners conducted the practical work and cleaned up after themselves.</p>

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4	15	<p>Learner paragraphs will vary, but this is a marking guideline:</p> <p>One of the biggest advantages of plastic is that it is durable ✓ and lasts. ✓ This is also the biggest disadvantage of plastics too. They do not disintegrate or decompose and rot away. ✓ Once they are dumped into the environment, they stay there for years and years. ✓ Scientists are working on making biodegradable plastics. ✓ But although plastics do have disadvantages for the environment, we would not be able to live our lives without plastic.</p> <p>Think of how firemen rely on a plastic called nomex to make fire-resistant gloves and clothing. ✓ Helmets which prevent head injuries are made of polycarbonate plastic. ✓ Space suits are made of layers of lightweight plastic to resist heat and cold. ✓ A policeman's bullet-proof vest is made of Kevlar – and it might just save his life. ✓ Artificial limbs are made of plastic components. ✓ Your toothbrush, comb, school bag, pens, lunch boxes and drink bottles are made of plastic. ✓ Plastics are not bad. ✓ It's what we do with the plastics when we have finished using them that is bad. ✓✓</p> <p>Award up to 3 marks for paragraph structure and grammar.</p>
5	30	<ol style="list-style-type: none"> 1. No longer get free plastic bags with shopping ✓ – adding a cost to the plastic bag ✓ encouraged people to recycle old bags ✓ and not just throw them away. ✓ Shops were encouraged to manufacture bigger and stronger plastic bags ✓ so that customers used fewer bags. ✓ Companies were encouraged to make plastic bags out of recycled plastic – combating the litter problem. ✓ [6] 2. Encourage the learners to design innovative and interesting tests to investigate the durability of plastic bags. How much weight can they carry? Will they rot? Can you make items like doormats out of plastic bags, etc.? Encourage the learners to set out their investigations according to the scientific method. [24] <p>See rubric in Appendix of Assessment Tools.</p>
6	12	See rubric in Appendix of Assessment Tools.

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Appendix of Assessment Tools

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Results	Results are presented in an easy to read format, observations well	Results are presented in a fairly easy to read format, observations communicated	Results are incompletely presented, observations need to be better	Results are presented in a poor format.

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	communicated in the most appropriate means (e.g. diagrams, tables, graphs).	in an acceptable means (e.g. diagrams, tables, graphs).	communicated.	
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