Grade 9 Natural Sciences Worksheet

Solar energy

Part One: Facts about solar energy

Complete the notes by filling in the missing words.

Have you ever used a (a) to make wood scorch or paper catch fire? The sun's rays are bent to (b) at a point and because the rays are (c) around a point, it gets so hot that the wood or paper burns. This was one of the very first ways humans used (d) energy.
(e) are the biggest users of the energy from the sun and through them this solar energy flows to all living things.

Some homes have solar panels on their roofs to the (f) water. When the (g) falls on the solar panels, the (h) from the sun heats up the water inside pipes under the solar panels. Solar (i) change the (j) energy of the Sun into electrical energy. These solar cells are used in solar panels to provide (k) to rural areas and in small appliances like (l) , (m) watches, and radios.

Solar (n) uses both the heat and light (o) from the Sun to make electricity. The heat rays from the Sun are used to generate electricity in a solar (p) plant. Curved (q) focus the sunlight onto a pipe containing (r) . The heat boils the water and the (s) produced is used to turn the (t) – just like in a coal burning power plant.

toys	turbine	sunlight	water	energy	cells	meet
light	calculators	steam	plants	mirrors	magnifying glass	
electricity	solar	heat	heat	concentrated	power	technology

[20 marks]

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Part Two: Act out a short role play

You and your partner are going to plan and act out a short role play based on the following: You have a younger brother or sister who wants to use your calculator because theirs is not working. You are using yours for your homework. When you look at their calculator, you can see that it says 'solar powered'. Apparently it has been in the cupboard for a long time. Explain to them why their calculator isn't working and what they can do about it.

When you have worked out your role play, show your play to another group and you watch their play. Assess each other according to the checklist below:

[10 marks]

Checklist to assess role play

Checklist	Yes [2]	No [0]
Both partners are equally involved in the role play		
The role play clearly illustrated what the problem was		
The role play provided a solution to the problem		
The role play was suitable to use to teach younger children about solar energy		
I enjoyed the role play		

Part Three: Cooking with solar power

1. Have you ever heard anyone say that it is so hot that they could fry an egg on the roof of their car? Have you ever walked on the road and felt that the tar is rather soft and sticky? The sun's heat is awesome! But can it really be used to cook something? Do some research on solar cookers and answer these questions.

What is a solar cooker?

Can you cook "normal food" in a solar cooker?

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What are the advantages of a solar cooker?

What are the disadvantages of a solar cooker?

Write your answers in an informative paragraph.

[10 marks]

2. You are going to design and make your own solar cooker in a group. You can use the instructions below, or do some further research and improve on this simple design! This design will produce an oven that can warm food only, like hotdogs. You won't be able to bake in this oven as it does not get that hot. However, do be careful that you don't burn yourself.

Your group will need:

- Craft knife to cut cardboard
- A cardboard box
- Tinfoil - preferably the 'heavy duty' type
- Masking tape (or duct-tape)
- Black poster paint (or PVA = water-based)
- Newspaper

What to do:

Seal the cardboard box with the tape. With the knife, cut a hole in the top of the cardboard box, so that you make a lid that flaps up. The lid needs to be at an angle to the sun and must be able to reflect the rays into the box. Now cover the inside (sides and base) of the box with a few layers of newspaper. This will act as an insulator. Then cover the newspaper again with a layer of tinfoil – shiny side facing out. Make sure that the foil overlaps all the edges of the box, and tape the excess to the outside of the box. Paint the outside of the box with the black paint (this absorbs the sun's rays).

Your solar cooker is now ready to be used!

A fun way to test all the ovens is to have a competition to see whose oven can warm water the fastest or cook a hotdog the best.

[20 marks]

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Rubric to assess solar cooker

Criteria	Level 4 [4]	Level 3 [3]	Level 2 [2]	Level [1]
Group worked together well and in a disciplined manner	Outstanding, surpassed expectations.	Good, expectations well met.	Satisfactory achievement of expectations.	Did not meet expectations.
Group collected all the equipment and were able to construct the solar oven at the designated time	Outstanding, surpassed expectations.	Good, expectations well met.	Satisfactory achievement of expectations.	Did not meet expectations.
Solar oven was well constructed and instructions were followed	Outstanding, surpassed expectations. x 2	Good, expectations well met. x 2	Satisfactory achievement of expectations. x 2	Did not meet expectations. x 2
Solar oven worked well to heat hot dogs or other snack food	Outstanding, surpassed expectations.	Good, expectations well met.	Satisfactory achievement of expectations.	Did not meet expectations.

Part Four: Advantages of solar energy

1. Why don't we make better use of solar energy? [10 marks]

2. Give three advantages and three disadvantages of using solar energy to make electricity.

[12 marks]

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Suggested Solutions

Question number	Possible marks	Solution
1	20	Have you ever used a magnifying glass to make wood scorch or paper catch fire? The sun's rays are bent to meet at a point and because the rays are concentrated around a point, it gets so hot that the wood or paper burns. This was one of the very first ways humans used solar energy. Plants are the biggest users of the energy from the sun and through them this solar energy flows to all living things. Some homes have solar panels on their roofs to heat the water. When the sunlight falls on the solar panels, the heat from the sun heats up the water inside pipes under the solar panels. Solar cells change the light energy of the Sun into electrical energy. These solar cells are used in solar panels to provide electricity to rural areas and in small appliances like calculators, watches, toys and radios. Solar technology uses both the heat and light energy from the Sun to make electricity. The heat rays from the Sun are used to generate electricity in a solar power plant. Curved mirrors focus the sunlight onto a pipe containing water. The heat boils the water and the steam produced is used to turn the turbine – just like in a coal burning power plant.
2	10	Learners can discuss answers in a short feedback session in class. The solution is to put the calculator in the sun for a while to recharge the battery! See checklist in Appendix of Assessment Tools.
3.1	10	Solar cookers or solar ovens are easy to make and use the heat from the sun to reach temperatures of over 200 degrees Centigrade. ✓ This means that anything you can cook in a normal oven can be cooked in a solar cooker! ✓ The food is cooked because the heat from the sun ✓is reflected off the shiny material ✓and trapped by the layer of glass or plastic. ✓ There have been many projects undertaken in rural areas to use solar ovens. ✓ Of course, solar energy is free, ✓ it does not use any valuable resources such as wood or coal, ✓ and does not produce any waste products, ✓ so this is an ideal way of capturing energy and using it. The only problem is that it can only be used while the sun is shining! ✓
3.2	20	A fun way to test all the ovens is to have a competition to see whose oven can warm water the fastest or cook a hotdog the best.

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		See rubric in Appendix of Assessment Tools.
4.1	10	Learner answers will differ but this is a guideline: Although solar energy is free ✓, pollution free ✓ and unlimited, ✓ the amount of sunlight shining every day is not always the same. ✓ This is because some parts of the world get more sunlight per day than others. ✓ Also different times of the day and year and weather conditions like clouds and rain affect the amount of sunlight received. ✓ Using solar panels to make electricity is fairly new. ✓ Many people don't want to change to a new system ✓ while they have another one working already. Solar powered cells are made of silicon ✓and are expensive to make. ✓ Making electricity with solar energy is still more expensive than making it by burning coal. ✓
4.2	12	Advantages: 1. Free. 2. Pollution free. 3. Unlimited/endless supply. Disadvantages: 1. Amount of sunlight varies from place to place/is not constant. 2. Affected by weather. 3. Free to trap solar energy, but expensive to make electricity from solar power.

Checklist to assess role play

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