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MITIGATING AND ADAPTING TO WEATHER AND CLIMATE EXTREMES IN AGRICULTURE AND NATURAL RESOURCES WORKSHEET

1. **Put a check mark (√) by the ways below to lower the emission of greenhouse gasses into the atmosphere.** (5 points)

_____ Burn more coal to produce electricity.

__✓__ Increase the number of homes that have solar panels to produce electricity.

_____ Drive the family car more than we currently do.

__✓__ Conserve electricity by turning off the lights when we leave a room.

__✓__ Compost instead of burn paper and yard waste.

2. **Burning a gallon of gas in your car produces 20 pounds of carbon dioxide gas (CO_2) that is released into the atmosphere. If your car has a 15-gallon gas tank, how many pounds of CO_2 does it produce every time you use a tank of gas? If you use up a tank of gas every two weeks or 26 tanks of gas in a year, how many pounds of CO_2 is your car producing in a year?**

20 pounds/gallon x 15 gallons = 300 pounds of CO_2 produced/tank of gas. (1 point)

26 tanks of gas/year of driving x 300 pounds of CO_2 produced/tank of gas =

7,800 pounds of CO_2 for driving your car one year (2 points).

3. **Mulching Experiment** (3 points for the set up: 1 point each for correct dimensions to the square [control and treatments], depth of the mulch [treatments], and pre-moistening of soil or potting soil)

Instructions: This experiment is designed to help us understand how mulching can affect soil temperature and moisture level and hence, plant growth. Classes can set up the experiment outside where the sun hits bare soil at least during school hours, and/or inside under grow lights or fluorescent lights with an added heat lamp that are on 8 hours a day. The wood chip mulch that will be used in the experiment comes in three colors: black, brown, and reddish brown so students can look for differences in temperature and moisture level of the soil under the different colors of mulch. Overall, by doing the experiment, students will discover if mulching is a good way to conserve water (**mitigate** the use of water in the garden during times of scarcity or drought). Students will also learn if mulch modifies soil temperature to help plants **adapt** to extreme (very hot and/or very cold) air temperatures. Groups of four students will prepare one control square (indoors: one 6" pot) or one treatment square (indoors: one 6" pot). After

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following the specifications for the control or treatments, student groups should check with the teacher to receive a stamp for following correct scientific procedure.

a) Outside treatments: Use a metric ruler to get dimensions of the squares and depth of the mulch correct.

b) Outside control: Student groups will use string tied to four corner nails driven into the soil to indicate the square.

c) Outside pre-moistening: If the soil in the experimental area already has noticeable moisture, do not add additional water. If the soil appears dry, pour 1 liter of water per square from a watering can with a sprinkler head, aiming for the center of each square.

d) Indoor pre-moistening: If the potting soil to be used in the experiment already appears moist, do not add additional water. If the potting soil appears dry, add water and mix until the potting soil is moist and loose, but not soggy.

e) Indoor or outdoor measurements: After letting the treatment squares or 6" pots sit for 3 to 5 days, move the mulch away from the center of the squares or pots to the bare soil and take and record temperature readings with a digital soil thermometer (3 cm-deep) or hand-held infrared thermometer (surface) and take and record a soil moisture measurement (3 cm-deep) with a digital moisture meter. For the controls, take these readings the same way from the middle of an outdoor control square or 6" control pot.

Control and Treatments Outdoors (full sun during school hours):

- Control = a 50 cm x 50 cm square of pre-moistened bare soil with no mulch
- Treatment 1 = a 50 cm x 50 cm square of reddish brown wood chip mulch, 6 cm deep over pre-moistened bare soil
- Treatment 2 = a 50 cm x 50 cm square of brown wood chip mulch, 6 cm deep over pre-moistened bare soil
- Treatment 3 = a 50 cm x 50 cm square of black wood chip mulch, 6 cm deep over pre-moistened bare soil

Control and Treatments Indoors (under grow lights or fluorescent lights with an added heat lamp on for 8 hours a day):

- Control = no mulch over pre-moistened potting soil in a 6" pot to within 6 cm from the top of the pot
- Treatment 1 = reddish brown wood chip mulch, 6 cm deep over pre-moistened potting soil in a 6" pot
- Treatment 2 = brown wood chip mulch, 6 cm deep over pre-moistened potting soil in a 6" pot
- Treatment 3 = black wood chip mulch, 6 cm deep over pre-moistened potting soil in a 6" pot

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4. **Hypothesis** (3 points)

Remember to use an if/then/because format and make your writing clear. Check with your teacher if you need some coaching.

Think about these questions as you write your hypothesis: Will color of mulch (reddish brown, brown, and black) make a difference in soil (or potting soil) moisture and temperature under the mulch compared to bare soil (or potting soil)? If you think it will, what do you expect to happen under the different colored mulches in regard to temperature and moisture content of the soil? Why do you expect these results? Which mulch would be the best to encourage plant growth?

Example: If we put mulch of different colors over bare, moist soil and let it sit for 5 days in full sun, then the coolest and highest moisture level soil will be under the reddish brown mulch because it is the lightest color and light colors absorb less heat than dark colors and less heat will lead to less evaporation.

5. **Results and Conclusions** (10 points)

For Outdoor Measurements, Time Measurements Taken: _____ AM or PM (circle one)	**Soil or Potting Soil Temperature** (°F) (4 points)	**Soil or Potting Soil Moisture Content** (Measurement depends on your brand of soil moisture meter) (4 points)
Control		
Reddish Brown Mulch		
Brown Mulch		
Black Mulch		

Was your hypothesis correct or incorrect? Why? (2 points)

Depends on the data above and the hypothesis of each student team.