

3. Crude oil is extracted, transported, and refined for various uses by humans.

- (a) **Describe** one environmental impact on marine ecosystems associated with extraction or transportation of crude oil.
- (b) **Identify** an atmospheric pollutant released during the combustion of refined oil products.
- (c) **Propose** a solution an individual can use to reduce their reliance on refined oil products for transportation.
- (d) **Justify** the solution proposed in part (c) by providing a benefit to human health.

Other natural resources, such as gold and silver, are also extracted. These resources can be used to make components for the electronics humans use. One metric ton of gold ore contains 5.0 grams of gold.

- (e) A deposit is estimated to contain 260 million metric tons of gold ore. **Calculate** the number of grams of gold that could be extracted from the deposit. **Show** your work.
- (f) Assuming the price of gold is \$62.56 per gram, **calculate** the value of the gold that could be recovered from 1,000 metric tons of gold ore in the deposit. **Show** your work.
- (g) A typical cell phone contains 0.034 grams of gold. **Calculate** how many metric tons of gold ore would need to be mined to extract enough gold to manufacture 100,000 cell phones. **Show** your work.

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**Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.**

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- (f) The Type 2 GMO beans in Plot B were developed to grow more quickly than the unmodified beans in Plot D. Researchers have hypothesized that the Type 2 beans would use fertilizer more completely than the other varieties. Based on the data in the table and the experimental design, **explain** whether the researchers' hypothesis was supported or refuted. **1 point**

Accept one of the following:

- The hypothesis is supported because there is less fertilizer (phosphorus/nitrogen) in the runoff from plot B, so the beans in plot B are absorbing/taking up more fertilizer (phosphorus/nitrogen).
- The hypothesis is supported because there is more fertilizer (phosphorus/nitrogen) in the runoff from plot D, so the beans in plot D are absorbing/taking up less fertilizer (phosphorus/nitrogen).
- The hypothesis is supported because the plants in plot B were able to produce more beans given the same amount of fertilizer.

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- (g) **Describe** the ecological process that occurred on the plots after the crops were burned. **1 point**

Accept one of the following:

- Fast growing/early successional organisms returned to/colonized the soil after the fire/major disturbance.
- Secondary succession occurred where plants recolonize a habitat after the fields were burned/after a major disturbance.

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- (h) After each flooding event, the plot with twice the plant diversity returned to its prior level of biodiversity more quickly than the other plots did. **Explain** why a community with more plant diversity will recover more quickly from the flooding. **1 point**

Accept one of the following:

- The plot with higher diversity/richness has more species/organisms, so the floods harm a smaller proportion of the species/organisms.
  - The plot with higher diversity/richness has more connections between organisms, so the floods disrupt a smaller percentage of the connections between organisms.
  - The plot with higher genetic diversity within species may have more flood tolerant individuals that will survive a flood.
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**Question 3: Analyze an Environmental Problem and Propose a Solution Doing Calculations****10 points**

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- (a) **Describe** one environmental impact on marine ecosystems associated with extraction or transportation of crude oil. **1 point**

Accept one of the following:

- Marine life is harmed/killed by being coated/suffocated by oil from spills.
- Animals are harmed/killed by ingesting spilled oil.
- Oil slicks from spills can block sunlight from entering water and inhibit photosynthesis.
- Oil that washes up on beaches/in marshes/in estuaries damages habitat.
- Noise pollution disrupts marine animals' ability to communicate/mate/eat/evade prey.
- CO<sub>2</sub> from combustion of fuels in boats/equipment is absorbed by ocean and contributes to ocean acidification.

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- (b) **Identify** an atmospheric pollutant released during the combustion of refined oil products. **1 point**

Accept one of the following:

- Carbon dioxide (CO<sub>2</sub>)
- Nitrogen oxides (NO<sub>x</sub>, NO, NO<sub>2</sub>, N<sub>2</sub>O)
- Sulfur oxides (SO<sub>x</sub>, SO<sub>2</sub>, SO<sub>3</sub>)
- Particulate matter (PM)
- Carbon monoxide (CO)
- Volatile Organic Compounds (VOCs)

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- (c) **Propose** a solution an individual can use to reduce their reliance on refined oil products for transportation. **1 point**

Accept one of the following:

- Ride a bike/scooter/skateboard or walk instead of driving.
  - Replace a gasoline/diesel powered car with a hybrid or electric vehicle.
  - Replace a gasoline/diesel powered car with one that utilizes alternative fuel (biodiesel, ethanol, hydrogen).
  - Buy/Drive a more fuel-efficient vehicle.
  - Work from home/telecommute to reduce miles driven.
  - Choose housing that is close to employment to reduce miles driven.
  - Take public transportation instead of driving.
  - Carpool instead of driving alone.
  - Combine trips to reduce miles driven.
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- (g)** A typical cell phone contains 0.034 grams of gold. **Calculate** how many metric tons of gold ore would need to be mined to extract enough gold to manufacture 100,000 cell phones. **1 point**  
**Show** your work.

One point for the correct setup to calculate the number of metric tons of gold ore that would need to be mined to manufacture 100,000 cell phones:

Accept one of the following:

- $\frac{0.034 \text{ grams}}{1 \text{ cell phone}} \times \frac{1 \text{ metric ton}}{5 \text{ grams}} \times 100,000 \text{ cell phones}$
- $\frac{0.034 \text{ grams}}{1 \text{ cell phone}} \times \frac{1 \text{ metric ton}}{5 \text{ grams}} \times 100,000$
- $0.034 \text{ grams} \times \frac{1 \text{ metric ton}}{5 \text{ grams}} \times 100,000$
- $\frac{0.034 \times 100,000}{5}$

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One point for the correct calculation of the number of metric tons of gold ore that would need to be mined to manufacture 100,000 cell phones: **1 point**

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**Total for part (g) 2 points**

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**Total for question 3 10 points**