

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.
- CO₂ 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 (CO₂)
- Nitrogen oxides (NO_x, NO, NO₂, N₂O)
- Sulfur oxides (SO_x, SO₂, SO₃)
- 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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(d) **Justify** the solution proposed in part (c) by providing a benefit to human health.

1 point

Accept one of the following:

Solution proposed in part (c)	Justification of solution with additional advantage
Replace a gasoline powered car with a hybrid or electric vehicle. Replace a gasoline/diesel powered car with one that utilizes an alternative fuel. 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.	• Fewer air pollutants (particulates, NO_x, VOCs, smog) leads to lower rates of ○ respiratory illness/problems such as asthma, COPD, lung cancer. ○ cardiovascular illness such as heart attacks. ○ eye irritation.
Ride bike/scooter/skateboard or walk instead of driving.	• Fewer air pollutants (particulates, NO_x, VOCs, smog) leads to lower rates of ○ respiratory illness/problems such as asthma, COPD, lung cancer. ○ cardiovascular illness such as heart attacks. ○ eye irritation. • Improved health/Decreased risk of disease/cardiovascular illness from more physical activity/exercise.

- (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. **1 point**

One point for the correct setup to calculate the number of grams of gold that could be extracted from the gold deposit:

Accept one of the following:

- $260 \text{ million metric tons} \times \frac{5 \text{ grams}}{1 \text{ metric ton}}$
- $260 \times 10^6 \text{ metric tons} \times 5 \text{ grams}$
- $5 \times 260,000,000$

One point for the correct calculation of the number of grams of gold that could be extracted from the gold deposit: **1 point**

Accept one of the following:

- 1,300,000,000
- 1.3×10^9

Total for part (e) 2 points

- (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. **1 point**

One point for the correct setup to calculate the value of the gold that could be recovered:

Accept one of the following:

- $\frac{\$62.56}{1 \text{ gram}} \times 1,000 \text{ metric tons} \times \frac{5 \text{ grams}}{1 \text{ metric ton}}$
- $\$62.56 \times 1,000 \text{ metric tons} \times 5 \text{ grams}$
- $\frac{\$62.56}{\text{g}} \times \frac{5 \text{ g}}{\text{metric ton}} \times 1,000$
- $1,000 \times 5 \times \$62.56$

One point for the correct calculation of the value of gold that could be recovered: **1 point**

Accept one of the following:

- \$312,800
- 312,800 dollars

Total for part (f) 2 points

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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:

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

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

Total for question 3 10 points