

Question 3: Analyze an Environmental Problem and Propose a Solution Doing Calculations 10 points

- (a) **Identify** one negative human health effect linked to the exposure to pollutants resulting from the combustion of coal. 1 point

Accept one of the following:

- Lung disease/respiratory diseases (asthma, COPD, bronchitis, lung cancer)
- Neurological damage
- Birth defects
- Heart disease
- Eye irritation/respiratory irritation/headaches

Total for part (a) 1 point

- (b) (i) **Describe** an environmental problem associated with coal ash waste disposal. 1 point

Accept one of the following:

- Leaching from landfills/clay-lined pits
- Overflowing of coal ash into bodies of water
- Leaking and contamination of groundwater, soil, or nearby bodies of water
- Coal ash washing into bodies of water as a result of severe weather events
- Dry ash carrying into nearby bodies of water, increasing turbidity/decreasing photosynthesis

- (ii) A proposed solution is to dispose North Carolina's coal ash in clay-lined pits. **Justify** this solution by providing one advantage of using clay soil. 1 point

- Clay is less permeable than unlined pits and can prevent the leaching of coal ash into soil/groundwater.

Total for part (b) 2 points

- (c) (i) **Calculate** the percent change in Charlotte's population from 2013 to 2019. **Show** your work. 1 point

One point for the correct setup to calculate the percent change:

- $\frac{857,425 \text{ people} - 757,278 \text{ people}}{757,278 \text{ people}} \times 100$
- $\left(\frac{857,425 \text{ people}}{757,278 \text{ people}} - 1 \right) \times 100$

One point for the correct calculation of the percent change: 1 point

Accept one of the following:

- 13%
- 13.22%
- 13.224602%

- (ii) Based on Charlotte's 2019 growth rate of 1.88%, **calculate** the year when the population of Charlotte will double, assuming the growth rate stays the same. **Show** your work. 1 point

One point for the correct setup to calculate the year the population of Charlotte will double:

- Doubling time = $\frac{70}{1.88} = 37 \text{ years} + 2019$

One point for the correct calculation year the population of Charlotte will double: 1 point

- 2056

- (iii) The average Charlotte resident uses 90 gallons of water per day. **Calculate** the gallons of water used by the population of Charlotte in the year 2018. **Show** your work. 1 point

One point for the correct setup to calculate the gallons of water used in 2018:

- $\frac{90 \text{ gallons of water}}{\text{person per day}} \times 841,611 \text{ people} \times 365 \text{ days}$

One point for the correct calculation of the gallons of water used in 2018: 1 point

Accept one of the following:

- 27,646,921,350 gallons
- 2.76×10^{10} gallons
- 2.8×10^{10} gallons
- 3×10^{10} gallons

Total for part (c) 6 points

- (d) Drought periods are becoming more frequent in North Carolina, causing water resources to become more scarce. **Describe** one realistic action that citizens could take to reduce domestic outdoor water use. 1 point

Accept one of the following:

- Plant drought resistant plant species/use artificial landscaping/use xeriscaping to reduce the need for irrigation.
- Eliminate/reduce nonessential usage of water, such as washing of cars, power washing.
- Reduce the use of sprinklers/irrigation by monitoring soil conditions, weather conditions or reducing frequency.
- Collect rainwater or gray water for irrigation.
- Water plants/lawn before sunrise/after sunset to limit evaporation.
- Switch to drip irrigation to limit evaporation.

Total for part (d) 1 point

Total for question 3 10 points