Past-paper walk-through

Energy from Biomass ▪ 6.7

eXercise

Questions in this set

- 2016 Q3

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 3

2016 ▪ Q3

Municipal solid waste (MSW) is the trash collected from households and businesses. The graph below shows MSW generation in the United States from 1960 to 2012.
[Line graph titled "MSW GENERATION RATES, 1960-2012". Left y-axis: "Total MSW Generation (millions of tons)", scale 0 to 300 in increments of 50. Right y-axis: "Per Capita MSW Generation (pounds per person per day)", scale 0 to 10 in increments of 2. X-axis: "Year", from 1960 to 2012 in 5-year increments (1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2012).
Line labeled "Total MSW" (triangles), approximate values: 1960 80, 1965 105, 1970 120, 1975 128, 1980 150, 1985 165, 1990 205, 1995 215, 2000 240, 2005 252, 2010 250, 2012 250.

Question 3

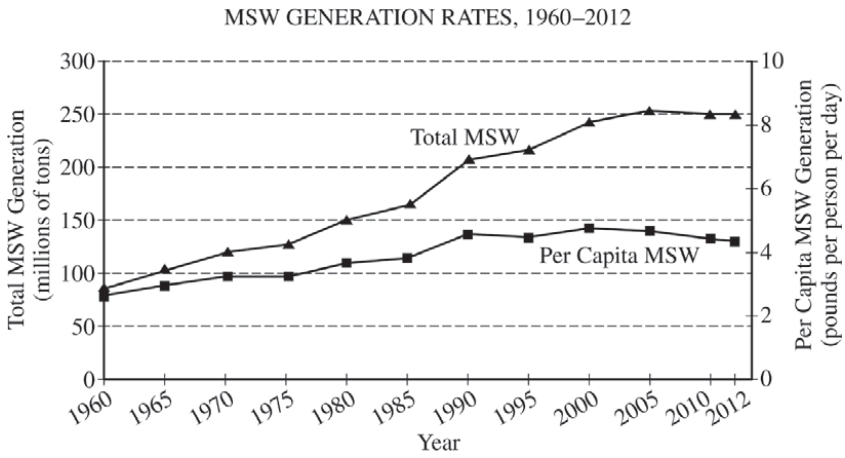
Line labeled “Per Capita MSW” (squares), approximate values: 1960 2.6, 1965 2.8, 1970 3.2, 1975 3.2, 1980 3.6, 1985 3.7, 1990 4.5, 1995 4.4, 2000 4.7, 2005 4.6, 2010 4.4, 2012 4.2.]

(a)(i) Use the data provided in the graph above to respond to the following.

Explain one probable cause (other than increased composting) for the change in per capita waste generation from 2000 to 2012.

(a)(ii) Calculate the percent increase in total MSW generation from 1980 to 2012.

Question 3


MSW GENERATION RATES, 1960–2012
Total MSW Generation (millions of tons)
Per Capita MSW Generation (pounds per person per day)
Total MSW
Per Capita MSW
300
250
200
150
100
50
0
10
8
6
4
2
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2012
Year

Question 3

2016 ▪ Q3

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Question 3

(b)(i) Two ways of managing MSW are incineration and disposal in landfills. **Identify** one disadvantage of waste incineration.
(b)(ii) Identify one disadvantage of waste disposal in landfills.

Question 3

2016 ▪ Q3

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Question 3

(c) Trash incineration is one way to generate electricity from MSW. Electricity can also be generated from waste buried in landfills.
Describe the specific steps of a process used to produce electricity from waste buried in a landfill.

Question 3

2016 ▪ Q3

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Question 3

(d) Many landfills do not accept used tires. As a result, the tires are often dumped in poorly regulated piles. **Describe** one human health problem associated with piles of discarded tires.

Question 3

2016 ▪ Q3

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Question 3

(e)(i) Composting is one way to reduce the amount of waste that enters a landfill. Other than reducing the volume of waste, **identify** one advantage of composting.
(e)(ii) Identify one disadvantage of composting.

Solution 3

(a)(i)

Mark scheme

- 1 point for a correct explanation (other than increased composting) for the change in per capita waste generation from 2000 to 2012: people/businesses practicing refuse, reduce, reuse, recycle, or repurpose; lighter materials contribute to less MSW (e.g., plastic bottles instead of glass); less material used per product (e.g., thinner newspapers, lighter aluminum cans); technology reduces waste generation (e.g., reading magazines online instead of on paper); or economic recession leading to less consumption and less MSW produced.

Solution 3

(a)(ii)

Mark scheme

- 1 point for the correct answer with work shown: ((250 million tons − 150 million tons) / 150 million tons) × 100 = 66% to 67% increase in total MSW generation from 1980 to 2012.

Solution 3

(b)(i)

Mark scheme

- 1 point for a correct identification of a disadvantage of waste incineration: releases a specific air pollutant (e.g., CO, CO2, dioxin, halogens, particulates, SOx, NOx); ash disposal is necessary; incinerators are expensive to construct and/or operate; MSW supply/quality may be limited, requiring additional fuel; or reduced quality of life and property value due to the incinerator and supply trucks.

Solution 3

(b)(ii)

Mark scheme

- 1 point for a correct identification of a disadvantage of waste disposal in landfills: groundwater, surface water, or soil contamination through some transport mechanism; reduced quality of life and property value due to the landfill and supply trucks; release of methane or CO2; odor source; attracts vermin; habitat destruction; precludes other land uses; or explosion/seepage hazard from methane produced.

Solution 3

(c)

Mark scheme

- 3 points, 1 point for each correct step in the process of generating electricity from landfill gas: (1) Acquire fuel (chemical energy) — methane is collected/gathered from the landfill; (2) Use fuel (chemical $\rightarrow$ mechanical) — the fuel is combusted to produce steam or hot air; (3) Generate electricity (mechanical $\rightarrow$ electricity) — the steam or hot air spins/turns/rotates a turbine/generator to generate/produce electricity.

Solution 3

(d)

Mark scheme

- 1 point for a correct description of a human health problem associated with piles of discarded tires: discarded tires provide standing-water habitat for mosquitoes/pests that can act as disease vectors; or tires may catch fire and release air pollutants that cause respiratory issues in humans.

Solution 3

(e)(i)

Mark scheme

- 1 point for a correct identification of an advantage of composting (other than reducing waste volume): the resulting compost can be used or sold as fertilizer or soil amendment; municipal composting facilities may provide jobs; MSW may emit less foul odor if organic material is composted; or tipping fees and trash removal costs may be reduced by removing dense compostable material.

Solution 3

(e)(ii)

Mark scheme

- 1 point for a correct identification of a disadvantage of composting: compost may attract undesirable animals (vermin); compost may emit foul odors or spontaneously combust; nutrients released from decomposing organic matter may run off into surface waters and cause water quality problems; compost may release methane; or composting organic material requires a great investment of time and labor by humans.