

Past-paper walk-through

Adaptations ■ 2.6

eXercise

Questions in this set

- 2024 Set 2 Q3
- 2023 Set 2 Q1
- 2018 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

2024 Set 2 ■ Q3

The Rocky Mountains, the headwaters for the Colorado River, have experienced a severe drought for many of the past twenty years. States and cities downstream that depend on the river water have had to find solutions to the reduced water flow.

One city located downstream from the Rocky Mountains is Las Vegas, Nevada. In Las Vegas, one solution to reduce the amount of water used for irrigation is to remove landscaping and lawns that use grasses not native to the local area and replace them with desert-tolerant landscaping.

(a) Identify a typical type of plant that would be used in desert-tolerant landscaping.

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(b) Justify the removal of landscaping and lawns that use grasses not native to the local area by describing an additional advantage, other than reducing the amount of water needed for irrigation.

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(c) Warmer seasonal temperatures in the Rocky Mountains have led to earlier mountain snowmelt and an increased risk of forest fires as soil and vegetation dry out. Describe how a prescribed burn would reduce the severity and spread of forest fires.

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(d) Describe a disadvantage of a prescribed burn in a forested ecosystem.

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(e) Lake Powell is a large reservoir on the Colorado River. Lake Powell is formed by a dam with a hydroelectric power plant. At full capacity or full pool, Lake Powell contains 25.16 million acre-feet (maf) of water. Currently, Lake Powell is at 36% full capacity.

Question 3

Calculate the number of million acre-feet (maf) of water currently in Lake Powell.
Show your work.

Question 3

2024 Set 2 ■ Q3

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(f) In 2021, after years of drought, Lake Powell held 7.9 million acre-feet (maf) of water. One million acre-feet is equivalent to 3.26×10^{11} gallons.

The watershed of the Upper Colorado River contributes an average of 9.60 maf of water to Lake Powell annually. The melted mountain snow found in the watershed contributes 50

Question 3

2024 Set 2 ■ Q3

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(g) The average household in the United States consumes 5.0×10^4 gallons of water in a year. Calculate the number of households that could be supported for one year by the average flow of 9.60 maf of water into Lake Powell. Show your work.

Solution 3

(a)

Mark scheme

- A typical desert-tolerant landscaping plant: cactus/cacti, succulent plants, or other drought-tolerant plants. Full credit for naming one such plant type.

Solution 3

(b)

Mark scheme

- An additional advantage (besides reduced irrigation water) of removing non-native grass lawns: any one of (1) native desert plants support habitat/provide food for local wildlife; (2) less mowing means decreased yard-maintenance time/cost; (3) desert-tolerant plants need less fertilizer/pesticide; (4) it creates jobs for landscapers to remove/replace turf; (5) less use of gas-powered yard tools reduces air pollution/noise pollution/gasoline consumption. Full credit for any one such advantage.

Solution 3

(c)

Mark scheme

- A prescribed burn reduces the severity/spread of forest fires because it removes undergrowth, decreasing available fuel/flammable material, and/or it thins the forest, creating a fire break that reduces the spread of future fires. Full credit for either mechanism.

Solution 3

(d)

Mark scheme

- A disadvantage of a prescribed burn: any one of (1) it reduces habitat for wildlife/can harm or displace animals; (2) it releases carbon dioxide, contributing to climate change; (3) it releases particulates/air pollutants, worsening air quality; (4) runoff after the burn can degrade water quality; (5) it reduces competition, which can help invasive species spread/expand. Full credit for any one such disadvantage.

Solution 3

(e)

Mark scheme

- Setup (1 point): $25.16 \text{ maf} \times 36\% = 25.16 \times 0.36$. Calculation (1 point): $\approx 9.06 \text{ maf}$ (accept 9.0576, 9.058, 9.06, or 9.1). Full credit (2 points) needs both a correct setup showing 25.16 maf multiplied by 36

Solution 3

(f)

Mark scheme

- Setup (1 point): $9.60 \text{ maf} \times 36\% \times 50\% = 9.60 \times 0.36 \times 0.5$. Calculation (1 point): $\approx 1.73 \text{ maf}$ (accept 1.728, 1.73, or 1.7). Full credit (2 points) needs both the correct multiplicative setup (annual average flow times 2021's 36

Solution 3

(g)

Mark scheme

- Setup (1 point): $9.60 \text{ maf} \times \frac{3.26 \times 10^{11} \text{ gallons}}{1 \text{ maf}} \times \frac{1 \text{ household}}{5.0 \times 10^4 \text{ gallons}}$.

Calculation (1 point): $\approx 62,592,000$ households (i.e. 6.2592×10^7). Full credit (2 points) needs both the correct unit-conversion setup (maf to gallons to households) AND the correct resulting value.

Question 1

2023 Set 2 ■ Q1

Two restoration methods designed to reclaim the overburden piles removed from open pit coal mines in temperate forests of eastern Europe were studied over several years. The first method was spontaneous restoration, where the soil and rock were dumped in noncompacted, random piles and not replanted with vegetation. The second method was technical restoration, where the land was leveled by heavy machinery, organic material was added, and eight plant species were added. Technical restoration started 5 years after the piles were formed, so no bar is included in the 1-5 year range in the graph.

Number of Plant Species in Spontaneous and Technically Restored Overburden Piles over Time

Question 1

[Bar graph titled “Number of Plant Species in Spontaneous and Technically Restored Overburden Piles over Time”. Y-axis: “Average Number of Plant Species”, from 0 to 20, gridlines at 0, 10, 20. X-axis: “Age (years) of Overburden Piles”, with six categories: 1-5, 6-10, 11-15, 16-25, 26-35, >35. Two bars per category (legend: light gray = Spontaneous restoration piles, dark/black = Technical restoration piles). Approximate bar heights: 1-5: Spontaneous ~6.5, Technical (none, no bar); 6-10: Spontaneous ~12, Technical ~9.5; 11-15: Spontaneous ~13, Technical ~11.5; 16-25: Spontaneous ~13, Technical ~8.5; 26-35: Spontaneous ~14, Technical ~8; >35: Spontaneous ~17.5, Technical ~8.]

Scientists hypothesized that after 35 years, the number of animal species in the spontaneously restored piles would be higher than the number of animal species in the technically restored piles.

Question 1

Limiting runoff on disturbed land improves soil and water quality. To model water runoff, students set up three large plastic trays and filled each tray with loam soil to 1 centimeter below the edge. Loam soil is a balance of sand, silt, and clay soil. One tray was seeded with wheatgrass and grown for 30 days, one tray was covered with small wood chips, and one tray was soil only. Five hundred milliliters of water was sprinkled evenly onto the soil surface of each tray. All three trays were placed on a slight slope, and water that ran off the surface was collected. The results are shown in the following table.

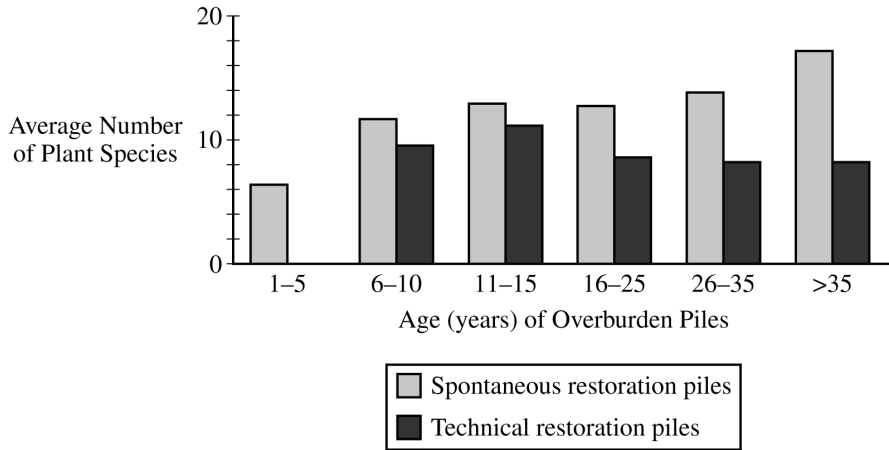
Tray	Water Collected (mL)	Water Appearance
Wheatgrass grown in soil; no small wood chips	190	Clear
Small wood chips covered soil; no wheatgrass	300	Transparent; light brown
Soil only; no wheatgrass or small wood chips	360	Cloudy; dark brown

Question 1

Runoff from mining waste can also affect water quality.

(a) Based on the data in the graph, **identify** the average number of species found in technically restored piles 16-25 years after restoration started.

Question 1



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