

Past-paper walk-through

The Tragedy of the Commons ▪ 5.1

eXercise

Questions in this set

- 2023 Set 2 Q2
- 2022 Set 1 Q2

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 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

Question 2

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

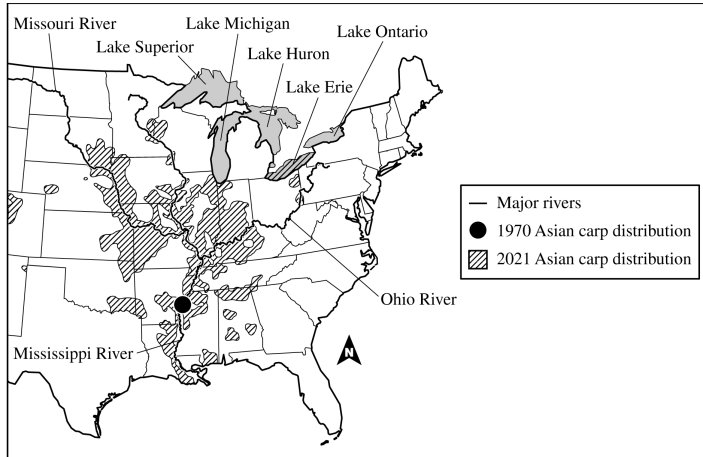
The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(a) Based on the information given, **identify** a body of water invaded by Asian carp that is labeled on the map.

Question 2



Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(b) Based on the information shown in the map, **describe** the change in the distribution of Asian carp since their introduction in the 1970s.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(c) Describe one impact the introduction of Asian carp could have on the ecosystem services provided by the Great Lakes region.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(d) Propose a realistic solution to help reduce the spread of the Asian carp from their current distribution.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(e) Justify the solution proposed in part (d) by providing an additional advantage.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(f) Identify the primary consumer in the Great Lakes food chain.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(g) Describe what the arrows in the aquatic food chain represent.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(h) Describe one possible effect of the introduction of the Asian carp on the Great Lakes food chain.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(i) Describe one way that overfishing of blue pike illustrates the tragedy of the commons.

Question 2

2023 Set 2 ■ Q2

Asian carp were first introduced in the southern United States in the 1970s by fish farmers wanting to control algal growth in fish ponds. Asian carp can eat up to 40

****Distribution of the Asian Carp in the United States****

[Map of the eastern/central United States titled "Distribution of the Asian Carp in the United States". Labeled features: Missouri River, Mississippi River, Ohio River, and the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario), each shown shaded gray. A compass rose (N) is shown. Legend: a solid line = Major rivers; a filled black circle = 1970 Asian carp distribution (shown as a single point near the lower Mississippi River/southern states); a diagonal-hatched pattern = 2021 Asian carp distribution (shown spread widely along the Mississippi, Missouri, and Ohio River systems and extending toward the Great Lakes, with hatching also appearing over Lake Erie).]

The Great Lakes are a group of five major freshwater inland lakes that all share the same watershed.

Question 2

The following is an example of a simple food chain in the Great Lakes.

Algae → Zooplankton → Macroinvertebrates → Yellow perch → Rainbow trout

The blue pike, a fish that was endemic to the Great Lakes, was commercially fished from the late 1800s until their population crashed in 1958. In 1970, the species was declared to be extinct.

(j) One potential solution to reduce overfishing is to use aquaculture. **Describe** one disadvantage of this solution.

Solution 2

(a)

Mark scheme

- A body of water labeled on the map, e.g.: the Mississippi River, Lake Erie, the Missouri River, or the Ohio River.

Solution 2

(b)

Mark scheme

- Since their introduction in the 1970s, Asian carp have become far more widely distributed — found in most of the watershed / a much larger area than before — moving up and down the Mississippi River and up the Missouri and Ohio Rivers (i.e., spreading northwest and northeast up the river systems).

Solution 2

(c)

Mark scheme

- One impact on ecosystem services, e.g.: improved drinking water quality as carp consume algae; decreased recreational opportunities (boating/swimming) from the larger carp population; decreased fishing as carp outcompete native fish species; decreased drinking water quality as carp displace filter feeders like native mussels; or a decreased algae population leading to decreased photosynthesis and either increased greenhouse gases/warming or decreased oxygen production.

Solution 2

(d)

Mark scheme

- A realistic solution such as: offering incentives for fishers to catch and kill carp; encouraging consumption of carp; building fencing/netting between waterways; using shock treatment (a dispersal barrier system); creating/using an Asian-carp-specific poison or deterrent (e.g., carpicide, CO₂, microparticles); implementing a high-frequency sound deterrent system; or prohibiting the transfer of bait or ballast water from one body of water to another.

Solution 2

(e) Mark scheme

- An additional advantage that matches the solution proposed in (d). For fencing/netting, sound deterrents, carp-specific poison/deterrent, or shock treatment: creates jobs in the Great Lakes fishing industry, causes little/no harm to native animal/plant populations, reduces carp's negative impact on watershed feeding relationships, or maintains revenue for the existing fishing industry/tourism. For encouraging carp consumption or incentivizing fishers to catch/kill carp: increases revenue in the fishing industry/from carp sales, reduces carp's negative feeding-relationship impacts, provides a new food source (domestically/internationally) or combats hunger, or allows native species to return as competition from carp decreases. For prohibiting bait/ballast transfer:

Solution 2

causes no harm to native populations, reduces carp's negative feeding impacts, or maintains existing fishing/tourism revenue.

Solution 2

(f)

Mark scheme

- Zooplankton — the primary consumer in the Great Lakes food chain.

Solution 2

(g)

Mark scheme

- The arrows represent the flow of energy (or equivalently, the flow of matter) through the aquatic food chain.

Solution 2

(h)

Mark scheme

- One possible effect, e.g.: there will be fewer zooplankton/macroinvertebrates/yellow perch/rainbow trout; there will be less food available for other species at the same trophic level; or there will be less food for species that don't eat carp but are higher on the food chain.

Solution 2

(i)

Mark scheme

- The blue pike were a shared/common resource with unregulated access, so fishers maximized their own profits/catch, depleting (and ultimately causing the extinction of) the shared resource — illustrating the tragedy of the commons.

Solution 2

(j)

Mark scheme

- One disadvantage of aquaculture, e.g.: it contaminates water with excess organic waste/antibiotics; escaped fish compete or breed with wild fish; facilities can spread disease to wild fish; high fish density increases disease; it causes job losses in the fishing industry; it puts pressure on wild fish stocks used to make food pellets; it decreases the genetic diversity of farm-raised fish; it causes habitat degradation from converting ecosystems to fish farms; or antibiotic overuse creates antibiotic-resistant bacteria harmful to humans.

Question 2

2022 Set 1 ■ Q2

Developments in advanced hydraulic fracturing (fracking) technologies have allowed the total oil and gas production in the United States to increase rapidly.

[Scatter graph titled “METHANE CONCENTRATION IN DRINKING WATER WELLS IN PENNSYLVANIA.” Y-axis: “Methane Concentration in Well Water (mg/L),” scale 0 to 70 in increments of 10. X-axis: “Distance to Nearest Fracking Well (m),” scale 0 to 6,000 in increments of 1,000. A horizontal reference line is drawn at $y = 10$ mg/L, with an upward arrow above it labeled “Hazardous concentrations, mitigation required” and a downward arrow below it labeled “No mitigation required.” Data points (labeled “Well water sample” in the legend, shown as filled circles) are heavily concentrated at small distances (roughly 0–500 m) with methane concentrations ranging widely from near 0 up to about 64 mg/L (points near approximately 64, 60, 53, 52, 51, 42, 34, 33, 29, 24, 20, and several points below 10 clustered near $x = 0$ –300 m). A few points

Question 2

appear farther out: around $x = 1,300\text{--}1,500$ m with $y = 13\text{--}17$ mg/L, and isolated lower points scattered out to about $x = 3,600$ m ($y = 6$), $x = 3,700$ m ($y = 3$), and $x = 4,300$ m ($y = 1$), with most points beyond about $x = 1,000$ m sitting at or near $y = 0$, extending out to about $x = 5,700$ m.]

(a)(i) The graph shows the methane concentration in drinking water from home wells and the distance to the nearest fracking well in Pennsylvania. Based on the data in the graph, **identify** the highest methane concentration found in well water in Pennsylvania.

(a)(ii) Based on the data in the graph, **describe** the relationship between the concentration of methane in well water and the distance to a fracking well.

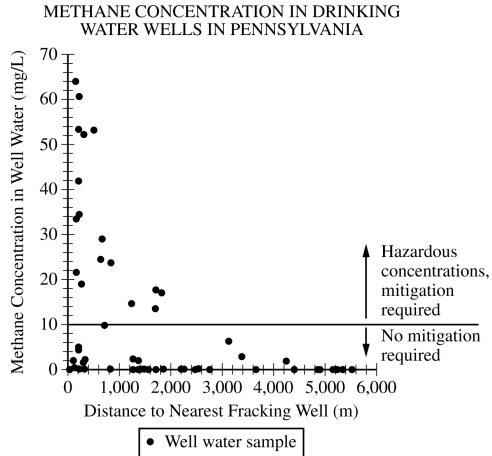
(a)(iii) Based on the data in the graph, **identify** the minimum safe distance that a new water well should be located from an existing fracking well.

(a)(iv) **Explain** how fracking fluid is used to access oil and natural gas in sedimentary rock, such as shale, during the fracking process.

Question 2

(a)(v) Identify one negative geologic effect in an area where hydraulic fracturing (fracking) occurs.

Question 2



Question 2

2022 Set 1 ■ Q2

Developments in advanced hydraulic fracturing (fracking) technologies have allowed the total oil and gas production in the United States to increase rapidly.

[Scatter graph titled “METHANE CONCENTRATION IN DRINKING WATER WELLS IN PENNSYLVANIA.” Y-axis: “Methane Concentration in Well Water (mg/L),” scale 0 to 70 in increments of 10. X-axis: “Distance to Nearest Fracking Well (m),” scale 0 to 6,000 in increments of 1,000. A horizontal reference line is drawn at $y = 10$ mg/L, with an upward arrow above it labeled “Hazardous concentrations, mitigation required” and a downward arrow below it labeled “No mitigation required.” Data points (labeled “Well water sample” in the legend, shown as filled circles ) are heavily concentrated at small distances (roughly 0–500 m) with methane concentrations ranging widely from near 0 up to about 64 mg/L (points near approximately 64, 60, 53, 52, 51, 42, 34, 33, 29, 24, 20, and several points below 10 clustered near $x = 0$ –300 m). A few points appear farther out: around $x = 1,300$ –1,500 m with $y = 13$ –17

Question 2

mg/L, and isolated lower points scattered out to about $x = 3,600$ m ($y = 6$), $x = 3,700$ m ($y = 3$), and $x = 4,300$ m ($y = 1$), with most points beyond about $x = 1,000$ m sitting at or near $y = 0$, extending out to about $x = 5,700$ m.]

(b)(i) The volume of water used for oil and gas extraction is 28 times greater than it was fifteen years ago. Much of the water used for oil and gas extraction comes from groundwater sources in arid or semiarid regions. This increased use of water for fracking may mean that less water is available for local use. The use of groundwater for fracking is an example of individuals using a shared resource for their own self-interest. **Identify** the environmental concept illustrated by this example of overuse of a shared resource.

(b)(ii) Describe one environmental problem that may result from increased use of groundwater for fracking in arid or semiarid regions.

Question 2

(b)(iii) Describe how overuse of coastal groundwater supplies can result in water that is unsuitable for human consumption.

Question 2

2022 Set 1 ■ Q2

Developments in advanced hydraulic fracturing (fracking) technologies have allowed the total oil and gas production in the United States to increase rapidly.

[Scatter graph titled “METHANE CONCENTRATION IN DRINKING WATER WELLS IN PENNSYLVANIA.” Y-axis: “Methane Concentration in Well Water (mg/L),” scale 0 to 70 in increments of 10. X-axis: “Distance to Nearest Fracking Well (m),” scale 0 to 6,000 in increments of 1,000. A horizontal reference line is drawn at $y = 10$ mg/L, with an upward arrow above it labeled “Hazardous concentrations, mitigation required” and a downward arrow below it labeled “No mitigation required.” Data points (labeled “Well water sample” in the legend, shown as filled circles ) are heavily concentrated at small distances (roughly 0–500 m) with methane concentrations ranging widely from near 0 up to about 64 mg/L (points near approximately 64, 60, 53, 52, 51, 42, 34, 33, 29, 24, 20, and several points below 10 clustered near $x = 0$ –300 m). A few points appear farther out: around $x = 1,300$ –1,500 m with $y = 13$ –17

Question 2

mg/L, and isolated lower points scattered out to about $x = 3,600$ m ($y = 6$), $x = 3,700$ m ($y = 3$), and $x = 4,300$ m ($y = 1$), with most points beyond about $x = 1,000$ m sitting at or near $y = 0$, extending out to about $x = 5,700$ m.]

(c)(i) In addition to water quality issues caused by fossil fuel extraction, air quality can also be negatively affected by combustion of oil and natural gas. **Make a claim** for a realistic governmental action to improve air quality by reducing consumption of oil.

(c)(ii) **Justify** the action proposed in part (c)(i) by stating a potential environmental advantage of that action, other than slowing global climate change.

Solution 2

(a)(i)

Mark scheme

- The highest methane concentration found in well water in Pennsylvania is 64 mg/L.

(a)(ii)

Mark scheme

- Methane concentration in well water decreases as distance from the fracking well increases — an inverse/nonlinear, negative relationship between the two variables.

Solution 2

(a)(iii)

Mark scheme

- Any value between 1,800 and 2,200 meters is an acceptable minimum safe distance for a new water well from an existing fracking well.

Solution 2

(a)(iv)

Mark scheme

- Fracking fluid is injected/pumped into the well under high pressure, opening fissures in the shale/sedimentary rock and releasing the oil and natural gas; sand grains suspended in the fluid prop open the newly formed cracks/fractures so the oil and gas can flow up the well.

(a)(v)

Mark scheme

- One negative geologic effect of fracking: earthquakes/increased seismic activity, or ground subsidence/sinkholes.

Solution 2

(b)(i)

Mark scheme

- The environmental concept illustrated is the Tragedy of the Commons.

Solution 2

(b)(ii)

Mark scheme

- One environmental problem from increased groundwater use for fracking in arid/semiarid regions: loss of habitat/productivity in spring-fed ecosystems as springs dry up; loss of habitat/productivity or degraded water quality in streams and estuaries fed by groundwater discharge; soil erosion as vegetation dies due to a lowered water table and roots no longer hold soil; or desertification resulting from a lowered water table.

Solution 2

(b)(iii)

Mark scheme

- Overuse of coastal groundwater lowers the water table, allowing ocean water to flow into the aquifer (saltwater intrusion), contaminating it with saltwater and making it unfit for human consumption.

Solution 2

(c)(i)

Mark scheme

- A realistic governmental action to improve air quality by reducing oil consumption, e.g.: increase fuel economy standards for motor vehicles; invest in renewable energy resources; use tax incentives to encourage hybrid/electric vehicle sales; subsidize public transportation/walking/cycling projects; create tax incentives for work-from-home options; or increase the gasoline tax/reduce oil subsidies.

Solution 2

(c)(ii)

Mark scheme

- Justification must state a benefit (other than slowing climate change) tied to the action named in (c)(i) — e.g. decreased oil/fuel consumption leads to reduced particulates, surface ozone/photochemical smog, or acid rain; decreased oil consumption leads to fewer oil spills and decreased groundwater depletion/contamination from fracking/drilling; or decreased oil consumption leads to less disruption to wildlife/habitats (fragmentation, noise pollution) from drilling operations.