Tracing a storm through a basin

Suggested time for the entire exam: 35–50 min; adjust to local conditions.

Name _____ **Date** _____

Hourly readings at a stream gauge are 4, 5, 11, 16 and 9 m³/s at noon, 1, 2, 3 and 4 p.m. The heaviest rain over the upstream basin occurred at 1 p.m. The values are simulated.

Time	Noon	1 p.m.	2 p.m.	3 p.m.	4 p.m.
Flow (m³/s)	4	5	11	16	9

1. What is the lag from heaviest rain to the highest measured discharge?

- ○ A 1 h
- ○ B 4 h
- ○ C 3 h
- ○ D 2 h

2. Which change would generally shorten travel time to the channel during a comparable storm?

- ○ A Increasing infiltration into unsaturated soil
- ○ B Restoring storage in floodplain wetlands
- ○ C Increasing deep soil storage
- ○ D Replacing permeable soil with connected paved drains

3. Explain a process that can account for the lag. Predict how a detention basin that releases water slowly could change the peak under otherwise similar conditions.

An ocean-floor transect

Use the stimulus and your course knowledge.

Name _____ **Date** _____

A ridge lies at distance 0. At 40, 80 and 120 km on its east side the crust is 2, 4 and 6 million years old. On the west side rocks of the same ages occur at the corresponding distances. Assume rates were approximately constant.

4. What is the mean outward speed for one side?

- ○ A 2 cm/year
- ○ B 0.2 cm/year
- ○ C 4 cm/year
- ○ D 20 cm/year

5. Which observation most strongly supports formation of new crust at the ridge?

- ○ A Crust becomes older away from the ridge on both sides.
- ○ B The six samples have different distances.
- ○ C The data table includes ages in millions of years.
- ○ D Each sample was collected on Earth.

6. Predict the distance between two pieces of same-age crust, one on each side, after 8 million years at the stated rates. Explain the distinction between plate speed and total separation.

The star’s missing light

Use the stimulus and your course knowledge.

Name _____ **Date** _____

A monitored star has a stable baseline brightness. Dips of almost identical size recur on days 2, 8, 14 and 20. Each lasts about 3 hours. A second proposed orbit model predicts a transit every 4 days. Assume continuous observing and no missed transits.

7. Which period best fits the dip sequence?

- ○ A 18 days
- ○ B 6 days
- ○ C 3 hours
- ○ D 8 days

8. What is the strongest reason to question the 4-day model?

- ○ A The first observation occurred after day zero.
- ○ B It predicts dips at times with no observed dips.
- ○ C It uses calendar days instead of hours.
- ○ D It predicts the star must be smaller than Earth.

9. Predict the next dip after day 20. Explain why repeated dimming is consistent with an orbiting body, and give one observation that would test the prediction.

Reading a rock record

Use the stimulus and your course knowledge.

Name _____ **Date** _____

In an undisturbed sequence, sandstone S is beneath shale H. A dike D cuts both. An erosion surface truncates S, H and D. A horizontal limestone L was deposited above that surface. Fossils in L are marine.

10. Which event must predate the intrusion?

- ○ A Formation of fossils within L
- ○ B Deposition of L
- ○ C Deposition of H
- ○ D Erosion that truncated D

11. Which conclusion is supported by the fossils in L?

- ○ A The exact age of L is known from the word marine.
- ○ B The dike was deposited by waves.
- ○ C Marine deposition occurred at that site when L formed.
- ○ D Every underlying layer formed in deep water.

12. Order the deposition and disturbance events from earliest to latest. Identify where time is missing from the rock record and explain how you know.