

USES0 2021

# Open Exam

Section I



---

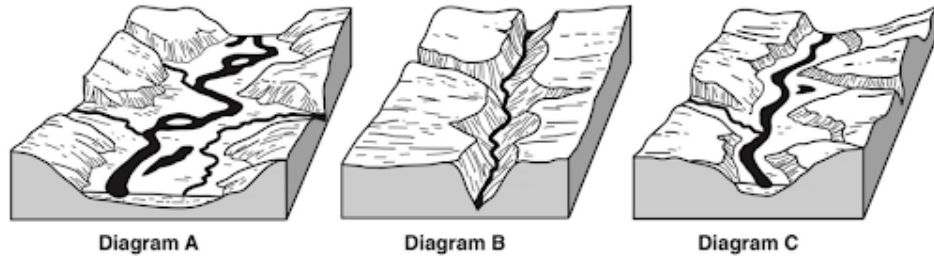
**Instructions:**

- Section I is 60 minutes and consists of 30 multiple choice and multiple select questions
- Questions marked with a (\*) may have one or more correct answers
- For multiple select questions: correct answers earn 1 pt, incorrectly marked answers deduct 1 pt, and unmarked correct answers do not earn nor deduct points

**ANSWER FORM HERE**

1. A volcano currently extrudes rhyolitic magmas but used to extrude basaltic magmas. Which of these is likely true about the volcano's history? (\*)
- A. The silica content of the magma increased over time
  - B. The solidification temperature of the magma increased over time
  - C. The explosivity of the volcano decreased over time
  - D. The viscosity of the magma from the volcano decreased over time
  - E. The magma may have assimilated felsic continental crust

2. Refer to the following river valleys for this question.



Identify all of the following statements regarding these river valleys that are true. (\*)

- A. River valley A is older than river valley B
- B. The stream in river valley A has the most angular sediments
- C. The stream in river valley B has the highest stream discharge
- D. The stream in river valley B has the greatest channel roughness
- E. The stream in river valley C has the most poorly-sorted sediments

3. Lunar rock samples are collected from two sites, labeled 1 and 2 in the image below.

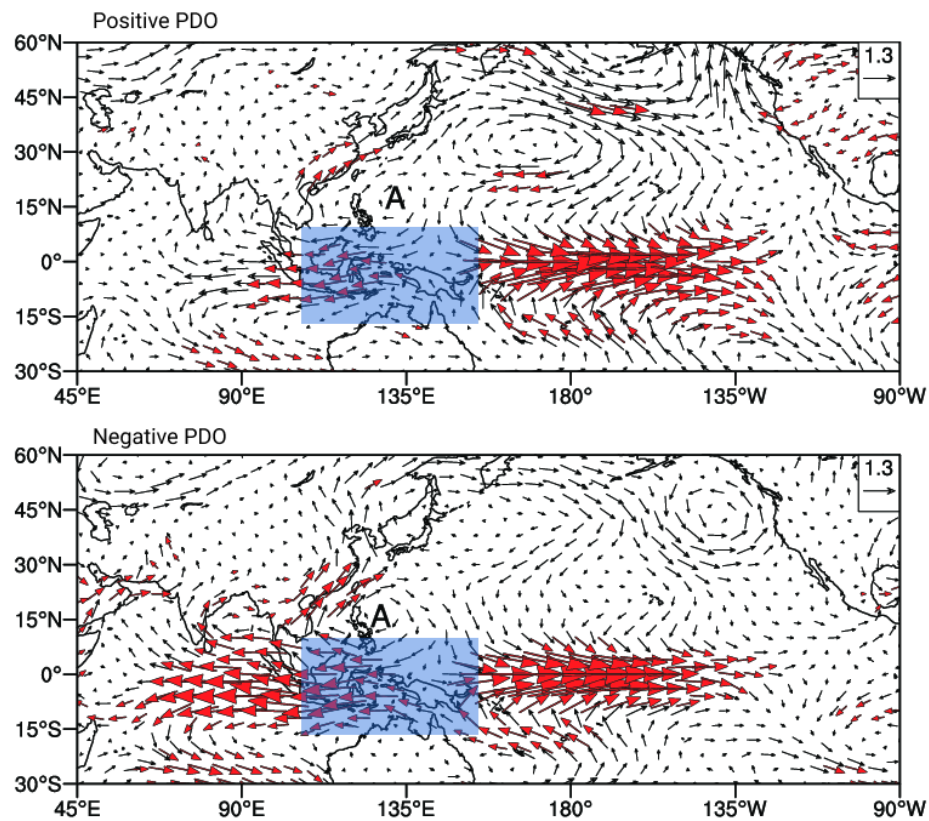


Lunar rock sample	Ca-rich plagioclase content	Olivine content
A	45%	35%
B	90%	5%

Data from chemical analysis of two of the lunar rock samples, A and B, are presented in the table above. Based on this information, which of the following could be reasonably concluded? (\*)

- A. Sample A is from site 1
- B. Sample A is from site 2
- C. Sample B is from site 1
- D. Sample B is from site 2
- E. Sample A formed earlier than sample B
- F. Sample B formed earlier than sample A

4. The figure below shows the wind velocity anomalies at 850 hPa for both phases of the Pacific Decadal Oscillation (PDO), a mode of climate variability in the Pacific Ocean. The region highlighted in blue will be denoted as Region A.



(adapted from Li et al., 2017)

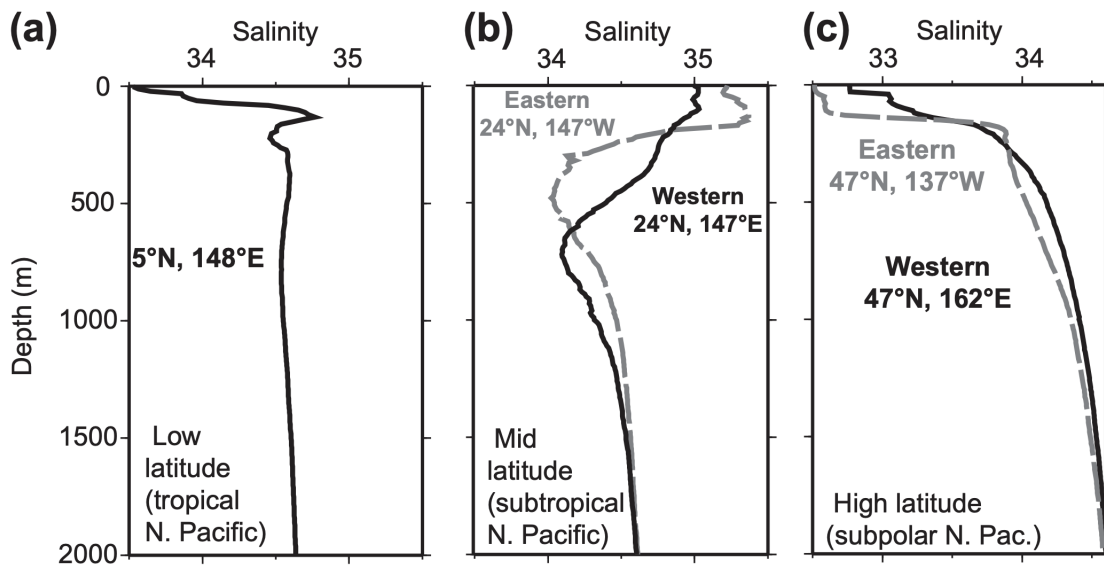
(a) Which phase of ENSO is shown?

- A. El Niño
- B. La Niña

(b) Which of the following is true?

- A. There is greater sinking of air in Region A during positive PDO
- B. There is greater sinking of air in Region A during negative PDO

5. Wanda, an active member of the Swellesley Institute of Technology Crew Team, notices her wind vane indicating that the predominant direction of the wind is 195 degrees clockwise from North. Assuming Wanda is in the Northern Hemisphere and that there are no frictional effects from the ocean bottom, what direction should she expect the surface currents to be pushing her boat in?
- 105°
  - 150°
  - 195°
  - 240°
  - 285°
6. Which of the following sequences of processes will lead to the formation of a nonconformity?
- Deposition → uplift and tilting → erosion → deposition
  - Deposition → erosion → uplift and tilting → deposition
  - Deposition → weathering and erosion → deposition
  - Pluton emplacement → weathering and erosion → deposition
  - Pluton emplacement → deposition → weathering and erosion
7. The diagrams below are the typical salinity profiles (ppt) of low, mid, and high latitude regions of the North Pacific Ocean.



Identify all of the following statements regarding these salinity profiles that are true. (\*)

- The surface salinity at low latitudes can be explained by high evaporation rates
- The surface salinity at mid latitudes can be explained by high precipitation rates
- For mid latitudes, the Eastern region receives more abundant rainfall than the Western region
- For mid latitudes, the Western region receives more abundant rainfall than the Eastern region
- At low latitudes, the pycnocline depends more on the salinity profile than the temperature profile



8. Which of the following statements regarding our solar system's formation is **not** true?
- A. Since the planets formed from the same rotating protoplanetary disk, they orbit the sun in the direction of the sun's axial rotation
  - B. The composition of the matter that condensed at a given region of the solar nebula was primarily determined by the temperature of the gas
  - C. Interstellar dust present in the solar nebula slowed down planetary accretion by disrupting gravitational attractions
  - D. After the protoplanets accreted a large amount of mass, gravitational collapse allowed them to rapidly accumulate additional gas from the nebula
9. A hiker encounters this wide, U-shaped valley (shown below) and begins to explore the area.



Which of the following features is the hiker likely to find? (\*)

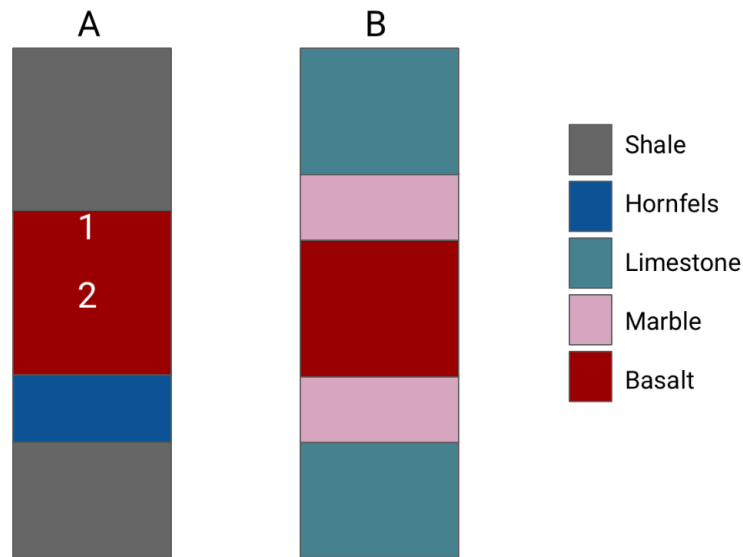
- A. Symmetrical ripple marks
- B. Ridges of unsorted sediment
- C. Boulders that are different from the bedrock of the area
- D. Large scale cross-stratification
- E. Stalagmites
- F. Turbidity current deposits

10. Shown below is a figure of the position of the ITCZ (Intertropical Convergence Zone) in East Asia. X, Y, and Z refer to labeled locations on the map.



- (a) Identify all of the following statements concerning the figure that are likely true. (\*)
- A. This figure represents the ITCZ in January
  - B. This figure represents the ITCZ in July
  - C. Location X is a surface low-pressure center, and location Y is likely a surface high-pressure center
  - D. Location X is a surface high-pressure center, and location Y is likely a surface low-pressure center
  - E. The ITCZ represents a zone where winds converge aloft, instead of at the surface
- (b) Which of the following is the mean prevailing surface wind direction at Z?
- A. NE
  - B. NW
  - C. SE
  - D. SW

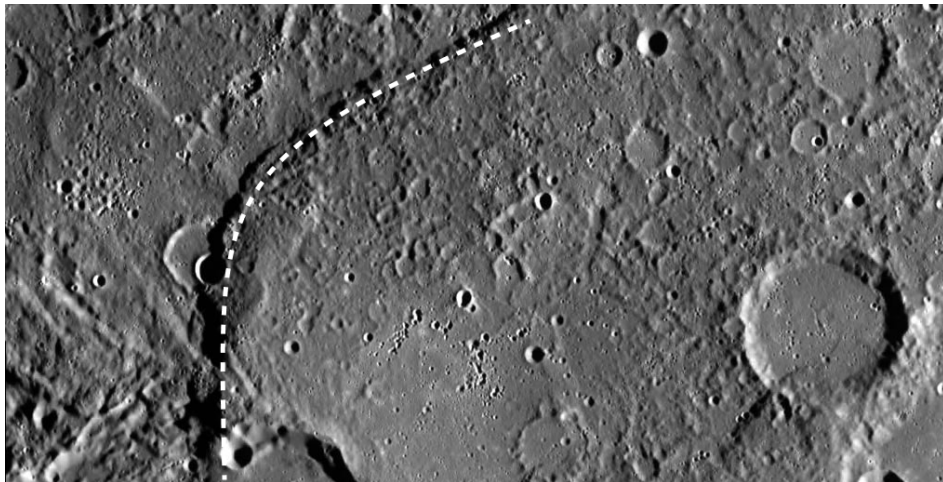
11. A geologist observes cross-sections of two separate outcrops A and B, shown below. It is found that each of the basalt units were formed in a single event.



Which of the following can be inferred from the outcrops above? Assume there has been no overturning. (\*)

- A. The basalt in outcrop A formed extrusively
  - B. The basalt in outcrop A is a sill
  - C. The largest crystals in outcrop A are found in the area labeled “1”
  - D. The largest crystals in outcrop A are found in the area labeled “2”
  - E. The basalt in outcrop B formed extrusively
  - F. The basalt in outcrop B is probably younger than the surrounding limestone
  - G. The marble in outcrop B was formed by partial melting and solidification
12. Jupiter’s four largest moons, from innermost to outermost, are Io, Europa, Ganymede, and Callisto. The first three exhibit 1:2:4 orbital resonances. Callisto, which is not part of this resonance, has a much more homogenous interior than the other moons because it:
- A. Formed earlier in Jupiter’s history
  - B. Is a captured satellite
  - C. Has a significantly inclined orbital plane
  - D. Is tidally locked with Jupiter
  - E. Experiences less tidal heating
13. Which of the following phenomena could occur due to a thermal inversion, in which a layer of warm air overlays a layer of cool air? (\*)
- A. Accumulation of air pollutants
  - B. Formation of fog
  - C. Isolated rain showers
  - D. Supercell thunderstorms

14. Initially (before 8:00 AM), measurements of the dry-bulb temperature ( $T_D$ ) and the wet-bulb temperature ( $T_W$ ) show a relative humidity of 60%. From 8 AM to noon,  $T_D$  increased by 2 °C. From 1 to 5 PM,  $T_W$  also increased by 2 °C. Given that the relative humidity must be below 60% for a school to safely reopen during a pandemic, when should the school hours be?
- A. From both 8 AM to noon and 1 to 5 PM, because in both instances the relative humidity is lower than 60%
  - B. From 8 AM to noon, because the relative humidity is lower than 60%
  - C. From 1 to 5 PM, because the relative humidity is lower than 60%
  - D. Neither instance, because relative humidity is higher than 60% in both cases
  - E. This setup does not give information about relative humidity; investigators should use a different method instead
15. Karst topography is associated with high relief terrain and extensive systems of underground caves. What general kind of weathering is most relevant to karst, and which of the following would likely contribute most to further weathering?
- A. Mechanical weathering; abrasion from more running water
  - B. Mechanical weathering; frost wedging with lower temperature
  - C. Chemical weathering; elevated water table from precipitation
  - D. Chemical weathering; higher groundwater carbonic acid content
16. Tsunamis are fast waves that are often seismically induced and can be very destructive. Identify all of the following statements about tsunamis that are true. (\*)
- A. Tsunami waves have very short wavelengths
  - B. As tsunamis encounter shallower waters, their speed decreases
  - C. A tsunami event consists of a single, large wave
  - D. Tsunamis are considered to be tidal waves due to the long distances that they travel
  - E. The most destructive tsunamis occur as a result of earthquakes originating from mid-ocean ridges
  - F. Abnormal retreat of water from the coast could be a warning sign of a tsunami
17. Lobate scarps (dashed line) are long thrust faults that are ubiquitous on the surface of Mercury.



Which of the following best explains the presence of these lobate scarps?

- A. Mercury has active tectonics that generate areas of compression
- B. Mercury has shrunk after its formation due to cooling
- C. Mercury experiences abundant impact cratering
- D. Tidal forces due to Mercury's proximity to the Sun
- E. Mercury experiences strong solar wind

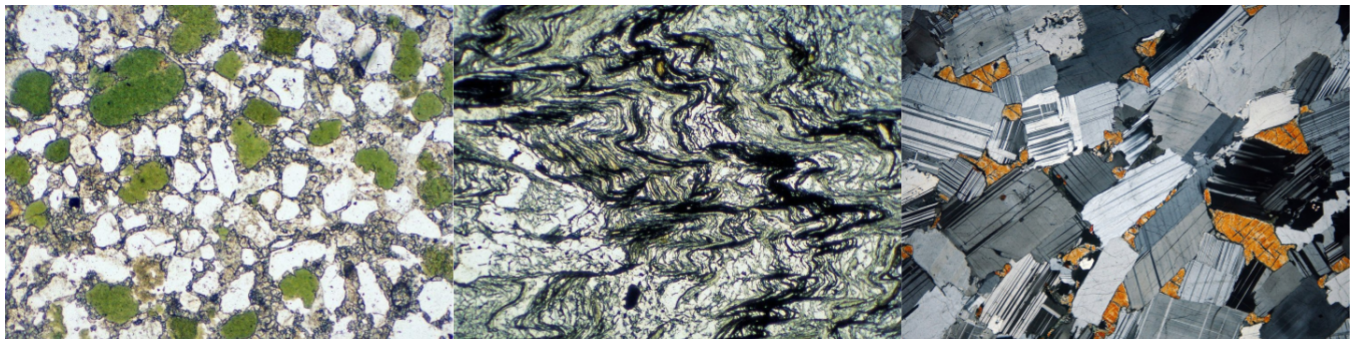
18. Nimbostratus clouds generally lack considerable vertical development and form in relatively stable atmospheric conditions. Identify all of the following statements that are true about nimbostratus clouds and the precipitation that they may produce. (\*)

- A. They are more often associated with warm fronts
- B. They are more often associated with cold fronts
- C. They generally produce heavy precipitation lasting for a short time
- D. They generally produce light to moderate precipitation lasting for a long time
- E. They are likely to produce large hail if there is a shallow layer of above-freezing air aloft above a deeper layer of sub-freezing air
- F. They are likely to produce freezing rain if there is a shallow layer of above-freezing air aloft above a deeper layer of sub-freezing air

19. Which of the following characteristics do **not** differ between active continental margins and passive continental margins? (\*)

- A. Presence of submarine canyons
- B. Presence of an offshore trench
- C. Presence of a continental rise
- D. Continental shelf width
- E. Continental slope steepness

20. Photomicrographs are close up images of thin slices of rock seen under a microscope. The three photomicrographs below represent samples of the three major rock types.



Rock 1

Rock 2

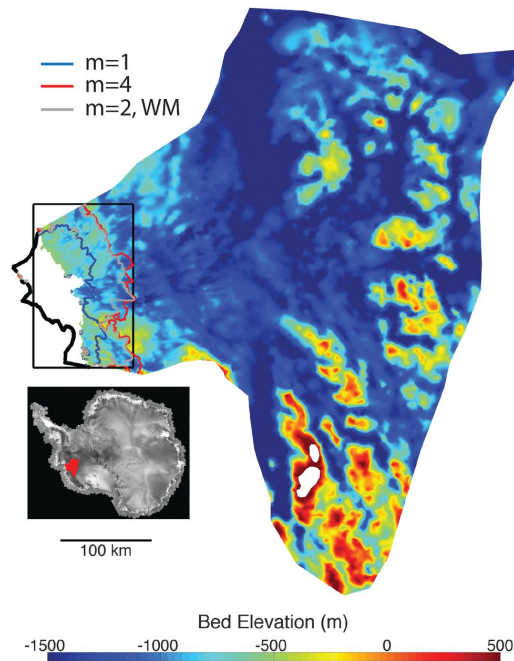
Rock 3



Identify all of the following statements regarding these photomicrographs that are true. (\*)

- A. The formation of Rock 1 involved the crystallization of magma
- B. The formation of Rock 1 involved the lithification of sediment
- C. The formation of Rock 1 involved the metamorphism of a parent rock
- D. Rock 2 is commonly found in a stream channel
- E. Rock 2 is commonly found adjacent to an igneous intrusion
- F. Rock 2 is commonly found in areas under differential stress
- G. The formation of Rock 3 involved the crystallization of magma
- H. The formation of Rock 3 involved the lithification of sediment
- I. The formation of Rock 3 involved the metamorphism of a parent rock

21. The Thwaites Glacier in West Antarctica is of particular interest because its bed is hundreds of meters below sea level, as shown in the bathymetric map below.

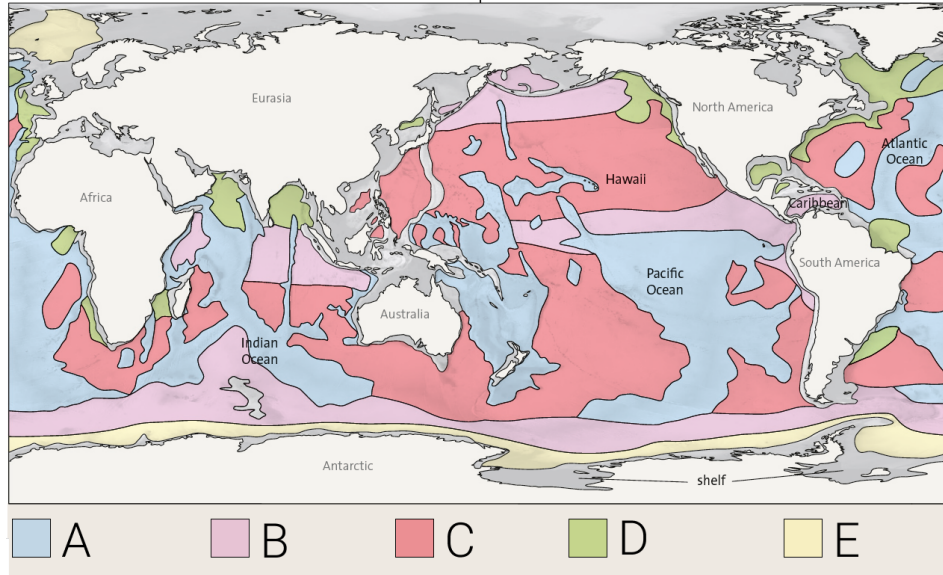


(Joughlin et al., 2014)

Which of the following is the primary reason for accelerated ablation (i.e., mass loss) of the Thwaites Glacier?

- A. Calving
- B. Sublimation of ice
- C. Warming of circumpolar deep water
- D. Surficial meltwater streams
- E. Avalanches

22. Refer to the following figure for this question:



Region B represents areas dominated by what type of sediment?

- A. Alluvial deposits
- B. Glacial deposits
- C. Pelagic red clay
- D. Siliceous ooze
- E. Calcareous ooze

23. Oftentimes, a sudden warm wind may descend from mountains and evaporate up to a foot of snow in less than a day, leading to their nickname, “snow eaters.” Why do Chinook winds such as “snow eaters” lead to a sudden increase in temperature?

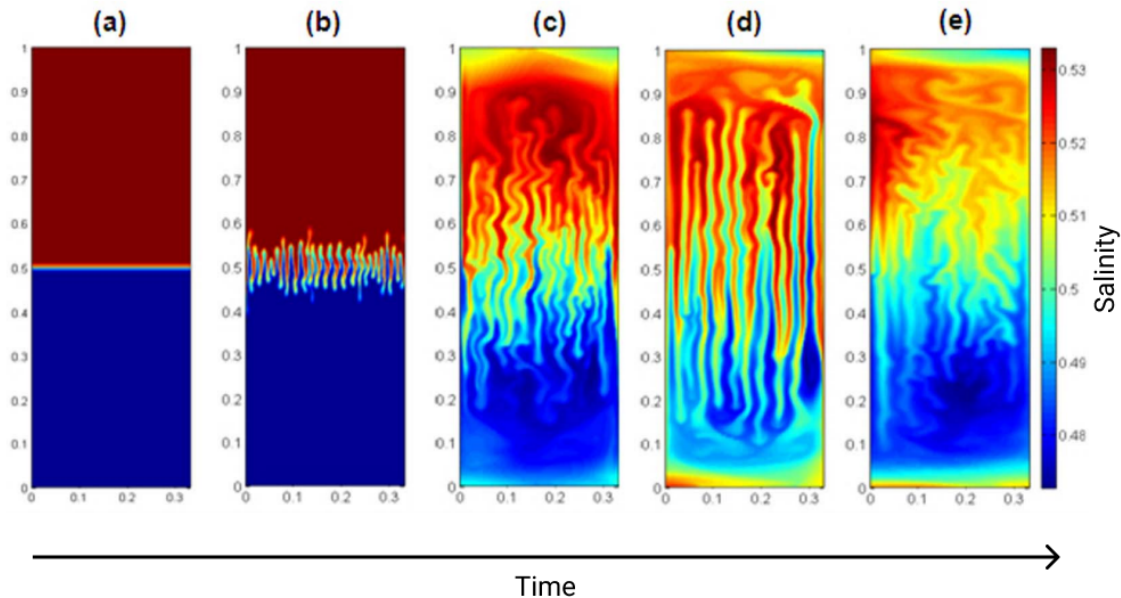
- A. A chinook wind travels long distances over desert areas, retaining heat, before being diverted into cooler areas nearby
- B. A chinook wind warms through adiabatic heating after travelling over and descending from a mountain
- C. A chinook wind gains moisture after travelling over a body of water, leading to an increased environmental lapse rate that warms the wind
- D. A chinook wind follows a warm front, bringing heat to previously cold areas

24. Most of the primordial Martian atmosphere has since escaped to space while Earth has maintained its atmosphere. Identify all of the following comparisons between the present-day Mars and Earth that contribute to this difference. (\*)

- A. Mars has a lower mass than Earth
- B. Earth is closer to the Sun than Mars is
- C. Average atmospheric pressure varies seasonally on Mars
- D. Earth has a liquid outer core while Mars does not
- E. Mars no longer has liquid water at its surface while Earth still does
- F. Mars displays more impact cratering than Earth does



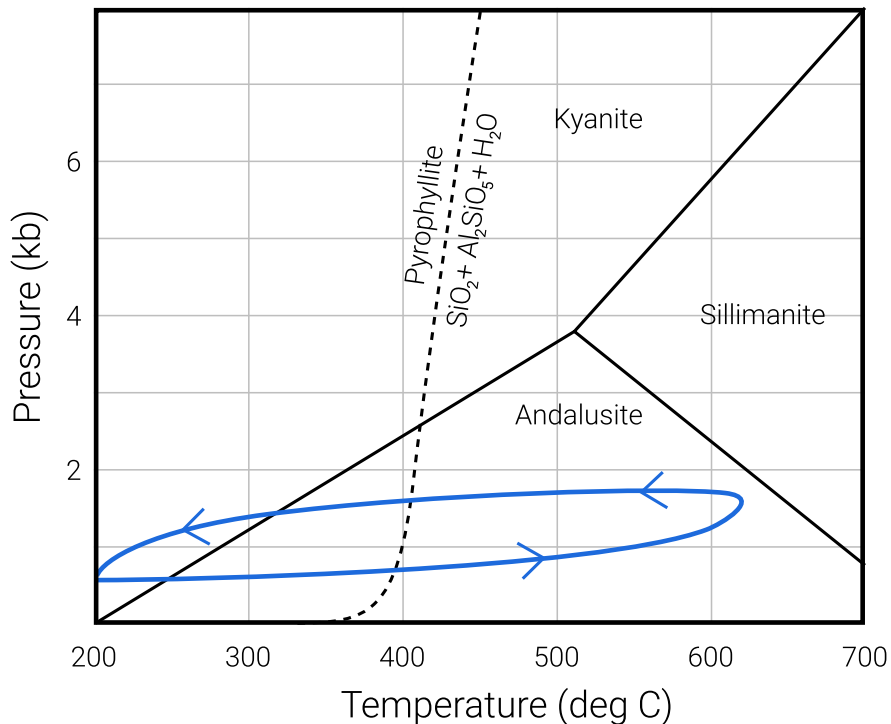
25. A geologist encounters a large granite outcrop and examines the various minerals included in the matrix. When the geologist visits the outcrop much later, which of the following minerals would have weathered the most since her previous visit?
- Quartz
  - Orthoclase feldspar
  - Biotite
  - Muscovite
  - All of the minerals would have weathered the same amount
26. Mimas is a shepherd moon of Saturn that clears the Cassini Division, a gap in Saturn's rings. Particles on the inner edge of the Cassini Division are known to have a 2:1 orbital resonance with Mimas. If Mimas is 3 planetary radii ( $R$ ) away from Saturn, estimate the distance from Saturn to the Cassini Division in terms of  $R$ .
- $1.5R$
  - $1.9R$
  - $2.7R$
  - $3.5R$
  - $4.8R$
27. Salt fingers, shown below, are a curious phenomenon caused by density variation in the oceans.



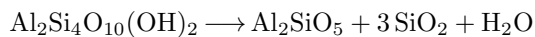
(modified after Singh and Srinivasan, 2014)

- Identify all of the following statements regarding salt finger formation that are true. (\*)
- A cold, salty layer contacts warm freshwater, forming warm, salty fingers
  - A warm, salty layer contacts cold freshwater, forming cold, salty fingers
  - Salt diffusion is faster than heat diffusion, which causes fingers to sink
  - Heat diffusion is faster than salt diffusion, which causes fingers to sink
  - Salt water is less dense than fresh water at the same temperature

Use the following diagram for questions 28 and 29.



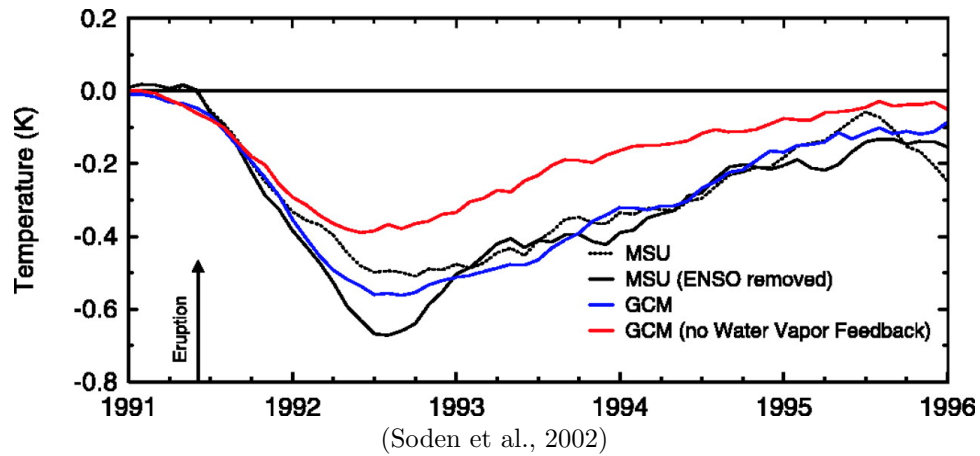
28. The phase diagram above shows the stability field of  $Al_2SiO_5$ , present as either kyanite, andalusite, or sillimanite. The dashed line divides the stability field of pyrophyllite ( $Al_2Si_4O_{10}(OH)_2$ ) and its dehydrated components. Pyrophyllite dehydrates as such:



A mass of pure pyrophyllite undergoes metamorphism via the pressure-temperature-time (P-T-t) path shown in blue. Which of the following petrogenic environments is most closely associated with the P-T-t path?

- A. Subduction zone
  - B. Impact crater
  - C. Pluton aureole
  - D. Orogenic belt
29. Upon analysis, it is determined that the molar composition of the rock at the end of the P-T-t path is 20% pyrophyllite, 60% quartz, and 20% andalusite. Which of the following statements are true?
- I) The retrograde reaction did not readily occur because water was lost to the surroundings.
  - II) The retrograde reaction did not readily occur because it is kinetically unfavorable at low temperatures.
- A. I only
  - B. II only
  - C. I and II
  - D. None

30. The figure below shows the change of the global average lower-troposphere temperature following the 1991 Pinatubo eruption. The blue and red lines represent the temperature response simulated by a general circulation model (GCM), with the red model having no water vapor feedback.



- (a) Identify all of the following statements that are true. (\*)
- A. The eruption increased atmospheric shortwave reflectivity
  - B. The eruption caused atmospheric warming
  - C. The global response in temperature is mainly driven by the release of aerosols by the volcano
  - D. The presence of the water vapor feedback significantly speeds up the return of the climate to equilibrium
  - E. The effect of the water vapor feedback on temperature may only be seen on decadal timescales
- (b) The water vapor feedback may be best characterized as a:
- A. Positive feedback loop
  - B. Negative feedback loop

**END OF SECTION I**

USES0 2021

# Open Exam



Section II

---

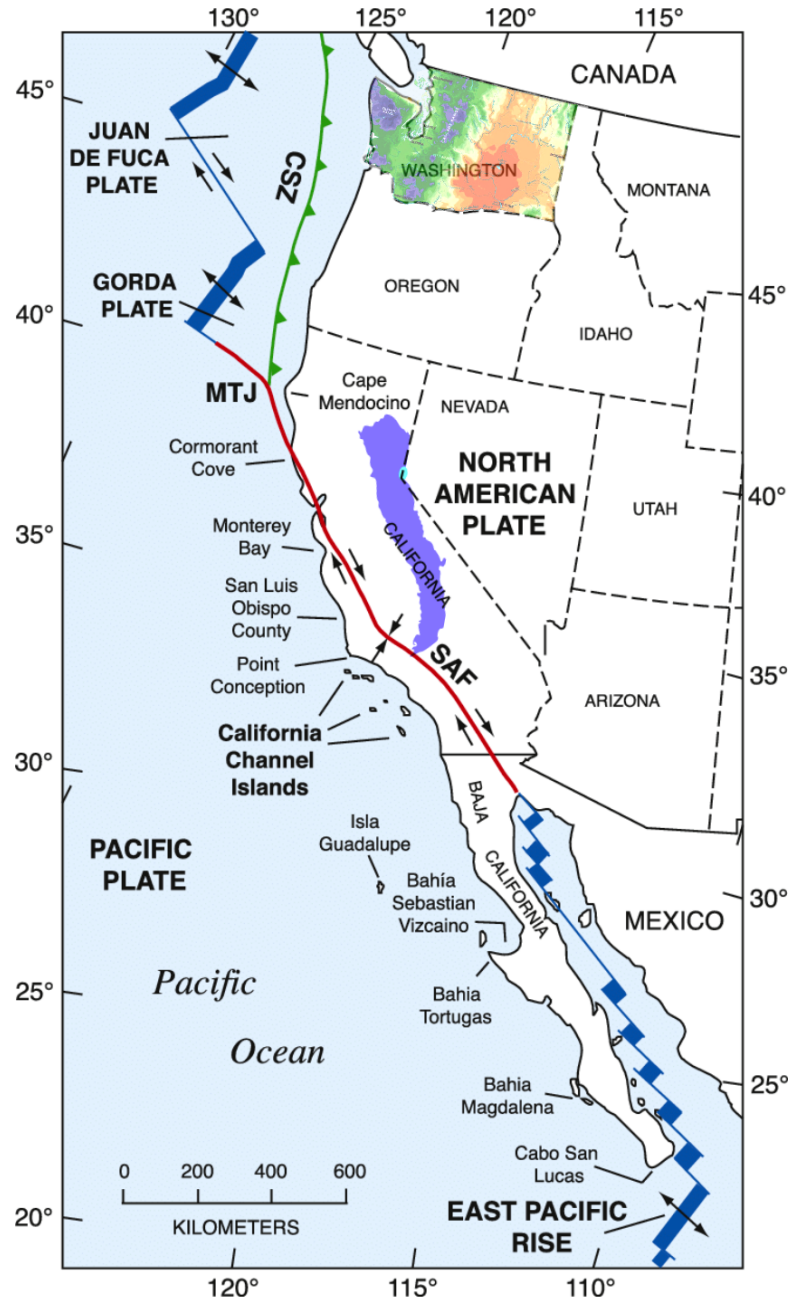
**Instructions:**

- Section II is 90 minutes and consists of 5 multipart questions that further assess geoscience knowledge in the form of free response and multiple choice questions
- A non-graphing, non-programmable calculator is allowed; show all work for calculations
- Questions marked with a (\*) may have more than one answer
- For multiple select questions: correct answers earn 1 pt, incorrectly marked answers deduct 1 pt, and unmarked correct answers do not earn nor deduct points

[ANSWER FORM HERE](#)

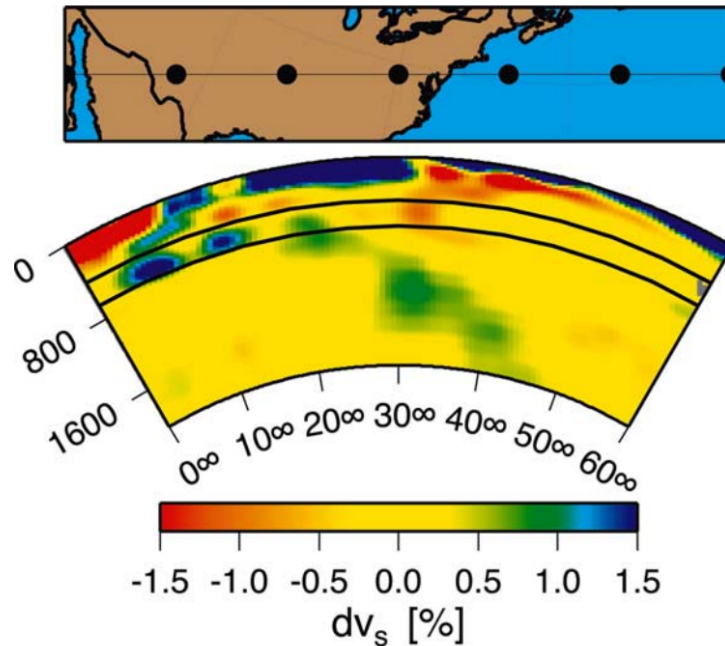
# Problem 1

Question	1	2	3	4	5	6	Total
Points	1	2	3	2	3	1	12 (20%)



**Figure 1:** Tectonic settings in western North America. Abbreviations: SAF, San Andreas Fault; MTJ, Mendocino Triple Junction; CSZ, Cascadia Subduction Zone.

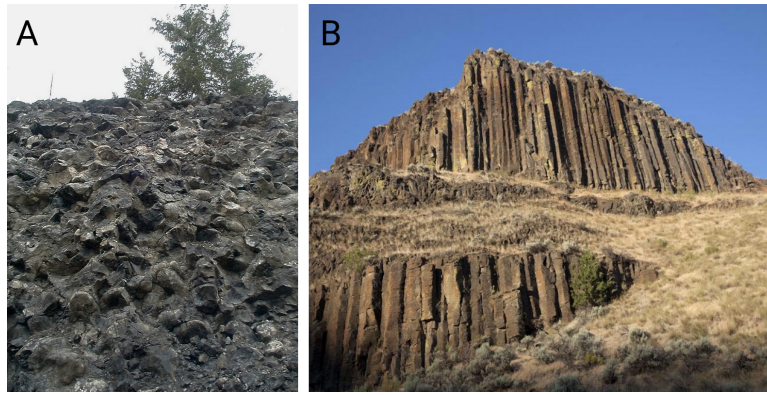
1. (1 point) The Sierra Nevada, marked in violet in Figure 1, is a mountain range in California. Which of the following describes the predominant composition and texture of igneous rocks found in the core of the Sierra Nevada?
    - A. Felsic, coarse-grained
    - B. Felsic, fined-grained
    - C. Mafic, coarse-grained
    - D. Mafic, fined-grained
  
  2. (2 points) Half Dome is a well-known example of an exfoliation dome, a structure with joints that parallel the surface of the dome. Describe a change in the environment after the initial crystallization of the pluton and how it is responsible for this jointing.
- 



(Schmid et al., 2002)

**Figure 2:** A seismic tomography cross section along the line in the map above. Positive values of  $dv_s$  represent relatively cold regions in the mantle.

3. While California is mostly bordered by a transform boundary, volcanic activity in the Sierra Nevada is still detected today.
  - (a) (1 point) Identify the green feature sloping down towards the east in Figure 2.
  - (b) (2 points) Describe the mechanism responsible for melt formation in the Sierra Nevada. How does the feature in (a) support this?



**Figure 3:** Two basalt formations in Washington: the Columbia River Flood Basalts and the Crescent Formation Basalts (a Mid-Ocean Ridge Basalt, or MORB), in no particular order.

4. (2 points) Classify A and B as either the Columbia River Flood Basalt or the Crescent Formation. Provide one piece of evidence for the classification.
5. (3 points) A sample from Formation A is crushed and analyzed. The following data are gathered:

$^{39}\text{K}$ mass	1.290 g
$^{40}\text{K}/^{39}\text{K}$ mass fraction	$1.254 \times 10^{-4}$
$^{40}\text{Ar}$ mass	$5.084 \times 10^{-6}$ g
Half-life of $^{40}\text{K}$	$1.248 \times 10^9$ years

Potassium-40 ( $^{40}\text{K}$ ) decays to argon-40 ( $^{40}\text{Ar}$ ), an inert gas that is trapped after crystallization. Assume that  $^{40}\text{Ar}$  does not escape the rock. If Formation B has an age of 16.7 million years (Ma), how many times as old is Formation A than Formation B? Show work for all calculations.

6. (1 point) In Figure 1, Washington state is overlaid with a map of the local precipitation, with warm colors indicating low precipitation. Briefly account for why the eastern half of Washington receives significantly less precipitation than the west.



## Problem 2

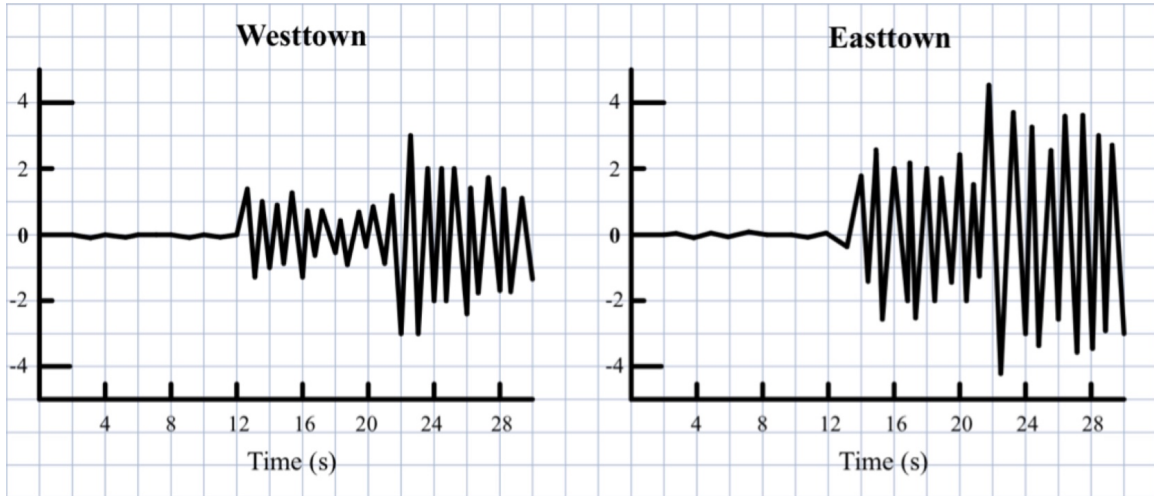
Question	1	2	3	4	5	6	Total
Points	1	3	2	1	2	2	11 (18%)

In the following map, Westtown and Easttown are separated by a normal fault. The red X represents the epicenter of an earthquake the same distance away from both towns. Assume no other faults are located nearby.



- (1 point) Identify the type of stress that resulted in the formation of the fault.
- (3 points) After the earthquake, which town, if any, was uplifted relative to the other town? Justify your answer.
- (2 points) What additional pieces of information would need to be known to calculate the depth of the earthquake's focus (hypocenter)?
  - The strike direction of the fault
  - The dip angle of the fault
  - Map distance from the epicenter to the fault
  - Map distances from the epicenter to Westtown and Easttown
  - I and III
  - II and III
  - II and IV
  - II, III, and IV
  - I, II, and III

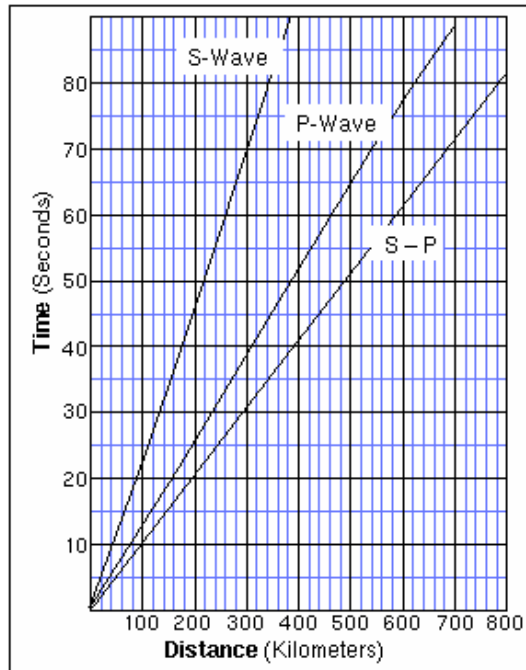
4. (1 point) Shown below are two seismograms (records of seismic waves) for Westtown and Easttown.



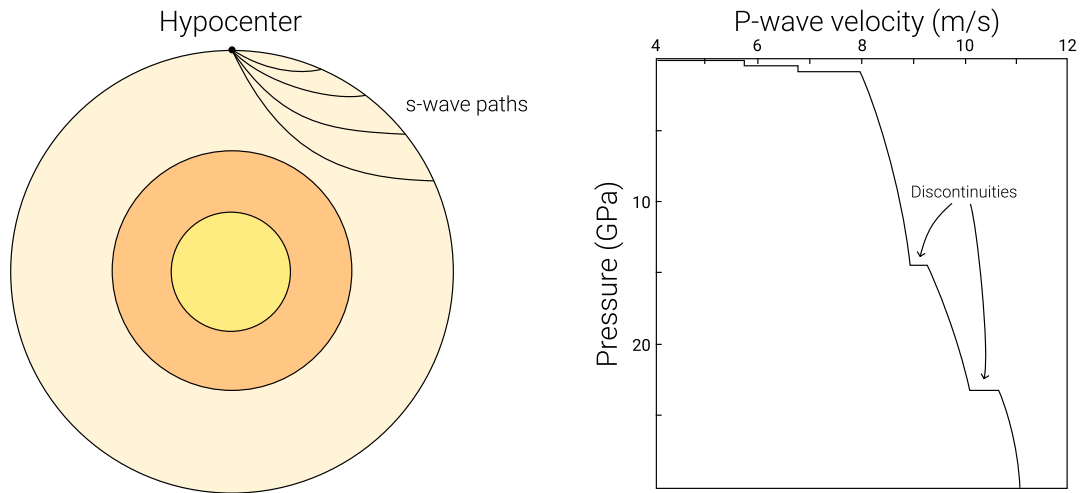
Which of the towns, if any, is more likely to be located on alluvial deposits than solid bedrock?

- A. Westtown, because the amplitude of the seismic waves is lower
- B. Westtown, because the frequency of the seismic waves is lower
- C. Easttown, because the amplitude of the seismic waves is higher
- D. Easttown, because the frequency of the seismic waves is higher
- E. Neither, because the P-waves arrive at the same time for both towns

5. (2 points) Shown below are travel time curves for S-waves, P-waves, and the SP interval (lag time).



Using the information from both the seismograms and the above chart, how far away is Westtown from the epicenter of the earthquake, in kilometers? Justify your answer.

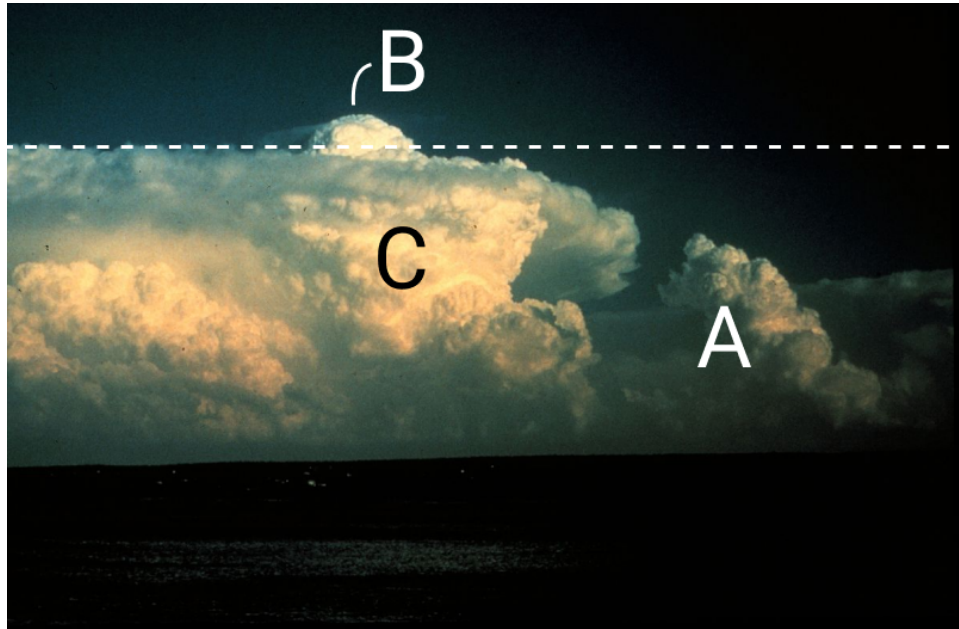


**Figure 4:** (left) S-wave paths through the mantle; (right) P-wave velocity with pressure (depth) in the mantle.

6. (2 points) Give brief explanations to account for the following observations:
- (a) S-wave paths are curved and concave-up towards the surface.
  - (b) There are discontinuities in p-wave velocities at certain depths.

### Problem 3

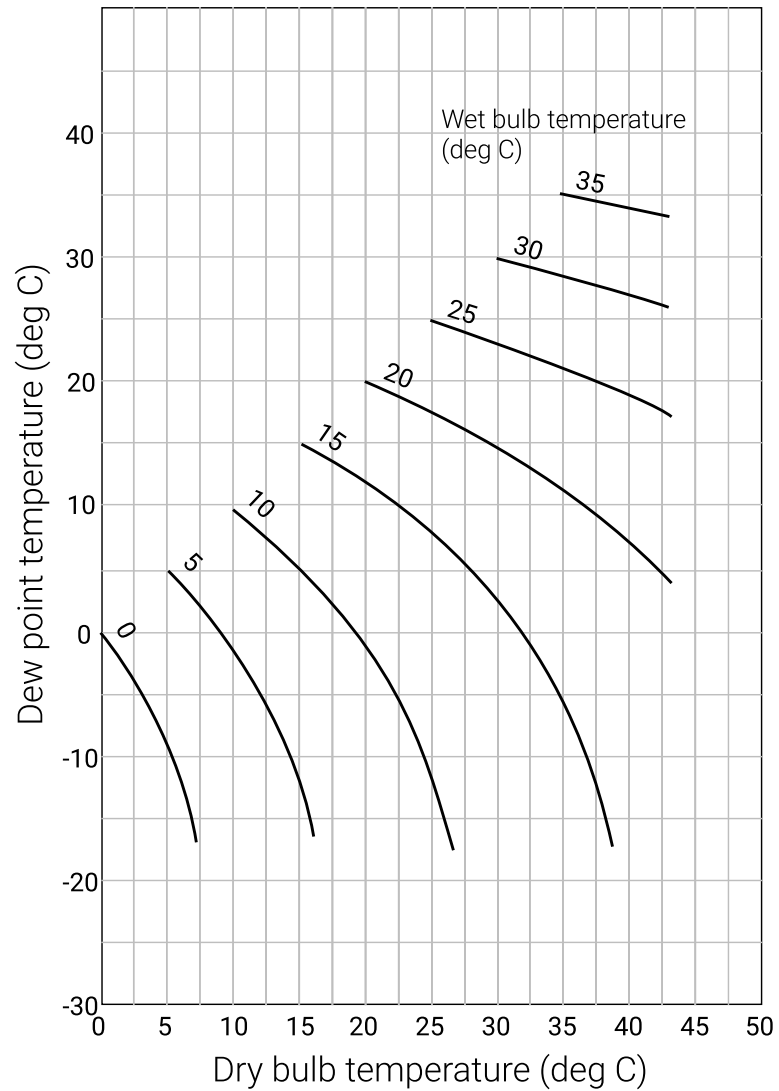
Question	1	2	3	4	5	Total
Points	1	1	3	2	5	12 (20%)



- (1 point) Cloud A is called a cumulus congestus cloud, which is simply a large cumulus cloud. What is the primary direction of motion of the air in cloud A?
- (1 point) What is the name of the dashed line?
- (3 points) Why is most of cloud C limited to elevations below the dashed line? What occurs when a cloud overshoots this line?
- Feature B is called an overshooting top.
  - (1 point) Why does it extend above the dashed line?
  - (1 point) What does this indicate about the condition of the underlying atmosphere?
- A parcel of air at ground level has a dry bulb temperature of  $15^{\circ}\text{C}$  and a wet bulb temperature of  $12.5^{\circ}\text{C}$ . To analyze its interactions with the environment, radiosonde observations and thermodynamic calculations revealed the following parameters:

Environmental lapse rate (ELR)	$7.80^{\circ}\text{C}/\text{km}$
Dry adiabatic lapse rate (DALR)	$9.69^{\circ}\text{C}/\text{km}$
Moist adiabatic lapse rate (MALR)	$6.75^{\circ}\text{C}/\text{km}$
Dew point lapse rate	$2.00^{\circ}\text{C}/\text{km}$

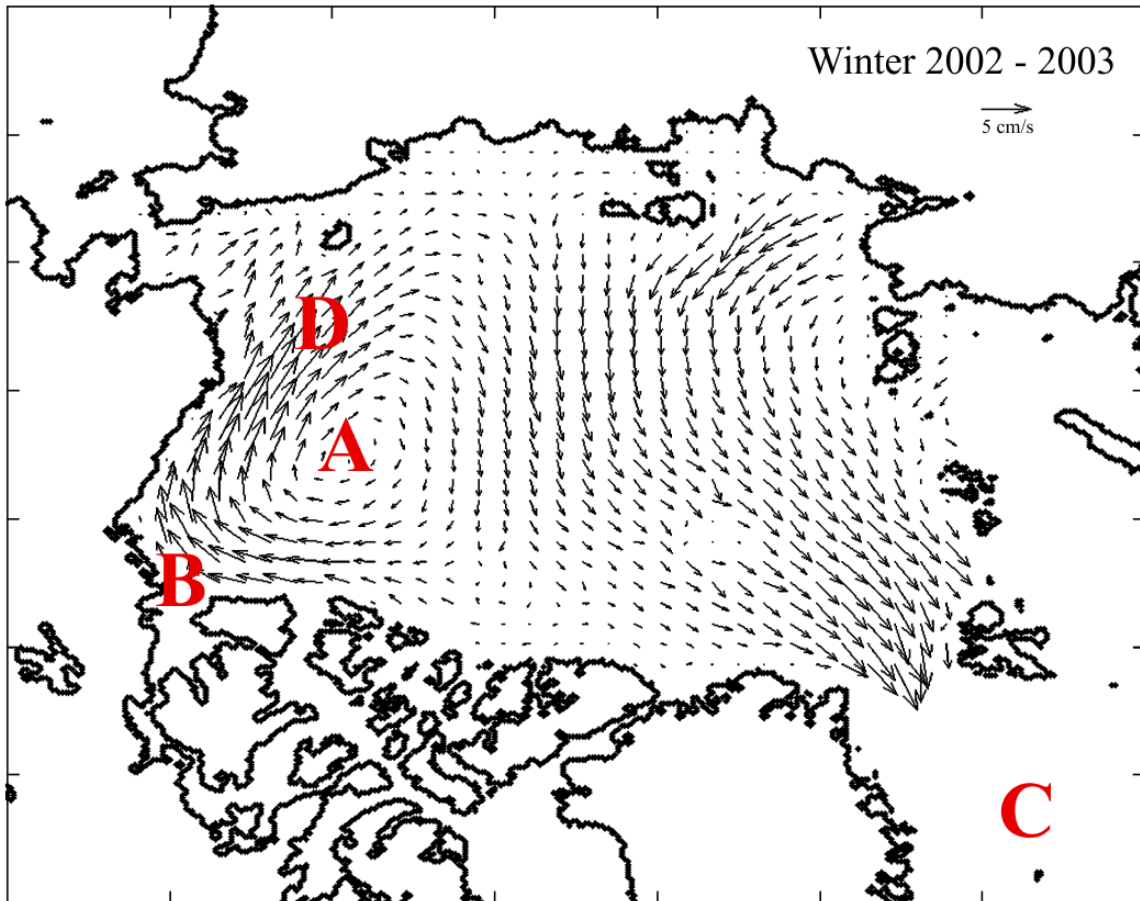
### Dew Point from Dry and Wet Bulb



- (a) (1 point) What is the dew point at the surface?
- (b) (1 point) The local atmosphere is:
- A. Absolutely stable
  - B. Absolutely unstable
  - C. Conditionally unstable
- (c) (3 points) At what elevation, in meters, will the cloud base be? Show work for all calculations.

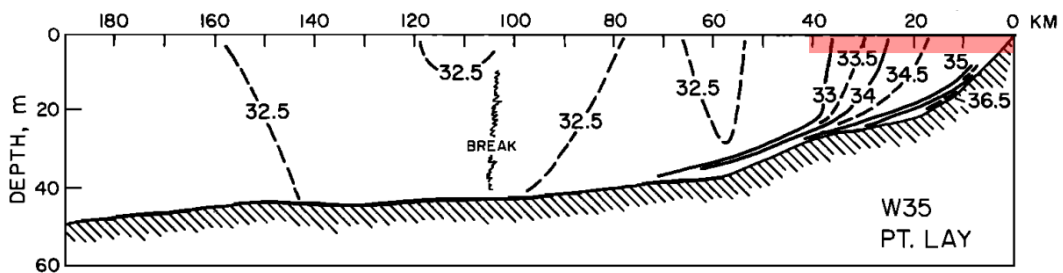
## Problem 4

Question	1	2	3	4	Total
Points	2	4	4	4	14 (23%)



**Figure 5:** Arctic Ocean mean sea-ice motion map of the 2002-2003 winter season. Figure adapted from Zhao and Liu (2007).

- (2 points) Letter A denotes the center of the Beaufort Gyre. Classify the Beaufort Gyre as either anticyclonic or cyclonic and describe the relative sea surface heights at A and B (i.e., higher or lower).



**Figure 6:** Salinity profile at an Arctic polynya (colored red). The bottom topography is denoted with the shaded portion. Figure adapted from Aagaard et al. (1985)

2. Water masses in the Arctic are largely altered through sea ice formation.
- (a) (1 point) Briefly describe one way by which sea ice formation may alter the temperature or salinity of a water mass.
  - (b) (3 points) Letter B marks the location of the Cape Bathurst Polynya. Polynyas are areas of coastal ocean that are semi-permanently exposed to air (i.e., no ice cover) and function as zones of active ice formation. Describe the vertical movement of water at a polynya, and justify why it may move as such.
3. Circulation in the Arctic Ocean may be simplified as a combination of Ekman (i.e., wind driven) and geostrophic components.

$$v_{tot} = v_{Ek} + v_{geo} \quad (1)$$

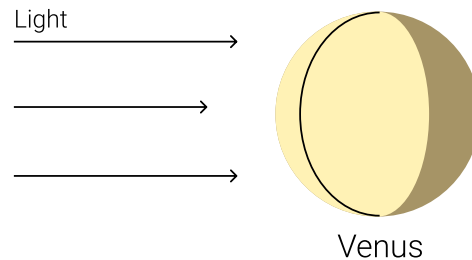
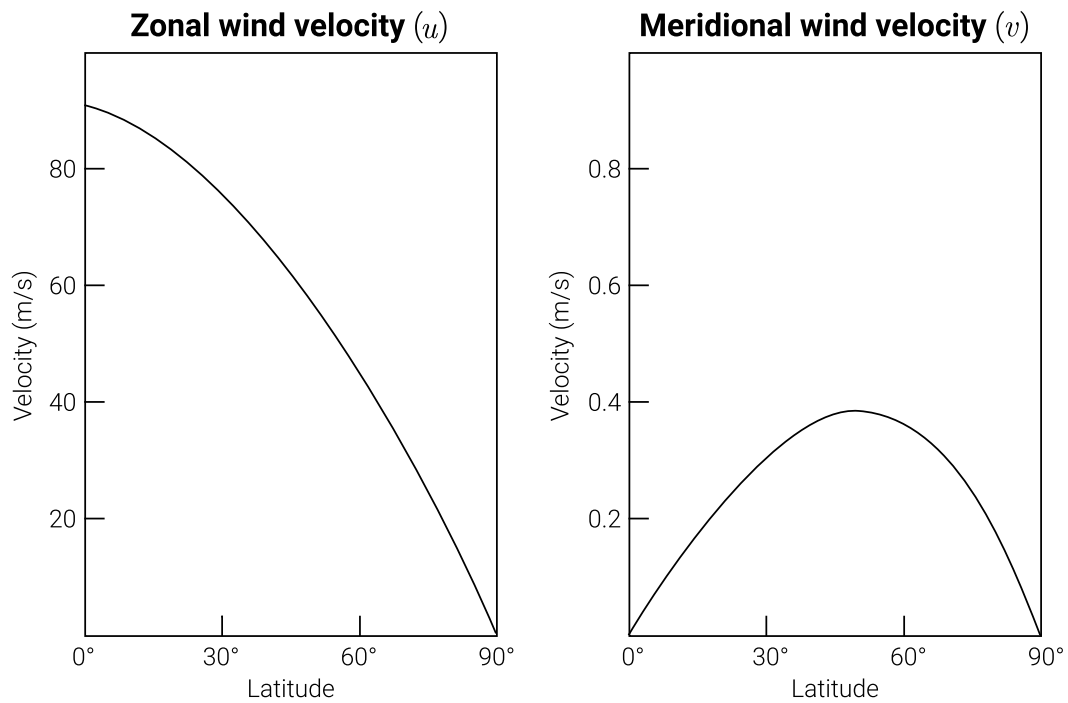
- (a) (1 point) Which two of the following forces must be balanced for geostrophy? (Select two)
    - A. Pressure gradient force
    - B. Coriolis force
    - C. Centripetal force
    - D. Centrifugal force
    - E. Buoyant force
  - (b) (3 points) Would the ratio of Ekman to geostrophic velocity  $v_{Ek}/v_{geo}$  be greater at (the surface of) D or C? Justify your answer.
4. (4 points) The Arctic is one of the most rapidly evolving regions on Earth due to the effects of anthropogenic climate change. An important feedback loop in the Arctic is the sea-ice albedo feedback. Describe its mechanism and characterize it as either a positive or negative feedback.



## Problem 5

Question	1	2	3	Total
Points	3	6	2	11 (18%)

- (3 points) Venus has an orbital period of 224.65 days. On Venus, an apparent solar day (i.e., the amount of time it takes for the sun to pass over the same spot in the sky) is 116.75 earth days. Calculate the rotation period of Venus, to the nearest day. Note that Venus spins in retrograde, meaning that its rotation is in the opposite direction of its revolution about the Sun. Show work for all calculations.
- An idealized atmospheric model of Venus gives the following zonal (i.e., in the east-west direction) and meridional (i.e., in the north-south direction) wind velocity profiles. The profiles are taken along the meridian shown in the model below and are averaged across all heights.



Provide a brief explanation to account for the following observations:

- (2 points) Meridional velocity is strictly positive, meaning there is only one atmospheric convection cell, contrary to the three on Earth.
- (2 points) Zonal velocity is two orders of magnitude greater than meridional velocity.
- (2 points) Zonal wind velocity is the greatest at the equator and weakest at the poles.



3. (2 points) A surface map of Venus is shown above. Notice the lack of craters, despite Venus lacking an active tectonic cycle. Propose an explanation for the relative lack of impact craters on Venus.

**END OF SECTION II**