Name_

You have two hours for this test. Answer all questions.



1) This photo shows two large stratovolcanoes, made mostly of andesite lavas and ash. Explain the tectonic environment in which these kinds of volcanoes form.



2) This photo shows the same volcanoes as above. White arrows show features surrounding the nearest volcano. Explain what these features probably are and how they might form.



3) Round scars like this sparsely dot the Earth's landscape. They vary in size from 1 km or so up to 100's of km in diameter. They contain evidence for highly disturbed rocks and high pressure minerals. Explain how these features formed.



4) The bases of these mountain slopes are strewn with rocks. Gravity immediately pulls down the unbalanced rocks, and frequent high winds and occasional earthquakes should have detached the loose ones long ago. Yet, rocks continue to fall. Explain the processes that continue to loosen the rocks on these steep slopes. 5) 40 K decays to 40 Ar with a half life of 1 billion years. A potassium feldspar crystal (orthoclase) is analyzed for 40 K and 40 Ar. Since silicate crystals do not accept argon into their structures, we may assume no 40 Ar in the crystal when it formed, and that all of the argon analyzed was from the decay of 40 K. The analysis shows the crystal to have 18,000,000 atoms of 40 Ar and 6,000,000 atoms of 40 K. How old is this orthoclase crystal?

6) Earthquakes and explosions produce a variety of different seismic waves. The so-called body waves traverse the Earth's interior and come in two varieties: P waves (primary, compressional waves) and S waves (secondary, shear waves). Seismic stations very distant from an earthquake epicenter cannot detect direct S waves, whereas closer stations can (see diagram). Direct P waves are generally detected loud and clear. Explain why this is so, drawing on the diagram to help.



7) A chain of volcanoes and seamounts on the floor of an ocean basin is 2400 km long. If the plate is moving at 3.6 cm/year, estimate how long the hot spot has been active.



8) Explain how the peculiar, bent trees on this hillslope got to be the way they are.



9) A common feature of many landscapes is the presence of modest rivers cutting through high, erosion resistant rock ridges. Because the water obviously cannot have flowed uphill and over the ridge to erode it, another explanation is needed. What is one such plausible and realistic explanation?



10) Here is a groundwater well gusher (natural, no pumps). Ordinarily, there is nothing to force water up from the water table. What is a reasonable and fairly common circumstance that will permit water to gush to the surface for long periods of time (sometimes indefinitely)?



11) Here is a community in Florida with a natural problem.

a) How did this circular feature form?

b) Why did groundwater withdrawal, with consequent lowering of the water table, make this feature more likely to form?



12) Everyone knows that glaciers carve U-shaped valleys.

a) Explain why they do.

b) Explain the origin of two kinds of glacial deposits in which the rock eroded from the valleys might be deposited.



13) Although movies frequently show sandy deserts, this image is more typical. The desert floor is covered with rocks of various sizes, mostly smallish. Typical soil, like in the Schenectady area, is made of all particle sizes, and a variety of processes continuously makes the small ones. Where did the small particles go, and how did they go there?



14) What is the average longshore drift current direction along this shoreline? Explain your answer.



Illustrated by NANCY HAYASHI

15) The bunnies have built a house. Discuss the geologic hazards that the bunnies need to be concerned about.



16) The Coreolis effect is vital for shaping Earth's atmospheric circulation.

a) Explain how the Coreolis effect works.

b) Show how air masses would change direction as they move north and south from mid latitudes in the northern and southern hemispheres, as shown in the figure below.

17) High mountains weigh a lot, and the tops erode away fast. We know that the underlying mantle is ductile and flows over geologic time, and that crustal rocks are relatively weak. What permits mountains to remain standing high for long periods of time?



18) A point source of groundwater contamination (a leaking storage tank, for example) is contaminating the groundwater (map view diagram below). The flow of groundwater is from left to right.

a) On the map, sketch a reasonable contaminant plume at some representative time in the future.

b) Explain why the plume changes appearance as time progresses.

19) Look at the maps of the world in the room. The Atlantic Ocean has a mid-level body of warm salty water, largely from the Mediterranean sea. This warm water upwells in the western North Atlantic and helps keep northern Europe warm. The Indian Ocean has a similar body of mid-level warm salty water.

a) Where is the source of this water?

b) Why is this a reasonable source?



20) The diagram above shows a geologic cross section or map. The 11 rock units have been labeled with random letters from A to K. Based on the rules of relative age determination, rearrange the letters and mark their locations on the geologic column to the right, to match the sequence of formation of each of the 11 different units. Also include in the geologic column the locations of the two unconformities.

11: Last unit, youngest

10:

- 9:
- 8:
- 7:
- 6:
- 0. 5:
- 5: 4:
- 4: 3:
- 3: 2:
- 1: First unit, oldest