

CE 70 Engineering Geology - Fall 2020 Final - Sitar

Score: ____/95

All Multiple Choices are worth 2 points.
The short answers (4) in total are worth 17 points.
The Rock Assignment is worth 5 points.
The Structural Problem is worth 10 points.

Question 1 (1pt)

The Berkeley Honor Code. Obviously agree.

Multiple Choice

Question 2)

Plate tectonics is the result of the movement of lithospheric plates caused by...

- a) Accretion along continental margins
- b) Coriolis effect due to earth's rotation
- c) Subduction of lithosphere
- d) Convection in the mantle

Question 3)

We know that the Hayward Fault is an active fault because...

- a) There is documented creep
- b) Creek channels are offset along the fault line
- c) There are frequent earthquakes along it
- d) All of the answers apply

Question 4)

Highly explosive volcanism is typically associated with...

- a) Ocean spreading
- b) Hot spots
- c) Transform faults
- d) Subduction

Question 5)

Glass cannot be scratched by...

- a) Quartz
- b) Topaz
- c) Corundum
- d) Calcite

Question 6)

A dark colored, fine grained, massive volcanic rock with a few vesicles is most likely...

- a) andesite
- b) diorite
- c) basalt
- d) gabbro

Question 7)

A rock is most likely a granite if...

- a) It is a light colored, coarse grained, crystalline rock with abundant feldspar and quartz
- b) It is light colored, coarse grained, crystalline, containing abundant plagioclase and more than 10% quartz
- c) It is light colored, coarse grained, crystalline and contains abundant orthoclase feldspar and more than 10% quartz
- d) It is light colored, coarse grained, rock with much muscovite and quartz

Question 8)

The mineralogy of andesite corresponds to following igneous intrusive rock.

- a) gabbro
- b) granodiorite
- c) granite
- d) diorite

Question 9)

Saprolite is...

- a) Deeply weathered rock produced by physical weathering of granite
- b) Weathered rock profile above intact rock
- c) Deeply weathered rock in a tropical climate
- d) Deeply weathered rock produced by chemical weathering/decomposition

Question 10)

Calcite is a major constituent of...

- a) Limestone and dolostone
- b) Marble and schist
- c) Limestone and marl
- d) Limestone and marble

Question 11)

Chemical weathering of plagioclase produces...

- a) K^+ in solution, dissolved silica and clay
- b) Na^+ and Al^{3+} in solution and clay minerals
- c) Na^+ , Ca^{2+} in solution and clay minerals
- d) K^+ and Ca^{2+} in solution and clay minerals

Question 12)

The fabric produced by the parallel alignment of platy minerals in a metamorphic rock is called...

- a) schistosity
- b) Metamorphic cleavage
- c) foliation
- d) lamination

Question 13)

Water table is a groundwater surface defined as...

- a) The top of the zone of saturation
- b) None of these applies
- c) Water below the ground surface
- d) The level to which water rises in an open well

Question 14)

An artesian aquifer is...

- a) An aquifer in which the water level reaches the ground surface
- b) A confined aquifer in which the water level rises above the bottom of the confining bed
- c) None of these answers
- d) A confined aquifer in which a well gushes above the ground

Question 15)

Hydraulic conductivity depends on...

- a) The shape of the cone of drawdown
- b) The density of the aquifer and water properties
- c) The porosity of the aquifer
- d) The properties of the aquifer material and water density and viscosity

Question 16)

The presence of CaCO_3 in groundwater means that...

- a) The aquifer is limestone or marble
- b) The water has been underground for a very short time
- c) The water may not be drinking quality
- d) The water has been underground for a very long time

Question 17)

The angle of repose is...

- a) The slope on which a landslide stops sliding
- b) The angle of friction
- c) Typical slope in sedimentary rocks
- d) A slope at which loose granular material just stops sliding

Question 18)

Glacial drift is...

- a) Till
- b) All types of sediments deposited by a glacier
- c) The movement of glaciers
- d) Outwash

Question 19)

A landform produced by a stream deposit in an ice tunnel is...

- a) A kame terrace
- b) An esker
- c) A drumlin
- d) A moraine

Question 20)

Which of the transporting agents will produce the best sorted material?

- a) Longshore current
- b) Water
- c) Wind
- d) Ice

Question 21)

How would you determine that groundwater in a well may be contaminated by surface runoff?

- a) The concentration of nitrate (NO_3^-) is high
- b) The Total Dissolved Solids (TDS) are high
- c) The concentration of soluble salts is high
- d) The concentration of CaCO_3 is high

Question 22)

The probability of a 200-year flood in any given year is...

- a) 0.1
- b) .05
- c) .001
- d) .005

Question 23)

A coarse, gravelly ground surface that results from the removal of the particles by wind erosion in arid areas is...

- a) Desert pavement
- b) Pediment
- c) Alluvial
- d) loess

Question 24)

Longshore current will cause erosion...

- a) Both, up current and down current from an obstruction or a pier
- b) Up current from an obstruction such as a breakwater or a pier
- c) As a function of depth
- d) Down current from obstruction such as a breakwater or a pier

Question 25)

The depth of a sea wall is determined by...

- a) Total depth of beach sediments
- b) Expected height of storm waves
- c) Potential amount of scour during major storms
- d) Velocity of the expected waves

Question 26)

Earthquake magnitude is a measure of...

- a) Total energy released
- b) The stiffness of the rock
- c) None of these answers
- d) The magnitude of fault displacement

Question 27)

A tall building on deep sediments along the shore of the bay in San Francisco will amplify motion from a distant earthquake _____ than a similar building on bedrock on Telegraph Hill.

- a) Could be either
- b) Less
- c) About the same
- d) More

Question 28)

An earthquake exceeding 10% in 50 years corresponds to an earthquake with the following return period of...

- a) 55
- b) 95
- c) 2475
- d) 475

Question 29)

A horizontal line in the plane of a bed is...

- a) Dip
- b) Strike
- c) None of these
- d) A structural contour

Question 30)

Increasing confining pressure...

- a) Increases rock brittleness
- b) All of these apply
- c) Increases rock stiffness
- d) Increases rock elasticity

Question 31)

The function of a filter in a zoned earthfill dam is to...

- a) Prevent saturation of the shell
- b) Prevent piping in the core
- c) Prevent contamination downstream of the dam
- d) Prevent clogging of the drain

Question 32)

A tunnel is being proposed at a site where the horizontal stress σ_h and the vertical stress σ_v at the tunnel depth are estimated to be equal. What will be tangential stress at the spring line?

- a) $3\sigma_v$
- b) $2\sigma_v$
- c) $-\sigma_v$
- d) $\sigma_v + \sigma_h$

The Rock

Question 33)

Describe and identify the rock sample as follows:

- a) Rock description - grain size etc.
- b) Rock class (igneous, metamorphic, sedimentary)
- c) Name



Short Answer Questions

Question 34) (5 pts)

What, if any, problems would you expect with slope stability of the rock mentioned above at a dam site?

Question 35) (5 pts)

Earthquake motion can be characterized by its duration, maximum acceleration, and dominant frequency/period. Explain the significance of these parameters in the evaluation of how a structure might respond to an earthquake.

Question 36) (4 pts)

Explain why earthquake shaking will be felt less on the footwall side of a reverse fault. Use a sketch to illustrate your answer.

Question 37) (3pts)

Explain the differences in the functions of a primary and secondary liner in tunnel support.

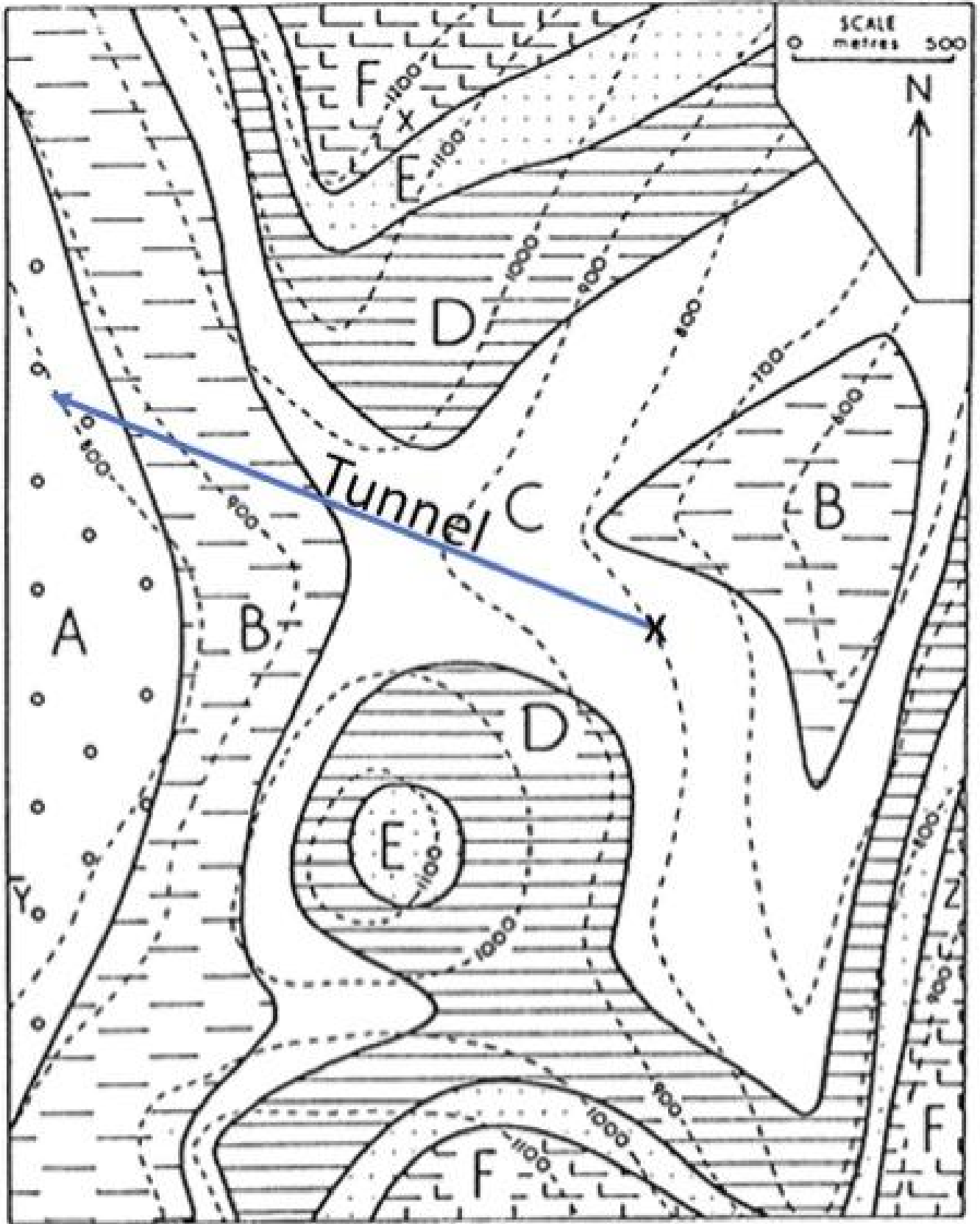
Structural Problem:

Question 38)

The map shows a sequence of sedimentary beds A-E.

- a) Find the strike and dip of unit B **(2 pts)**
- b) Label the top and bottom of the bed **(2 pts)**
- c) Determine the vertical thickness of the unit **(2 pts)**
- d) A tunnel will be driven at elevation 800 starting at X. Locate the point at which the tunnel will first encounter unit B and then label the length along which it will be unit B (i.e. find the point at which it will exit unit B). **(4 pts)**

Please put all your answers on the map, showing your work and upload the file as a picture or pdf.

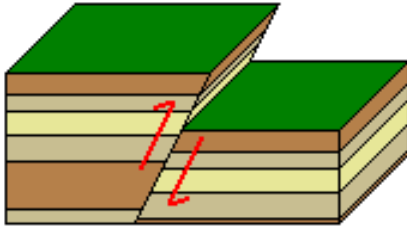


Answer Key:

1. Agree
2. D
3. D
4. D
5. D
6. C
7. C
8. D
9. D
10. D
11. C
12. C
13. D
14. B
15. D
16. A
17. D
18. B
19. B
20. C
21. A
22. D
23. A
24. D
25. C
26. A
27. D
28. D
29. D
30. C
31. B
32. B
33. a) light, dark gray, banding/foliation, coarse-grained
b) metamorphic
c) genesis
34. Because gneiss is a foliated metamorphic rock, the foliations as a result of the mica in the rock create planes of weakness that the rock can fail on, making it more susceptible to rockslides and landslides. These slope failures can be a large hazard at a dam site because of the risk of flooding due to an unexpected failure, and even with a strong dam structure, the water can be pushed over the top of the dam causing a lot of dam my age.
35. In general, the longer the duration of an earthquake, the more damage occurs to a structure. The natural period of the structure will also determine the max acceleration, and the larger the max acceleration the larger amount of damage. The dominant frequency when it matches or is closer to the natural frequency of the building will do the most damage to a structure since the building essentially amplifies the earthquake motion.

36. The focus of the earthquake, so where the earthquake originates is closer to the hanging wall and farther from the footwall, and therefore when it reaches the footwall side, more distance would have been traveled which would allow for more of the energy to dissipate and less shaking will be felt.

A reverse fault



The footwall is the bottom block. The hanging wall is the top block. The focus is between the blocks sliding past each other. The epicenter is directly above the focus which is on the top of the hanging wall block.

37. The primary liner in tunnel support serves as the main support system of the tunnel and is essential to the structure. The secondary liner, on the other hand, is a smooth surface on the inside that helps protect from small rocks or icicles falling from the top of the tunnel and also, makes the tunnel more aerodynamic, so if air or water flows through the tunnel there will be less resistance.

