

SIO 15 (FQ 2024) – Homework #3 Due October 22, 2024

Maximum score: 20 points + 2 bonus point

Homeworks submitted late (after due date) are subject to a 2-point reduction.

Divide by 4 for contribution to total cumulative

ANSWERSHEET

Topics 8 – 10

- 1) a) Which volcanic eruption (date and volcano) is considered the first documented eruption? (0.5 pt)
b) What was the VEI of this eruption? (0.25 pt)
c) As shown in class, which nearby city was destroyed in that eruption? (0.25 pt)
d) Find this volcano on Wikipedia.
Which large modern city is located just to the west of this volcano? (0.5 pt)
e) In 1984, how many people had to be evacuated from which nearby volcanic field? (0.5 pt)
f) Was there a subsequent volcanic eruption? (0.5 pt)

(2.5 points total)

a) Mt Vesivius; 79 A.D.

-0.25 pt if only partial answer

b) 5

c) Pompeii

no credit for any other city

d) Naples (also accepted: Napoli; Neapolis)

e) 40,000; Campi Flegrei

-0.25 pt of only partial answer

f) no

- 2) Follow the link to the volcanic field under 1e).
 - a) In which year was the last eruption? (0.5 pt)
 - b) As of 2017, what type of (ACTIVE!) volcanic activity can be observed? (0.5 pt)
 - c) There are many calderas. From what you learned in class, what general type of volcanism would we expect here? (0.5 pt)
 - d) In May 2024, at which rate did the ground rise? Given volcanic unrest, what would this rise indicate? (include units!) (0.5 pt)
 - e) An evacuation followed on 20 May 2024 after which type of activity? (0.5 pt)(2.5 points total)

a) 1538
b) fumaroles and boiling mud pools; also accepted: solfataras
c) (very) violent
d) 2 cm/month; a volcanic eruption may be imminent
-0.25 pt for partial answer, missing unit
e) intense seismic activity

- 3) a) What are the two principal types of volcanoes? Provide a real-world example for each. (0.5 pt)
 b) What are the three Vs? (0.5 pt)
 c) How does the temperature affect the viscosity of lava? (0.5 pt)
 d) How does the silica content affect the viscosity of lava? (0.5 pt)
 (2 points total)
a) shield and strato volcanoes; also accepted: shield and composite volcanoes
b) viscosity, volatile, volume
c) increasing temperature lowers viscosity; also accepted: declining temperature increases viscosity
d) increasing silica content increases viscosity; also accepted: decreasing silica content decreases viscosity
- 4) a) In one sentence, explain what the geotherm is. (0.5 pt)
 b) Use the graph shown in short video 7e or the lecture slides: The geotherm is entirely on the left side of the melting curve of dry peridotite. What happens when a rock moves from point A to just above point B? (0.5 pt)
 c) Where on Earth would be find a mantle rock that moves this way? (0.5 pt)
 d) Assuming the mantle consists of dry peridotite at 150 km depth, at which temperature does the rock start to melt? Include units! (0.5 pt)
 e) Which type of mechanism makes rock melt in subduction zones? (0.5 pt)
 (2.5 points total)
a) the geotherm traces Earth's pressure and temperature with increasing depth
b) the rock melts; also accepted: rock is molten
c) any of the following: mid-ocean ridges; divergent plate boundaries; hotspot volcanism; at mantle plumes
d) 1400°C
also accepted: any number between 1300 and 1450°C
-0.25 pt if unit is missing
e) addition of volatiles
- 5) Flyer 5 and lecture notes.
 a) On which volcano did the VEI 8 eruption occur? Going back to the class notes, which other volcano had the other known VEI 8 eruption? (0.5 pt)
 b) When did the eruption at Hawaii's Kilauea volcano end that started in (January) 1983? (0.25 pt)
 c) Consequently, for how long (in fractions of years, or years and months) did this eruption last? (0.25 pt)
 d) At Mt. St. Helens, when was the last eruption before the devastating 1980 eruption? (0.5 pt)
 e) So for how many years had the volcano been dormant? (0.5 pt)
 (2 points total)
a) Yellowstone; Toba
b) September 2018
c) 35 years and 8 months
Also accepted: 35 years, 9 months; 35.67 year; 35.7 years; 35.75 years; 35.8 years
d) 1857
e) 123 years

- 6) a) What is the difference between the plate boundary in Cascadia vs along the San Andreas fault? (0.5 pt)
 b) About when was the last megathrust earthquake in Cascadia? What was its likely magnitude? (0.5 pt)
 c) Where is the Salton Sea east of San Diego located relative to the San Andreas fault? (0.5 pt)
 d) In the last 800,000 years, which two eruptions in the U.S. had a similar VEI as the 1815 Tambora, Indonesia eruption? (0.5 pt)
 (2 points total)
a) Cascadia has a convergent plate boundary; SAF has a transform boundary
b) 1700; M=9.0
c) west of the SAF
d) 4900 B.C. Mt. Mazama; 760,000 B.C. Long Valley;
- 7) News Clip 5 October, 2024:
 a) Which main tributary to the Amazon River dropped to the lowest level ever recorded? Which major city is affected? (0.5 pt)
 b) To which year do measurements reach back in time? (0.5 pt)
 c) What was the measured level during that week? What is considered normal? (include units) (0.5 pts)
 d) Taking the 'normal' value as baseline, provide the percentage decline for this year's level? (0.5 pt)
 (2 points total)
a) Negro River; Manaus
b) 122 years;
also accepted: to year 1902; to year 1903
c) measured: 41.5 ft; normal: 69 ft
d) 39.9%
also accepted: 40%
-0.25 pt for 39%
- 8) News Clip 5 October, 2024:
 a) Which storm (include type and name) caused wide-spread power outages in the Southeast? (0.5 pt)
 b) Provide the date when this storm came ashore? (0.5 pts)
 c) Consider the date and day of the week of the news clip and reading the article carefully, how many days after the storm came ashore were 700,000 customers still without electricity? (0.5 pt)
 d) In terms of power outages, at that time, which three states were most affected? Careful, Florida is not one of them. (0.5 pt)
 (2 points total)
a) Hurricane Helene
-0.25 pt if either 'hurricane' or 'Helene' is missing
b) Sep 26
c) 8 days; also accepted 9 days
NB: "Friday" was Oct 4, so depending on whether or not you include the day when the storm came ashore, you get 9 or 8 days as answer
no credit: for dates
d) North and South Carolina; Georgia
also accepted: the Carolinas and Georgia
no credit for Florida

- 9) Google Earth: download the kmz file and load it into Google Earth. This kmz file identifies plate boundaries, Mexico City, Popocatepetl volcano and three large earthquakes in the last 40 years.
- a) The 1985 “Mexico City” earthquake and the 2022 Michoacan earthquake were close to which type of plate boundary? (0.5 pt)
 - b) Zoom out until you see the plate names. Given the fact that Mexico is on the same plate as the U.S., which two plates are involved here? (0.5 pt)
 - c) The 1985 event was called “Mexico City” earthquake. But how far, in km, was the epicenter from Mexico city? (use the bottom of the pins provided to measure the distance; include the unit in your answer) Error margin: 20 km. (0.5 pt)
 - d) How far away was the epicenter from the plate boundary? (include units) error margin: 15 km (0.5 pt) (2 points total)

a) convergent

b) Cocos Plate; North American Plate

no credit for Rivera plate

c) 362 km (accepted range: 342 – 382 km)

-0.25 pt for missing unit

d) 126 km (accepted range: 111 – 141 km)

-0.25 pt for missing unit

- 10) Google Earth: same kmz file

- a) Click on the symbol for the 1985 Mexico City Earthquake, open the box and follow the link to Wikipedia: How many people did that earthquake kill in Mexico City even though the epicenter was so far away? Which local geology in Mexico City contributed to the large destruction? (0.5 pt)
- b) Go back to Google Earth and find Popocatepetl (Popo). Measure the distance between Mexico City (M symbol) and Popo (P symbol. Do not use the generic GE symbol after you searched for it!). (error margin: 2 km) (0.5 pt)
- c) Zoom in on Popo. Using the map length as your result, measure the (maximum) east-west diameter of the outer crater. (error margin: 50 m) (0.5 pt)
- d)

EITHER

Students using the stand-alone Google Earth app:

Now provide the ground length. (error margin: 50 m) Why is it larger than the map length? (0.5 pt)

OR

Students using the web browser Google Earth or for people who do not find the ground length:

measure the area of the outer crater (error margin: 10,000 sq-m). Also measure the north-south diameter of the **inner** crater. (error margin: 10 m) (0.5 pt)

- e) Click on the Wikipedia link (or find the entry for Popocatepetl in Wikipedia). Popo is only the second tallest peak in Mexico. What is the tallest, and how much taller is it than Popo? (0.5 pt) (2.5 points total)

to clarify 10d): answer either the stand-alone ap or the browser version questions. No extra credit is given for answering both.

a) at least 5000 people (also accepted: any number between 5000 and 45,000 people);

prevailing silt and volcanic clay sediments amplify shaking

Also accepted: city sits on soft clay from volcanic ash; city is built on ancient lake bed

b) 67.9 km; accepted range: 65.9 – 69.9 km

-0.25 pt for 70 km; no credit for any other distance

-0.25 pt for missing unit

c) 836 m accepted range: 786 – 886 m

-0.25 pt for missing unit

d) **Google Earth app:**

861 m accepted range: 811 – 911 m; the map length is shorter because it is the projection of the real 3-dimensional path onto a 2-dimensional map

OR

Browser Google Earth:

396,000 sq-m; allowed range: 386,000 – 406,000 sq-m;

430 m; allowed range: 420 – 440 m

NO ADDITIONAL CREDIT IF BOTH WERE ANSWERED

e) Pico de Orizaba; 210 m taller