Telling Time Geologically – Chapter Questions

1. **Distinguish between numeric (absolute) and relative dating.
2. Why do we use both?
3. When you observe an outcrop of steeply inclined sedimentary layers, what can you say about its history?
4. A mass of granite lies below and in contact with a layer of sandstone. Using the principle of inclusions, explain how to tell whether the sandstone was deposited on top of the granite, or whether the granite intruded from below after the sandstone was deposited.
5. Explain what an unconformity is, and what it indicates about the geologic history of a region.
6. **Distinguish among angular unconformity, disconformity, and nonconformity. What history does each tell?

Disconformity sketch	Angular unconformity sketch	Nonconformity sketch

7. Build stratigraphies for sample cross-sections (see handout) – label and order all rocks, faults, and unconformities from oldest to youngest.
8. **What is meant by the term correlation? (see *Correlation* figure for *Grand Canyon, Zion, and Bryce Canyon*)?
9. **What is required to create a fossil? What organisms have the best chance of being preserved as fossils?
10. Describe several **types** of fossils (a fossil is any type of evidence – direct or indirect – of past life).
11. **What is an index fossil? What are the two requirements to be an index fossil?
12. How else are fossils helpful in geologic investigations?
13. **What are the four major divisions of the Geologic Time Scale and what age ranges do they represent?
14. Explain why Precambrian history is more difficult to decipher than more recent geologic history.
15. Order these events in Earth's history from oldest (1) to youngest!

Action/Environment	Order	Action/Environment	Order
Dinosaurs first appear		Earliest evidence of photosynthesis	
Trilobites first appear		Earth formed	
Earliest evidence of life with hard parts		Opening of Atlantic ocean (Pangea breaks up)	
Earliest evidence of multicellular life		Dinosaurs go extinct	
Earliest evidence of life moving onto land		Earliest evidence of life (prokaryotes)	
Pangea came into existence.		Earliest evidence of rocks (hard crust)	
Oceans first appear (water)		Eukaryotes first appear (nucleus in cells)	
Mammals first appear		Fishes first appear	

16. If a radioactive isotope of thorium (atomic number 90, mass number 232) emits 6 alpha particles and 4 beta particles during radioactive decay, what is the atomic and mass number of the stable daughter product?
17. A hypothetical radioactive isotope has a half-life of 10,000 years. If the ratio of radioactive parent to stable daughter product is 1:3, how old is the rock containing the radioactive material?
18. **To provide a reliable radiometric date, a mineral must remain a closed system from the time of its formation until the present. Why? What is a closed system?
19. What two main geologic processes would open a closed system? What does that mean for dating? Which rock types are the best closed systems? Why?
20. The following table shows decay rates for various isotope pairs. Why do we need more than one pair?

Parent (P)	Daughter (D)	Half-lives ($T_{1/2}$)	Materials dated
U-238	Pb-206	4.5×10^9 yr	Zircon (igneous rocks – source; and sedimentary rocks as grains)
U-235	Pb-207	0.7×10^9 yr	Zircon (igneous rocks – source; and sedimentary rocks as grains)
K-40	Ar-40	1.4×10^9 yr	Micas, volcanic rock (igneous rocks)
C-14	N-14	5700 yr	Shells, limestone, organic materials