Some comments on homework

1. Use metric units (put non-metric equivalents in brackets, but only if originally reported in the source that you cite).

2. Spell out acronyms on first use (e.g., CAP, Central Arizona Project).

3. Write clear, short sentences; the shorter, the better. Write short paragraphs; each dedicated to a single idea or thought.

4. Be precise in your writing and in your discussion of data. Do not use vague, imprecise words/ phrases (e.g., do not use ‘a lot of’).

5. Compare only comparable things (i.e., apples with apples, not apples with oranges).

6. Use consistent units to discuss the same result (e.g., do not use inches and feet to express yearly precipitation).

7. Use reasonable units (e.g., 500 km^2, not 5×10^{12} cm^2, unless cm^2 are necessary).

8. Be careful in reporting the units (e.g., yearly precipitation is in meters per year, not in meters).

9. Always give the source of information/data.

10. Do not write unsupported claims (e.g., ‘water usage has increased in the last decades’ does require supporting data or citation).

11. Check your calculations. Check the results: are they reasonable? possible? For example, residence time in ground water of 10^{-11} y, or water table decline of 2.6×10^{4} m are not reasonable. Why?

12. If you use figures (numbers) that you calculated, show (describe) the calculations, give the sources of data that you used, and state the assumptions that you used.

13. Check units (dimensions) of each new derived mathematical expression/formula. This dimensional analysis is a good first check of the correctness of the expression. For example, if you derived an expression for flow rate Q, and dimensional analysis shows units of cm/s, something has gone wrong.

14. Be quantitative. If asked “how will Q change?”, answer “it will change from 125 m3/d to 160 m3/d”, not “it will increase greatly”.

15. Check if the answer is reasonable. Hydraulic conductivity K=51840 m/d (or 52 km/d), pressure inside the column P=491 atm (car tire’s pressure is 2-3 atm), and specific discharge $q=2\times10^{8}$ m/d (or 200,000 km/d) are all unreasonable.

16. Write what you are doing in each step. If you go wrong, I will know how and where it happened; I can then give you partial credit and you will learn from your mistakes.

17. You cannot add intrinsic (per unit) variables, such as specific discharge, q, unless they apply to the same area. Specific discharge for two tubes is the same as for one tube, but specific discharge for a two-tube system is double of that for a one-tube system (assuming that the system's area is the same).

18. Pressure (P) and pressure head (ψ) are different things, with different dimensions and different units. They are related, though, and you should know this relation.

19. Be careful with reporting units. Don't write "kg/ms" because it may mean several things:

20. (kg/m)·skilogram per meter times second

21. kg/mskilogram per millisecond

22. kg/(m·s)kilogram per meter and per second

23. Use brackets, kg/(m·s), or exponents, $kg \cdot m^{-1} \cdot s^{-1}$ (preferred)

24. Where appropriate, derivative units should be used instead of the primary units. For example, use newton, N, instead of $kg \cdot m \cdot s^{-2}$, and pascal, Pa, instead of $N \cdot m^{-2}$.

25. Be careful with conversion of units. Often, you reverse the calculations (go the opposite direction) - with disastrous results.

26. When is average appropriate? When is it not? It depends on the problem. If the question is "how long until the contaminant shows up at a well?" then average velocity is not appropriate; the fastest velocity is.

27. Do not assume things that can be calculated using the information in hand. For example, if you know dh/dx, don't assume pressure gradient for the Navier-Stokes equation; you should know how to convert head to pressure, and head gradient to pressure gradient.