1. Time 1? $Q^* = [(218+61)-((218+61)\times 0.20)]+(379-408) = 194\ W/m^2$
   Time 2? $Q^* = [(0+0)-((0+0)\times 0.80)]+(121-97) = 24\ W/m^2$
   Time 3? $Q^* = [(107+63)-((107+63)\times 0.10)]+(243-291) = 105\ W/m^2$

2. Time 1 has the greatest amount of energy available to do work (Q* for Time 1 is greatest). The sources of energy are shortwave radiation, or solar radiation, and longwave radiation, or terrestrial radiation (radiation emitted from the earth and the air). We cannot tell how this energy is utilized. Energy may be utilized for sensible heat flux, latent heat flux or ground heat flux. The energy balance tells us that information.

3. $K\downarrow = S+D = 218+61 = 279\ W/m^2$
   $K\downarrow = S+D = 0\ W/m^2$
   $K\downarrow = S+D = 107+63 = 170\ W/m^2$

4. Net shortwave $= K\downarrow - K\uparrow = (S+D)-(S+D)\times a = 279-279\times 0.20 = 223\ W/m^2$
   Net shortwave $= K\downarrow - K\uparrow = (S+D)-(S+D)\times a = 0\ W/m^2$
   Net shortwave $= K\downarrow - K\uparrow = (S+D)-(S+D)\times a = 170-170\times 0.10 = 153\ W/m^2$

5. Net longwave $= L\downarrow - L\uparrow = 379-408 = -29\ W/m^2$
   Net longwave $= L\downarrow - L\uparrow = 121-97 = 24\ W/m^2$
   Net longwave $= L\downarrow - L\uparrow = 243-291 = -48\ W/m^2$

6. $\%Diffuse = D/(S+D) = 61/279 = 0.22$ or 22%
   $\%Diffuse = D/(S+D) = 0$
   $\%Diffuse = D/(S+D) = 63/170 = 0.37$ or 37%

7. Time 3 has the greatest percent of diffuse radiation. Diffuse radiation is caused by scattering, which is higher when conditions are cloudy than when conditions are clear. Time 3 must be cloudier than Time 1. Another name for diffuse radiation is scattered radiation or scattered light.

8. Comparing the values for $L\downarrow$ shows Time 1 has the most incoming longwave radiation. The hotter a substance the more intense the radiation emitted.

9. Comparing the values for $L\uparrow$ shows Time 1 has the most outgoing longwave radiation. The hotter a substance the more intense the radiation emitted.

10. Radiation emitted by the earth's surface.

11. According to the table on page 12 of your lab manual, an albedo of 0.20 could represent sand, grass, or a deciduous forest. An albedo of 0.80 could represent fresh snow or cumulus clouds. An albedo of 0.10 could represent a deciduous forest, asphalt or dark soil.

12. Time 2. In December (in particular on the solstice), locations north of 66.5° N experience 24 hours of darkness. The sun never gets above the horizon. At Time 2, there is no incoming shortwave radiation, which means the sun isn't shining; the sun is below the horizon.

13. Time 1. In the summer, shortwave (solar) radiation is at a maximum due to high incidence angles and long days. Time 1 has greater incoming shortwave radiation than Time 2 or 3. In addition, the air and the earth's surface are warmest in summer. The longwave radiation values are highest at Time 1 indicating warmer temperatures.

14. Location 1: cold and wet; Location 2: cold and dry; Location 3: hot and dry

15. Location 3. The sensible heat flux (H) is greatest at this location.

16. Location 1. The latent heat flux (LE) is greatest at this location.