

CHAPTER 2	Thought Lab 2.1: Water Gains and Losses Answer Key	BLM 2.1.6A
ANSWER KEY		

Answers to Procedure Questions

- a) Water gain from metabolic water—human, 10%; kangaroo rat, 90%.
 - b) Water gain from absorbed water—human, 90%; kangaroo rat, 10%.
- a) Total water loss from urine—human, 47.4% (50% using correct significant figures); kangaroo rat 22.5%.
 - b) Total water loss from evaporation—human, 42.1% (40% using correct significant figures); kangaroo rat 73.2%.

Answers to Analysis Questions

- Both organisms lose the largest percentage of water by evaporation (including breathing) and the lowest percentage through their feces. Water loss through urine is an intermediate percentage for both organisms.
- Metabolic water makes up 90% of the kangaroo rat's water gain. Comparatively, a human only gains 10% of its water from metabolic water.
- a) The kangaroo rat is able to recycle water more efficiently from urine, feces, and metabolic water.
 - b) Answers may include the following: the kangaroo rat sweats relatively little—it uses behavioural adaptations such as deep burrowing and nocturnal behaviour to stay cool; the kangaroo rat has a relatively long digestive tract to allow for more complete reabsorption of water from the digestive system; the kangaroo rat has very efficient kidneys that are able to reabsorb a great deal of water from the urine.
- 73.2% of the kangaroo rat's water loss occurs from evaporation, while a typical human loses 42.1%. By being active only at night when temperatures are cooler, the kangaroo rat is able to reduce water loss from evaporation. The kangaroo rat loses a greater percentage of water through evaporation than a human does; however, a kangaroo rat lives in a much more extreme environment than the typical human.
- a) Carbohydrate: $(620\text{ g})(0.6) = 372\text{ g}$; Fat: $(20\text{ g})(1.07) = 21.4\text{ g}$; Protein: $(110\text{ g})(0.4) = 44\text{ g}$
 $372\text{ g} + 21.4\text{ g} + 44\text{ g} + 104\text{ g free water} = 541.4\text{ g}$

$$\frac{541.4\text{ g}}{60.0\frac{\text{g}}{\text{d}}} = 9.02\text{ d}$$

The cellular respiration of 1 kg of grain will release 541.4 g of water, sufficient to maintain a kangaroo rat for about 9 days.
 - b) Carbohydrate: 0 g; Fat: $(70\text{ g})(1.07) = 74.9\text{ g}$; Protein: $(270\text{ g})(0.4) = 108\text{ g}$
 $74.9\text{ g} + 108\text{ g} + 656\text{ g free water} = 838.9\text{ g}$

$$\frac{838.9\text{ g}}{1900\frac{\text{g}}{\text{d}}} = 0.44\text{ d}$$

The cellular respiration of 1 kg of steak will release 838.9 g of water. This should be sufficient water to maintain a human for 0.44 days.