

Thought Lab 2.1: Water Gains and Losses Answer Key

Answers to Procedure Questions

- Water gain from metabolic water—human, 10%; kangaroo rat, 90%.
 - Water gain from absorbed water—human, 90%; kangaroo rat, 10%.
- Total water loss from urine—human, 47.4% (50% using correct significant figures); kangaroo rat 22.5%.
 - 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.
- The kangaroo rat is able to recycle water more efficiently from urine, feces, and metabolic water.
 - 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.
- 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.
 - 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.