Warm Up: Unit 0: Energy, Work, Food, and Polar Travel

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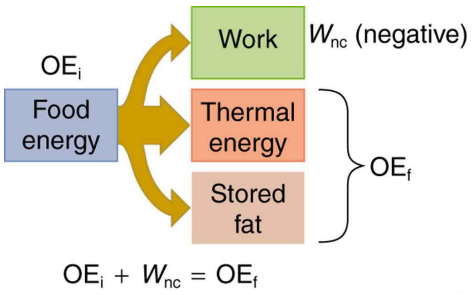
1 Memory Bank

- 1 Joule = 1 Newton × 1 meter
- 1 calorie = 4.184 Joules
- 1 kcal = 4184 Joules
- Carbohydrates: 4 kcal/gram
- Protein: 4 kcal/gram
- Fat: 9 kcal/gram
- 1 kilogram = 1000 grams
- 1 Watt = 1 Joule / 1 second
- A Watt is a unit of *power*, while a Joule is a unit of *energy*.



Organ	Power consumed at rest (W)	Oxygen consumption (mL/min)	Percent of BMR
Liver & spleen	23	67	27
Brain	16	47	19
Skeletal muscle	15	45	18
Kidney	9	26	10
Heart	6	17	7
Other	16	48	19
Totals	85 W	250 mL/min	100%

2 Work and Energy

1. Convert the following:
   - 440 Joules to calories.
   - 2500 calories to kcal.
   - 2.5×10^6 Joules to kcal.

2. (a) If an activity requires 2.5×10^6 Joules to complete, and it needs to be done in 6 hours, how many Watts of power does this imply? (b) How many Joules of energy are required for playing tennis for 3 hours?

3. (a) Convert your response for part (b) of the previous exercise to kcal. (b) How many grams of carbohydrates would provide this energy?

Activity	Energy consumption in watts	Oxygen consumption in liters O_2/min
Sleeping	83	0.24
Sitting at rest	120	0.34
Standing relaxed	125	0.36
Sitting in class	210	0.60
Walking (5 km/h)	280	0.80
Cycling (13–18 km/h)	400	1.14
Shivering	425	1.21
Playing tennis	440	1.26
Swimming breaststroke	475	1.36
Ice skating (14.5 km/h)	545	1.56
Climbing stairs (116/min)	685	1.96
Cycling (21 km/h)	700	2.00
Running cross-country	740	2.12
Playing basketball	800	2.28
Cycling, professional racer	1855	5.30
Sprinting	2415	6.90