Unit Conversions

Work Unit Conversions

1 MET = 3.5 ml/kg/min

1 MET = 1 kcal/kg/hr

L/min to ml/kg/min = divide L/min by the subject's body weight in kg, then multiply x 1000

ml/kg/min to L/min = multiply ml/kg/min by the subject's body weight in kg. then divide by 1000

L/min to kcal/min = multiply L/min x 5

kcal/min to L/min = divide kcal/min / 5

ml/kg/min to METS = divide ml/kg/min by 3.5

METS to ml/kg/min = multiply METS x 3.5

METS to Kcal/min = multiply METS x 3.5 x body weight in kg then divide by 200

Speed Conversions

1 mph = 26.8 m/min

1 mph = 1.62 km/hr

1 km/hr = 0.62 mph

Weight Conversions

1 kg = 2.2046 lbs

1 kg = 9.8 N

1 kg = 1000g

Distance Conversions

feet to meters, multiply feet x 0.3048

meters to feet, multiply meters x 3.281

inches to meters, multiply inches x 0.0254

meters to inches, multiply meters x 39.37

miles to meters, multiply miles x 1609

meters to miles, divide meters / 1609

Pace Conversions (To find pace in min : sec per mile)

A. Find the reciprocal of mph (1 / mph)
B. Multiply the reciprocal of mph x 60
C. The whole number portion is the minute part of min : sec per mile
D. Multiply the decimal portion of this number x 60
E. The decimal portion x 60 is the seconds part of min : sec per mile

Example: Find the pace of a runner who is running at 7.8 mph.
A. 1 / 7.8 = 0.1282
B. 0.1282 x 60 = 7.692
C. The minutes part of pace is 7
D. 0.692 x 60 = 42 (rounded)
E. The pace is 7:42 or 7 min 42 sec per mile.

Power Conversions

To find power in kgm/min, divide work in kgm / time in minutes

To find power in watts, divide work in joules / time in seconds

kgm/min to watts = multiply kgm/min x 0.164

watts to kgm/min = multiply watts x 6.12

kgm/min to kcal/min = multiply kgm/min x 0.0023

kcal/min to kgm/min = multiply kcal/min x 427

kcal/min to watts = multiply kcal/min x 69.8

watts to kcal/min = multiply watts x 0.014

Energy Conversions

1kcal is the energy required to raise the temperature of 1 kg of water 1 degree Celsius; 540 kcal evaporates 1 kg of water

kcal to kgm, multiply kcal x 427

kgm to kcal, divide kgm / 427

kcal to joules, multiply kcal x 4190

joules to kcal, divide joules / 4190

ACSM Metabolic Equations

Walking (1.9 to 3.7 mph)

VO_2 (ml/kg/min) = (0.1 x speed) + (1.8 x speed x grade) + 3.5

Speed is calculated in m/min.

Grade = fraction of the elevation / distance

The numbers 0.1 and 1.8 are constants that refer to the following:

0.1 = oxygen cost per meter of moving each kilogram (kg) of body weight while walking (horizontally)

1.8 = oxygen cost per meter of moving total body mass against gravity (vertically)

Running (greater than 5.0 mph - or 3.0 mph or greater if the subject is jogging)

VO_2 = (0.2 x speed) + (0.9 x speed x grade) + 3.5

Speed is calculated in m/min.

Grade = fraction of the elevation / distance

The numbers 0.2 and 0.9 are constants that refer to the following:

0.2 = oxygen cost per meter of moving each kg of body weight while running (horizontally)

0.9 = oxygen cost per meter of moving total body mass against gravity (vertically)

Cycling or Leg Ergometry (for power outputs of 300–1,200 kgm/min, or 50-200 watts, and speeds of 50–60 rpm

VO_2 = [1.8 (work rate) ÷ body mass in kg] + 7

*You may need to convert watts to kgm/min (1 watt = 6 kgm/min).

The numbers 1.8 and 7 are constants that refer to the following:

1.8 = oxygen cost of producing 1 kgm/min of power output

7 = oxygen cost of unloaded cycling plus resting oxygen consumption

Stepping (for stepping rates of 12–30 steps/min and for step heights ranging from 1.6 to 15.7 inches)

VO_2 = [0.2 (step rate)] + [1.33 x 1.8 (height in meters x step rate)] + 3.5

Since the height that needs to be plugged into the equation is in meters, you must convert inches to meters (1 inch = 0.0254 meters).

The numbers 0.2, 1.8 and 1.33 are constants that refer to the following:

0.2 = oxygen cost of moving horizontally during stepping

1.8 = oxygen cost of moving vertically during stepping

1.33 = correction factor for positive and negative (up and down) component of stepping