

- 1/ A person consumes 2900 Calories per day. Express this in joules.
- 2/ Calculate the average power output from the person in question 1.
[141W]
- 3/ The reaction for glucose burning is $C_6H_{12}O_6 + 6O_2 \Rightarrow 6CO_2 + 6H_2O$. Each mole of glucose releases 2.88MJ of energy. Calculate the amount of energy produced for every mole of O_2 consumed.
[480kJ]
- 4/ During a race, a runner accelerates smoothly from 4m/s to 7m/s over a distance of 53m.
 - a) Calculate their acceleration.
 - b) Calculate the time taken to change their velocity.
 - c) If the runner has a mass of 55kg, calculate the force they must apply to accelerate.
 - d) Calculate the work done to accelerate.
 - e) Calculate the power output from the runner during the acceleration.
[0.311m/s², 9.64s, 17.12N, 907.5J, 94W]
- 5/ During a 30 minute workout, a person consumes 650 Calories
 - a) Express this figure in joules
 - b) Calculate the average power produced during the workout
 - c) Calculate the amount of litres of oxygen needed during the workout
 - d) Assuming 7% of air inhaled is absorbed oxygen (21% O_2 in regular air, 14% in exhaled air), calculate the amount of air that must be inhaled.
 - e) Assuming a tidal volume of 2.4L, how many breaths per minute are required?
 - f) What mass of fat is burnt during this workout (1kg of fat contains $26.9 \times 10^6 J$ of energy).
[2.72x10⁶J, 1.5kW, 136L, 1942L, 27 breaths/minute, 0.101kg]
- 6/ A cricket ball of mass 0.156kg is bowled at 30ms^{-1} . It is stuck by the cricket bat, mass 1.5kg, moving at 4ms^{-1} . If the coefficient of restitution of the cricket ball is 0.58, calculate its speed after the impact. Calculate the speed of the cricket bat after the collision. Calculate the loss of mechanical energy in the collision.
[18.65ms⁻¹, 1.06ms⁻¹, 53.2J]