EQUATIONS PRACTICE

1. A cube with sides of length 5cm, weighs 50g. What is its density?

2. A horse takes part in a race. It runs around the 3km track in 2.5 minutes.
   a) What is its average speed?
   b) The horse accelerates at $2m/s^2$. How long will it take to reach a speed of 30m/s?
   c) Whilst the horse accelerates, its legs provide a forward force of 1000N, how heavy is the horse?
   d) What is the horse's momentum?
   e) One of the horse's hooves has an area of $50cm^2$. What pressure does the horse exert on the ground?

3. A mass of 12kg is put on a spring that has a spring constant of 240 N/m. How far will the spring stretch?

4. A door requires a moment of 10Nm to open. It is 80cm wide. What force is needed to pull the door open?

5. An apple falls from a tree that is 2.5m high.
   a) If it has a mass of 100g, how more energy is stored gravitationally by the apple?
   b) How fast will it be going when it hits the floor?

6. A shopping trolley has a mass of 25kg and is pushed with a force of 50N for 5s.
   a) What is the power used if it is pushed 10m?
   b) It reaches a speed of 4m/s. What is the efficiency of the trolley?

7. A hairdryer has a current of 10A when the potential difference is 230V.
   a) What is the power of the hairdryer?
   b) If the hairdryer is on for 20s, how much energy does it use?
   c) How much charge goes through the hairdryer in that time?
   d) What is the hairdryer's resistance?

8. A person shouts across a canyon and hears an echo 4s later. The speed of sound in air is 330m/s.
a) How wide is the canyon?
b) If the frequency of the sound is 660Hz, what is the wavelength of the sound wave?
Answers:

1) $p = m/V = 0.05 / (0.05)^3 = 400kg/m^3$

2a) $s = d/t = 3000/150 = 20m/s$
b) $a = (v - u) / t$ --- $2 = 30/t$ --- $t = 15s$
c) $F = ma$ --- $1000 = 2 \times m$ --- $m = 500kg$
d) $p = mv = 500 \times 30 = 15000kgm/s$
e) $P = F/A = (500 \times 10) / (50 \times 4) = 25N/m^2$

3) $F = kx$ ---- $12 \times 10 = 240x$ ---- $x = 120/240 = 0.5m$

4) moment = Fd ---- $10 = 0.8 \times F$ ---- $F = 12.5N$

5a) $E_G = mgh = 0.1 \times 10 \times 2.5 = 2.5J$
b) $E_K = 0.5mv^2$ ---- $2.5 = 0.5 \times 0.1 \times v^2$ ---- $v^2 = 50$ ---- $v = 7.1m/s$

6a) $W = Fd = 50 \times 10 = 500J$ ---- $P = W/t = 500 / 5 = 100W$
b) $E_K = 0.5mv^2 = 0.5 \times 25 \times 4^2 = 200J$ ---- Efficiency = (useful output / total input) x 100 = (200/500) x 100 = 40%

7a) $P=VI = 10 \times 230 = 2300W$
b) $E=Pt = 2300 \times 20 = 46000J$
c) $Q = It = 10 \times 20 = 200C$
d) $V=IR$ ---- $230 = 10 \times R$ ---- $R = 23\Omega$

8a) $v = d/t$ ---- $330 = d / 4$ ---- $d = 1320m$ ---- $d/2 = 660m$
b) $v = f\lambda$ ---- $330 = 660 \times \lambda$ ---- $\lambda = 0.5m$