

USING EQUATIONS TEST 4

For the following questions you will be given credit for writing down the equation(s) used, the final answer and the correct S.I. units.

1. An arrow, in being fired from a bow, is accelerated over a distance of 0.40 m and leaves the bow with a velocity of 40 ms^{-1} . What is the average acceleration of the arrow while being fired? $V_f^2 = V_i^2 + 2ad$ 2000 ms^{-2}
2. A bullet is fired horizontally from a gun held 1.4 m above the ground on the Canterbury plains. If the bullet leaves the gun with a velocity of 300 ms^{-1} at what distance from the gun will the bullet strike the ground? $d = v_i t + \frac{1}{2}at^2$ 227 m
3. A stone of mass 0.20 kg on the end of a piece of string is whirled in a horizontal circle of radius 1.0 m with a constant speed of 2.4 ms^{-1} . What is the tension in the string? $F = \frac{mv^2}{r}$ 1.2 N
4. A car has a mass of 2000 kg and is moving at a velocity of 45 kmh^{-1} when it strikes, head on, a smaller car of mass 1200 kg and a velocity of 60 kmh^{-1} . What is the velocity of the cars after the impact if they become locked together? $p = mv$ 5.6 kmh^{-1}
5. A torch battery has an e.m.f of 1.5 V and an internal resistance of 2Ω . What is the potential difference across the terminals of the battery when a current of 0.2 A is being taken from it? $E = V + Ir$ $V = IR$ 1.1 V
6. An electric cable consists of 6 strands of bare copper wire twisted together. If each wire has a cross-sectional area of 1 mm^2 , what will be the resistance of a 20 m length of the cable (resistivity of copper is $1.7 \times 10^{-8} \Omega\text{m}$)? $(R = \frac{\rho L}{A})$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ 0.057Ω
7. What is the size of the maximum charge on the plates of a capacitor of capacitance $8 \mu\text{F}$ when connected to a 2.0 V battery? $Q = CV$ $1.6 \times 10^{-5} \text{ C}$
8. What is the capacitance of a system consisting of an $8 \mu\text{F}$ capacitor in series with a $16 \mu\text{F}$ capacitor? $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}$ $5.33 \mu\text{F}$
9. What is the energy of a photon of yellow light with a wavelength in a vacuum of $5.9 \times 10^{-7} \text{ m}$? ($c = 3 \times 10^8 \text{ ms}^{-1}$, $h = 6.63 \times 10^{-34} \text{ Js}$) $E = hf$ $v = f\lambda$ $3.36 \times 10^{-19} \text{ J}$
10. The speed of sound in air is 330 ms^{-1} . A clarinet sounds a note, which has a frequency of 660 Hz. Calculate the frequency of the sound. $v = f\lambda$ 0.5 m
11. Elizabeth skis down a slope and descends a vertical height of 6 m. Her mass is 55 kg. At the bottom of the slope her speed is 8 ms^{-1} . Assume her speed at the top was negligible. Calculate how much energy has been lost to the forces of friction. $E_p = mgh$ $E_k = \frac{1}{2}mv^2$ 1540 J
12. Kelvin stands on the equator of the earth (radius $6.4 \times 10^6 \text{ m}$). Find his linear velocity due to the spinning earth. $d = v_i t + \frac{1}{2}at^2$, $v = \frac{2\pi R}{T}$ 470 ms^{-1}
13. A resistor of 10 ohms has a current of 2 Amps in it. What heat is being produced per second in the resistor? $P = VI$, $V = IR$, $P = \frac{W}{t}$ 40 J s^{-1}
14. Calculate the gravitational force between a 5.0 tonne lead sphere and 2.0 tonne sphere which are 75 cm apart (take $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$). $F = \frac{Gm_1 m_2}{r^2}$ $1.19 \times 10^{-3} \text{ N}$