

USING EQUATIONS TEST 2

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. Calculate the wavelength of sound being emitted at a frequency of 10 Hz from a stationary source. The speed of sound in air is 330 ms^{-1} .
 $v = f\lambda$ 33 m
2. Calculate the power dissipated in a 10 ohm resistor carrying a current of 1.2 A.
 $P = VI$ $V = IR$ 7.2 W
3. A $4.7 \mu\text{F}$ capacitor stores 0.2 J of energy. Find the voltage across the capacitor
 $E = \frac{1}{2}QV$ $Q = CV$ 292 V
4. A capacitor has 20 Volts across it and $6 \times 10^{-6} \text{ C}$ charge on its plates. What is the value of its capacitance?
 $Q = CV$ $3 \times 10^{-7} \text{ F}$
5. When a bullet with mass 0.015 kg travelling at 650 ms^{-1} passes clean through a wooden block of mass 1.2 kg, initially at rest, the block moves off at 4 m s^{-1} immediately after the bullet has passed through it. What is the bullet's final speed?
 $p = mv$ 330 ms^{-1}
6. Calculate the wavelength of light emitted when an electron falls from an energy level of $6.06 \times 10^{-20} \text{ J}$ to an energy level of $-8.73 \times 10^{-20} \text{ J}$. (Take $c = 3.00 \times 10^8 \text{ m s}^{-1}$ and $h = 6.63 \times 10^{-34} \text{ J s}$).
 $\Delta E = |E_1 - E_2|$ $E = hf$ $v = f\lambda$ $7.45 \times 10^{-6} \text{ m}$
7. How far apart are two parallel plates in air, area 0.50 m^2 and capacitance $1.5 \mu\text{F}$? (Take $\epsilon_0 = 8.85 \times 10^{-12} \text{ N}^{-1} \text{ m}^{-2} \text{ C}^2$ and $\epsilon_r = 1$)
 $C = \frac{\epsilon_0 \epsilon_r A}{d}$ $2.95 \times 10^{-6} \text{ m}$
8. If a rifle of mass 7 kg fires a bullet of mass 8 g at a speed 210 m s^{-1} , what is the rifle's initial recoil velocity?
 $p = mv$ 33 ms^{-1}
9. A train of mass 5000 kg moves at a speed of 30 ms^{-1} on a horizontal surface. Calculate the kinetic energy of the train.
 $E_k = \frac{1}{2}mv^2$ $2.25 \times 10^6 \text{ J}$
10. What is the resistance of a 240 V, 60 W light bulb?
 $P = VI$ $V = IR$ 960Ω
11. A resultant force of 4 N is applied to a body of mass 2 kg for 1 second. What is the acceleration of the body?
 $F = ma$ 2 ms^{-2}
12. A bat squeaks at 33 kHz. It receives an echo 200 ms later. How many wavelengths away is the 'target'? The speed of sound is 330 ms^{-1} .
 $d = v_i t + \frac{1}{2}at^2$ $v = f\lambda$ 6600 wavelengths
13. One type of aeroplane has a maximum acceleration on the ground of 3.4 ms^{-2} . What is the minimum length of runway needed if it is to reach its take-off speed of 110 ms^{-1} ?
 $V_f^2 = V_i^2 + 2ad$ 1779 m
14. A 300 V battery is connected across capacitors of 3 microfarad and 6 microfarad connected in parallel. Calculate the total energy stored by the capacitors.
 $C_T = C_1 + C_2$ $E = \frac{1}{2}QV$ $Q = CV$
 0.405 J