

USING EQUATIONS TEST 6

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. (Take $c = 3.00 \times 10^8 \text{ m s}^{-1}$ and $h = 6.63 \times 10^{-34} \text{ J s}$ and $g = 10 \text{ ms}^{-2}$).

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} . $v = f\lambda$ 33m
2. If a tuning fork X gives beats at 6 Hz when sounded with fork Y (550 Hz.) and beats at 4 Hz when it is sounded with fork Z (540 Hz). What is the frequency of X? $f = |f_1 - f_2|$ 544 Hz
3. A 10 kg mass extends a spring by 50 mm. What is the spring constant of the spring? $F = -Kx$ 2000 Nm^{-1}
4. A bullet, mass 0.015 kg, travelling at 650 m s^{-1} passes through a wooden block of mass 1.2 kg, initially at rest. The block moves off at 4 m s^{-1} after the bullet has passed through it. What is the bullet's final speed? $p = mv$ 330 ms^{-1}
5. Calculate the wavelength of the light emitted when an electron falls from an energy level of $-6.06 \times 10^{-20} \text{ J}$ to an energy level of $-8.73 \times 10^{-20} \text{ J}$. $E = hf$
 $\Delta E = |E_1 - E_2|$ $v = f\lambda$ $7.45 \times 10^{-6} \text{ m}$
6. What power of electric fire can be connected to the 240 V mains supply if the maximum fuse value possible is 13 A? $P = VI$ 3120 W
7. A 5 kg mass extends a spring by 0.50 m. What is the spring constant of the spring? $F = -Kx$ 100 Nm^{-1}
8. A ballet dancer spins about a vertical axis at 2 revolutions per second with her arms outstretched. With her arms folded, her moment of inertia about the vertical axis decreases by 60 %. Calculate the new rate of revolution. $L = I\omega$
5 revolution
9. A 24 ohm resistor radiates 12 W. A 16 ohm resistor in parallel with it will radiate how much power? $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ $P = IV$ $V = IR$ 18 W
10. A loudspeaker is put close to the open end of a pipe 0.8 m long which is closed at the other end. Starting from $f = 0 \text{ Hz}$, the first resonance is heard at 105 Hz. Neglecting end effects, calculate the exact speed of sound in air. $v = f\lambda$ 336 ms^{-1}
11. How far apart are two parallel plates in air, area 0.50 m^2 and capacitance $1.5 \mu\text{F}$? (Take $\epsilon_0 = 8.85 \times 10^{-12} \text{ N}^{-1} \text{ m}^{-2} \text{ C}^2$) $C = \frac{\epsilon_0 \epsilon_r A}{d}$ $2.95 \times 10^{-6} \text{ m}$
12. The starter motor of a car draws 200 A from a 12 V battery for 5 seconds. How much energy is produced in the 5 seconds? $P = VI$, $P = \frac{W}{t}$ 12000 J
13. The timekeeper at an athletics meeting is 100 m from the starter. Find the time lag between seeing the flash of the starter's pistol and hearing the sound. (speed of sound = 340 ms^{-1} .) $d = v_s t + \frac{1}{2} a t^2$ $t = 0.29 \text{ s}$