

USING EQUATIONS TEST 3

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 $h = 6.6 \times 10^{-34}$ Js and $c = 3 \times 10^8$ ms⁻¹)

1. A 4 kg mass travels at 5 ms⁻¹ to the right. It collides with a 3 kg mass travelling at 6 ms⁻¹ to the left. After the collision, the 3 kg mass moves off to the right at 2 ms⁻¹. Use the law of conservation of momentum to work out the final speed of the 4 kg mass.
2. A student whirls a stone around on the end of a string in a horizontal circle. The stone rotates round at 10 times each second. What is the time period of the stone's rotation?
5. 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?
4. Calculate the total resistance in a circuit which consists of a 10 ohm, a 20 ohm and a 40 ohm resistor in parallel with each other.
5. A 500 kg car is travelling at 12 ms⁻¹. Four seconds later it is travelling at 16ms⁻¹. What is the impulse of the force?
6. Two resistors, 12 ohms and 24 ohms, are connected in series across a 9.0 V battery. Calculate the current flowing through the 12 ohm resistor.
7. What is the energy stored in a 200 μ F capacitor charged up to 200 V?
8. What is the capacitance of a system consisting of an 8 μ F capacitor in parallel with a 12 μ F capacitor?
9. An electron of a hydrogen atom drops from an energy state of -1.36×10^{-19} J to an energy state of -5.44×10^{-19} J. , what is the wavelength of the emitted photon (and for a bonus point: what part of the electromagnetic spectrum is it in)?
10. The mass of an alpha particle is about 6.644×10^{-27} kg. Calculate the binding energy of an alpha particle if the four nucleons separately mass 6.695×10^{-27} kg.
11. Two large masses are placed 10 m apart in space. It is found that the smaller mass is attracted to the larger mass with a gravitational force of 100 mN. What is the gravitational force of attraction on the larger mass given that it has five times the mass of the smaller mass?
12. Two points A and B are at different voltage levels. Calculate the potential difference between A and B if 16 J of work is done to move a 0.50 mC charge from A to B.
13. Blue light of frequency 7×10^{14} Hz is shone on a metal surface. The metal has a threshold frequency of 3×10^{14} Hz. Calculate the maximum kinetic energy of the ejected electrons.
14. The Milky Way is our local galaxy of stars. This galaxy is thought to rotate so it takes 200 million years to make one rotation. Our sun is situated about 5×10^{21} m from the galactic centre. Calculate the speed of the sun as the galaxy rotates.