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 x 10^{-34} Js and c = 3 x 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. $p = mv$ $1 ms^{-1}$ to left

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? $T = \frac{1}{f}$ 0.1s

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? $P = VI$ $P = W/t$ 12000 J

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. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ 5.7Ω

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? $\Delta p = m\Delta v$ 2000 $Kgms^{-1}$

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. $R_T = R_1 + R_2$ $V = IR$ 0.25A

7. What is the energy stored in a 200 μF capacitor charged up to 200 V? $E = \frac{1}{2}QV$ $Q = CV$ 4J

8. What is the capacitance of a system consisting of an 8 μF capacitor in parallel with a 12 μF capacitor? $C_T = C_1 + C_2$ 20μF

9. An electron of a hydrogen atom drops from an energy state of – 1.36 x 10^{-19} J to an energy state of –5.44 x 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)? $E = hf$ $v = f\lambda$ $\lambda = 488$ nm (visible)

10. The mass of an alpha particle is about 6.644 x 10^{-27} kg. Calculate the binding energy of an alpha particle if the four nucleons separately mass 6.695 x 10^{-27} kg. $E = mc^2$ 4.5×10^{-12} J

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? $\left(F = \frac{Gm_1m_2}{r^2}\right)$ trick question 100mN

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. $E = Vq$ 32000 V

13. Blue light of frequency 7 x 10^{14} Hz is shone on a metal surface. The metal has a threshold frequency of 3 x 10^{14} Hz. Calculate the maximum kinetic energy of the ejected electrons. $E = hf$, $hf = \phi + E_K$ $E_K = 2.6 \times 10^{-19}$ J

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 x 1021 m from the galactic centre. Calculate the speed of the sun as the galaxy rotates. $v = \frac{2\pi R}{T}$ 5×10^{6} ms^{-1}