

28p

ACDB4011 CHEMISTRY QUIZ 1

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3p 1. (6 points) Indicate whether each of the following statements is true or false:

- | T | F | |
|-------------------------------------|-------------------------------------|---|
| ☐ | ☒ | Chemical energy is stored in the nucleus. |
| ☒ | ☒ | There are three d orbitals. |
| ☐ | ☒ | Strontium ion used in pyrotechnics produces green light in fireworks. |
| ☒ | ☐ | X-rays have a longer wavelength than ultraviolet. |
| ☒ | ☒ | Isotopes of the same element always have the same number of protons. |
| ☒ | ☐ | If the velocity of a moving object increased two times its kinetic energy increased two times as well |

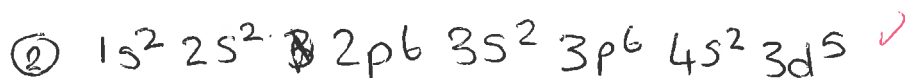
6p 2. (6 points) How many of each type of sub-atomic particles are contained in an atom ^{110}Cd ?

Protons: 48

Neutrons: 62

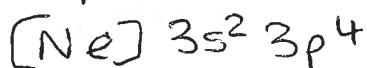
Electrons: 48

3. a) (6 points) Write the full and shorthand electronic configuration for manganese, Mn, atom.



b) (3 points) How many unpaired electrons are there in a sulphur, S, atom in the ground state?

16 protons/electrons



4 unpaired electrons

4. (6 points) The radio station 92.1 FM broadcasts at a frequency of 9.21×10^7 Hz (92.1 MHz). Calculate the wavelength of the broadcast, and the energy of one photon.

$F = 9.2 \times 10^7 \text{ Hz}$

$\lambda = ?$

$E = ?$

$h = 6.6 \times 10^{-34}$

$C = 3.0 \times 10^8 \text{ m/s}$

$E = h \times \nu$

$C = F \times \lambda$

$F = \nu$

$\lambda = \frac{C}{F} = \frac{3.0 \times 10^8}{9.21 \times 10^7} = 3.257 \text{ m} = \nu$ ✓

$E = h \times \nu$

$E = 6.6 \times 10^{-34} \times 3.257 = 2.1498 \times 10^{-33} \text{ J}$

5. A 200 g mass is held at a height of 0.8 m above the ground.

a) (3 points) Calculate the gravitational potential energy stored in the mass before it is dropped.

2p

$$mgh = gpe$$

$$m = 200g = 0.2kg$$

$$h = 0.8m$$

$$g = 10$$

$$~~200~~ \times 0.8 \times 10$$

$$~~1600~~$$

$$gpe = 1600J$$

b) (2 points) State the kinetic energy of the mass just before it hits the ground?

2p

$$ke = \frac{1}{2}mv^2$$

$$ke = 0.5 \times 200 \times v^2$$

$$v = \frac{d}{t} \quad \frac{0.8}{t}$$

$$\frac{1}{2}mv^2$$

$$gpe = ke$$

$$mgh = \frac{1}{2}mv^2$$

$$1600 = ?$$

$$1600 = \frac{1}{2}mv^2$$

$$0.5 \times 200 \times 4^2$$

$$0.5 \times 200 \times 12$$

$$1200J$$

c) (3 points) Calculate the speed of the mass just before it hits the ground.

3p

$$1600 = \frac{1}{2}mv^2$$

$$\div 0.5$$

$$\frac{1600}{0.5} = mv^2$$

$$\div m$$

$$\frac{1600}{0.5 \times m} = v^2$$

$$\sqrt{\quad}$$

$$\sqrt{1600 / 0.5 \times m} = v$$

$$4m/s^2$$

$$\sqrt{1600 / 0.5 \times 200} = 4m/s$$