Flashback 2

1. Ammonium hydroxide, NH_4OH, is a common compound found in many glass cleaners.

   You made a sample solution of NH_4OH in the laboratory. You used 6.50 g of NH_4OH.

How many ions of *ammonium* are in your sample solution of NH_4OH?

   6.50 g (mol/35.04 g) = 0.1855 moles of NH_4OH

   $NH_4OH \rightarrow NH_4^+ + OH^-$

   0.1855 moles of NH_4OH (1 mol NH_4^+ /1 mol NH_4OH) = **0.1855 moles** NH_4^+

   0.1855 moles NH_4^+ (6.02×10^{23} ions of NH_4^+ / **moles** NH_4^+) = 1.11×10^{23} ions of NH_4^+

2. There is force of attraction and repulsion between two electrically charged particles at rest.

   Two positively charged particles at rest exert a force of 4.6×10^3 N on one another. The charge of the first particle is 6.0×10^{-5} C and the charge of the second particle is 2.0×10^{-4} C.

What is the distance between the two charged particles?

$$F_e = \frac{kq_1q_2}{r^2}$$

$$r = \sqrt{\frac{kq_1q_2}{F_e}}$$

$$= \sqrt{\frac{\left(9 \times 10^9 \ \frac{\text{Nm}^2}{\text{C}^2}\right)\left(6.0 \times 10^{-5}\text{C}\right)\left(2.0 \times 10^{-4}\text{C}\right)}{\left(4.6 \times 10^3\text{N}\right)}}$$

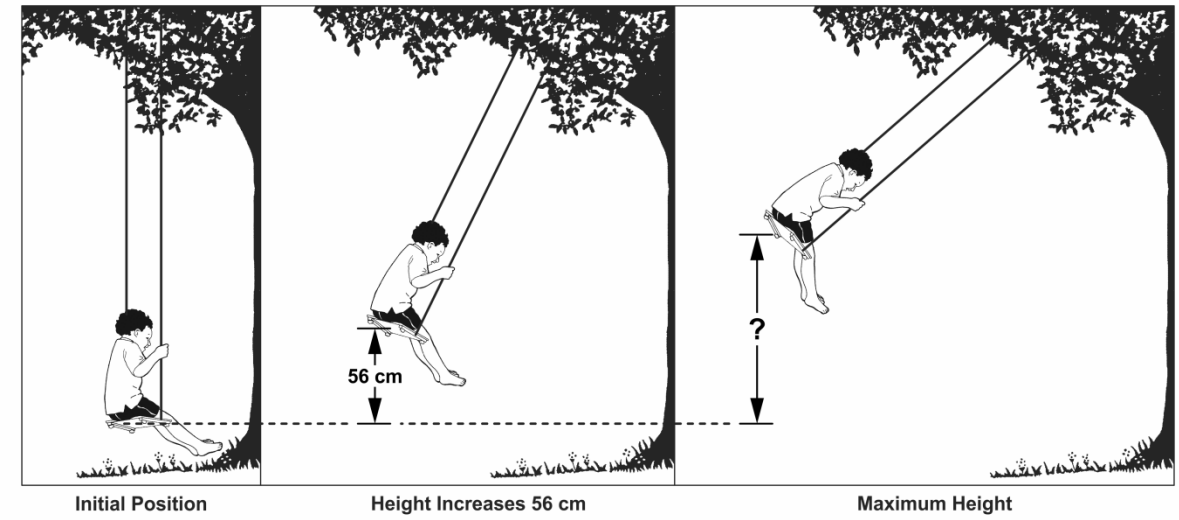
$$= 0.153 \text{ m}$$

The distance between the charged particles is **0.15 m**.

You could also plug the numbers into the original, cross-multiply and solve for r(by square rooting)

Note: *Significant figures are **not** evaluated in this question.*

3. At the playground, Joseph is swinging on a wooden swing. When the height of the swing rose to 56 cm above the initial position, Joseph's velocity was 4.0 m/s. His mass is 45 kg.



What is the maximum height above the initial position that Joseph will reach?
Assume there is no friction.

Note: *Significant figures will be evaluated in this question.*

Step 1 $E_m = \frac{1}{2} mv^2 + mgh$
$= \frac{1}{2}$ (45 kg) (4.0 m/s)^2 + (45 kg) (9.8 N/kg) (0.56 m)
= 360 J + 247 J
= 607 J

Step 2 At max height, velocity = 0 therefore $E_m = mgh$

$$607\ \mathbf{J} = mgh$$

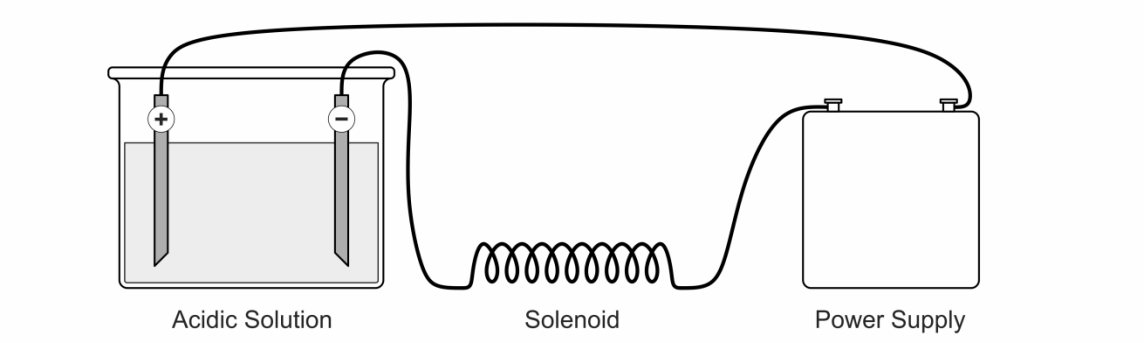
$$607\ \mathbf{J} = (45\ \mathbf{kg})(9.8\ \mathbf{N/kg})$$

$$h = \frac{607\ \mathbf{J}}{(45\ \mathbf{kg})(9.8\ \mathbf{N/kg})}$$

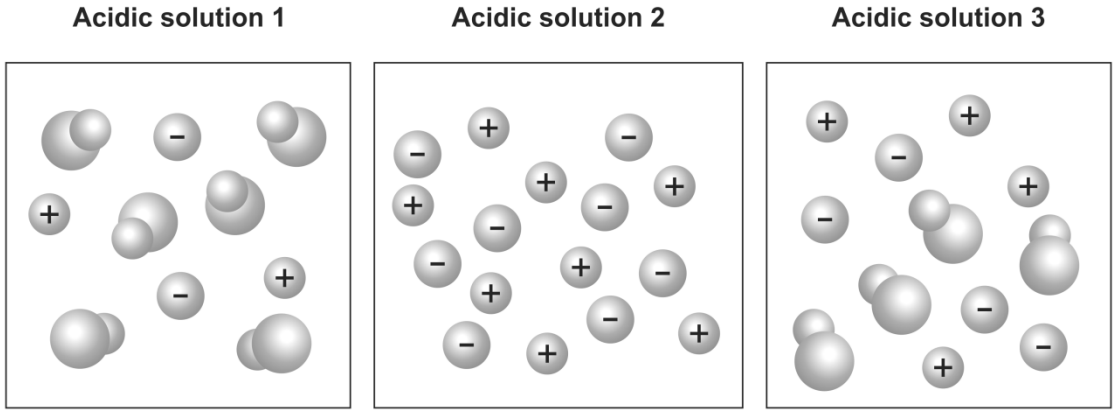
$$h = 1.4\ \mathbf{m}$$

The maximum height above the initial position that Joseph will reach is **1.4 m**.

4. An engineering student is designing a circuit with a solenoid. The design is such that the circuit uses an acidic solution as shown below.



She wants to vary the intensity of the magnetic field of the solenoid by using three different acidic solutions which are illustrated below.



Which of the following correctly ranks the intensity of the magnetic field produced, from **strongest** to **weakest**, when each acidic solution is used in the circuit?

The solution with the highest % of ions will be the strongest electrolyte. This will create the most current, which will then produce the strongest magentic field.

Acidic Solution 2 (100% ions) » **Acidic Solution 3** (8 ions/ total of 12) » **Acidic Solution 1 (4/10)**

5. A nuclear plant in Chalk River, Ontario is responsible for producing 40% of the world's supply of medical isotopes.

At the facility, uranium-235 is used to produce molybdenum, Mo, as well as other products. One of the isotopes of molybdenum produced at Chalk River is Mo-99.

Possible isotopes of the element are:

$^{96}_{42}Mo$ $^{99}_{42}Mo$

a) List the number of protons and neutrons found in each isotope of molybdenum.

b) What type of nuclear transformation does the production of Mo-99 represent? Explain your answer.

Isotopes of Molybdenum	Protons	Neutrons
$^{96}_{42}Mo$	42 protons	54 neutrons
$^{99}_{42}Mo$	42 protons	57 neutrons

b) The type of nuclear transformation represented by the production of Mo-99 is **nuclear fission**.

Explanation:

Nuclear fission occurs when a nucleus of an atom breaks apart. This happens when a neutron hits an uranium nucleus, releasing smaller nuclei such as Mo-99, other nuclei and neutrons.