

Problem Set #3 Newton's Laws
Due Thursday Sept. 12 (A/B)/Friday Sept. 13 (C/D)

Name: _____

I worked with:

Equations:

Force:	$F = ma$
Acceleration due to gravity:	9.8 m/s^2
Universal Gravitation:	$F = \frac{GMm}{r^2}$
Gravitational Constant:	$G = 6.67 \times 10^{-11}$
Avogadro's Number:	6.022×10^{23}

1. You are baking a cake using a very scientific recipe. The recipe calls for 2.78 moles of sugar. In your kitchen, you only have cups.
 - a. How many cups of sugar do you need? (the chemical formula for sugar, aka glucose is $\text{C}_6\text{H}_{12}\text{O}_6$ and there are 200g in a 1 cup of sugar?)
 - b. How many sugar molecules do you add to your cake mix?
2. List the force pairs that you see in the picture below and draw a free body diagram for each object involved in the picture below.



3. You weigh a bear by making him stand on four scales as shown in the picture below. Draw a free body diagram showing all the forces acting on the bear. If his weight is 1,500 N, what is the reading on the fourth scale?



4. A figure skating pair is skating their hearts out at the olympics. Their final crowning move is for male skater (with a mass of 80 kg) to throw the female skater (with a mass of 55 kg) through the air to land meters away on one leg. If the female skater accelerates away from the male skater with an acceleration of 8 m/s^2 what, if any, acceleration does the male skater experience?
5. A 65 kg astronaut wearing a 40 kg spacesuit is on Mars. How much more or less does the astronaut and their gear weight on Mars as opposed to Earth?

Mars Radius = $3.4 \times 10^6 \text{ m}$

Mars Mass = $6.4 \times 10^{23} \text{ kg}$

Earth Radius = $6.4 \times 10^6 \text{ m}$

Earth Mass = $6 \times 10^{24} \text{ kg}$

Periodic Table of the Elements

1 H Hydrogen 1.01																	2 He Helium 4.00												
3 Li Lithium 6.94	4 Be Beryllium 9.01											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18												
11 Na Sodium 22.99	12 Mg Magnesium 24.31											13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.06	17 Cl Chlorine 35.45	18 Ar Argon 39.95												
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.88	23 V Vanadium 50.94	24 Cr Chromium 51.99	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine 79.90	36 Kr Krypton 84.80												
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 98.91	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.6	53 I Iodine 126.90	54 Xe Xenon 131.29												
55 Cs Cesium 132.91	56 Ba Barium 137.33	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.85	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.20	83 Bi Bismuth 208.98	84 Po Polonium [208, 98]	85 At Astatine 209.98	86 Rn Radon 222.02												
87 Fr Francium 223.02	88 Ra Radium 226.03	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [289]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]												
57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium 144.91	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97	89 Ac Actinium 227.03	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium 237.05	94 Pu Plutonium 244.06	95 Am Americium 243.06	96 Cm Curium 247.07	97 Bk Berkelium 247.07	98 Cf Californium 251.08	99 Es Einsteinium [254]	100 Fm Fermium 257.10	101 Md Mendelevium 258.10	102 No Nobelium 259.10	103 Lr Lawrencium [262]

- Alkali Metal
- Alkaline Earth
- Transition Metal
- Basic Metal
- Metalloid
- Nonmetal
- Halogen
- Noble Gas
- Lanthanide
- Actinide