Bringing Real-World Context to Classroom Activities

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Oregon Institute of Technology

Oregon Institute of Technol

"Why is understanding how an electron works important to my future career as a fish biologist?"

- Primary Campus: Klamath Falls, OR
- Student Population: 4910
- No chemistry major
- General Chemistry is required of all biology health science, environmental science, and engineering majors (civil, manufacturing, mechanical, electrical, renewable energy)

Chemistry at Oregon Tech

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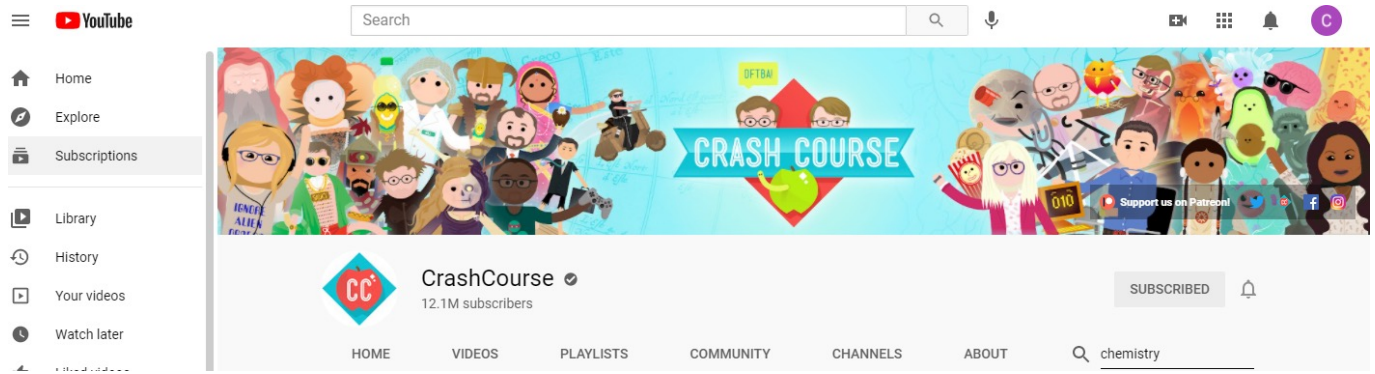
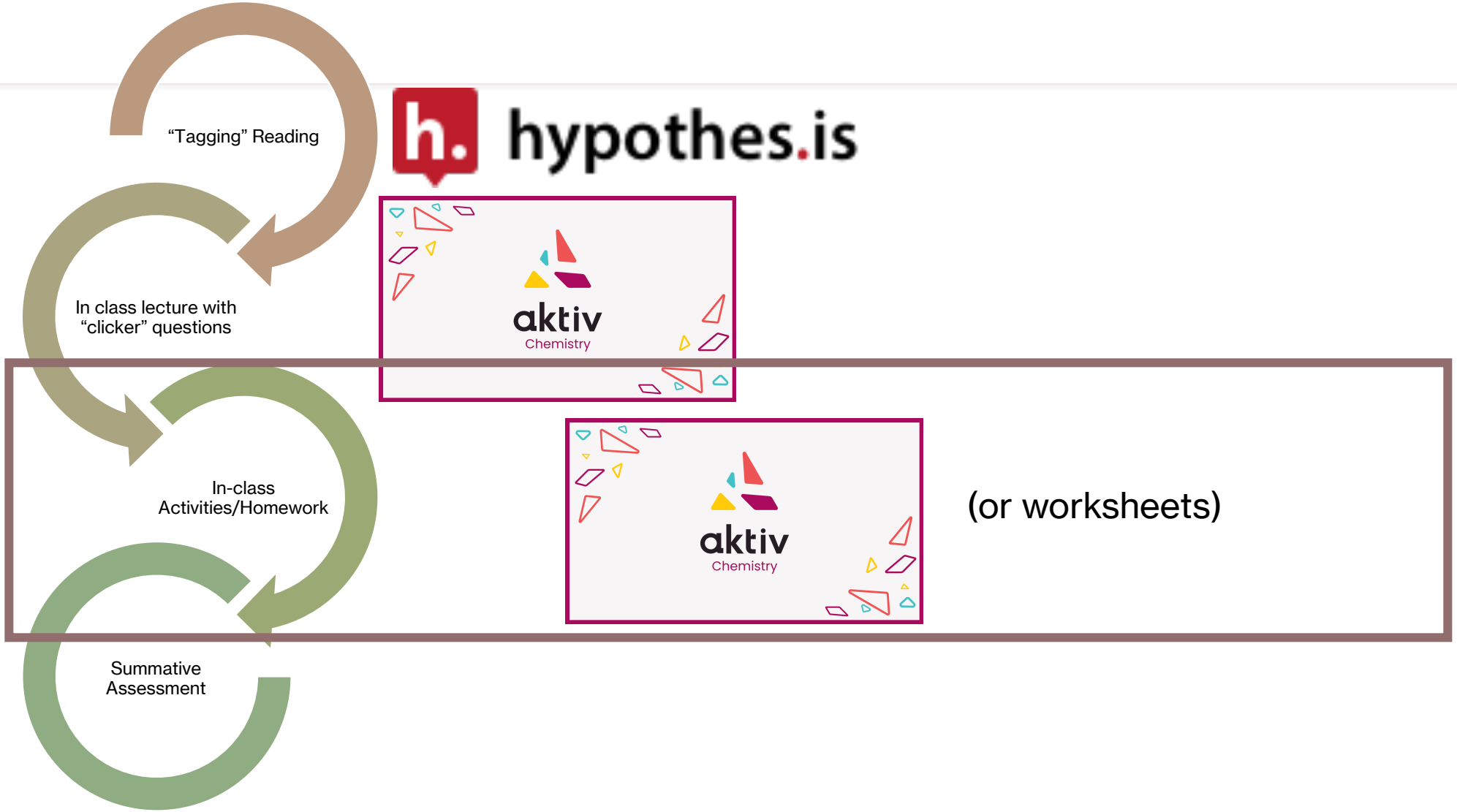
aktiv
Chemistry



Crash Course Chemistry

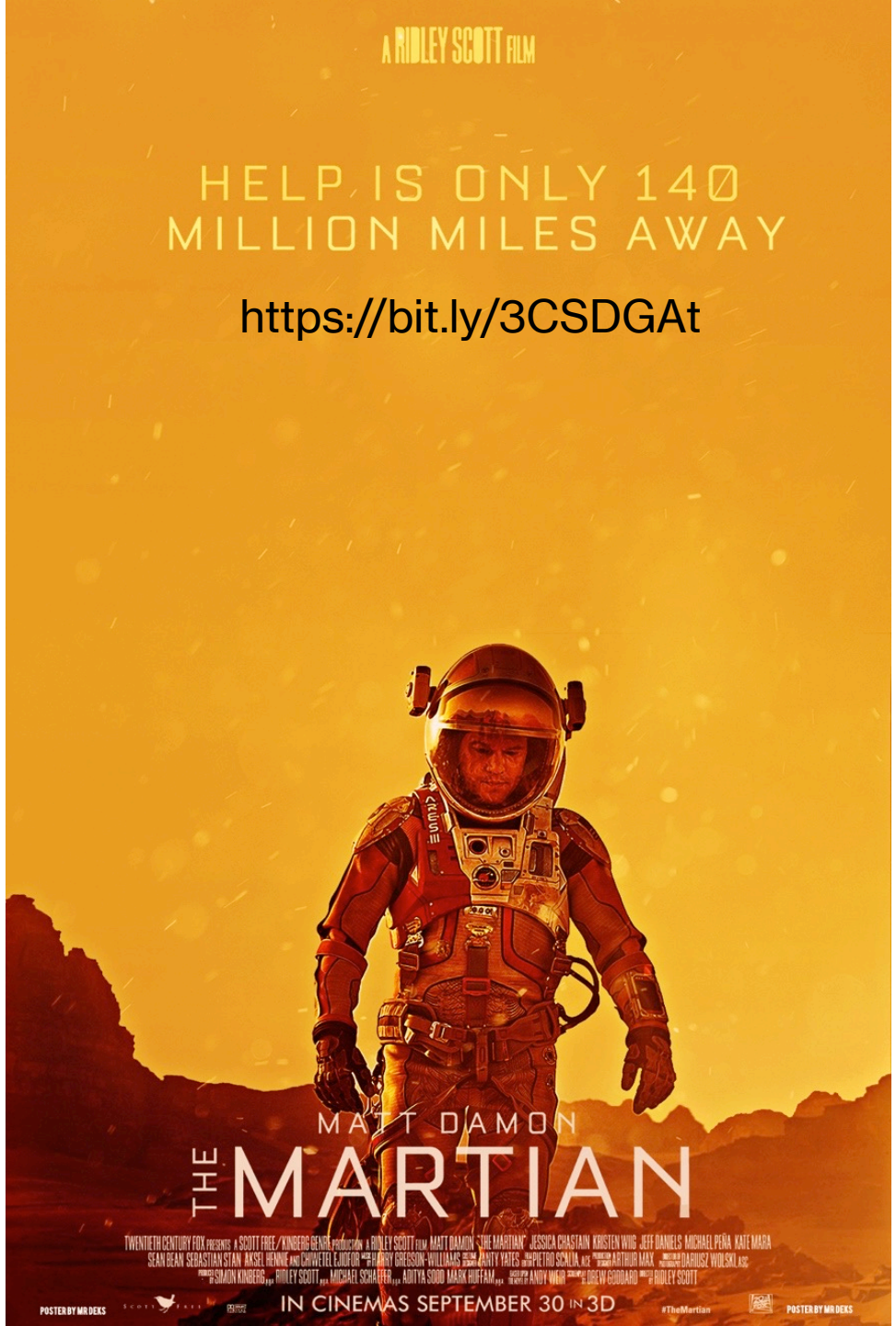
Scaffolded Teaching & Learning



Exploring Pop-Science Accuracy

Final Exam (Take Home)

Final Exam Review



Does that science hold up?

Developed with Dr. Chelsea Gustafson

At one point in the book, Mark states:

> "Anyway, the reserve oxygen would only be enough to make 100 L of water (50 L of O_2 makes 100 L of molecules that only have one O each)."

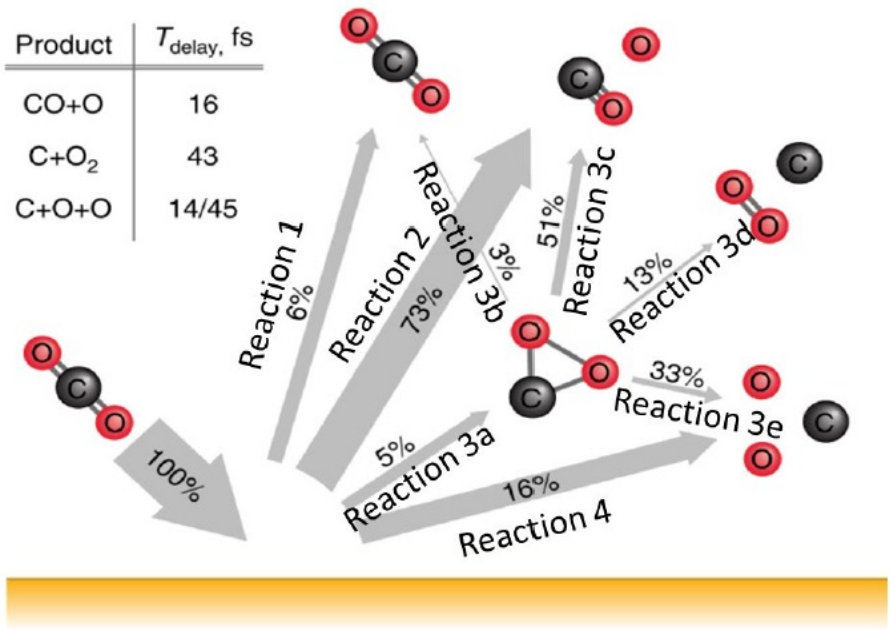
Is that true? Use dimensional analysis to check Mark's assertion that 50 L of O_2 would make 100 L of H_2O. **HINT** You will probably want the density of liquid water (0.997 g/mL) and the density of liquid oxygen (1.141 g/mL), among some other values (use the periodic table on canvas!). **Show your work.**

64.4 L of water

Developed with Dr. Chelsea Gustafson

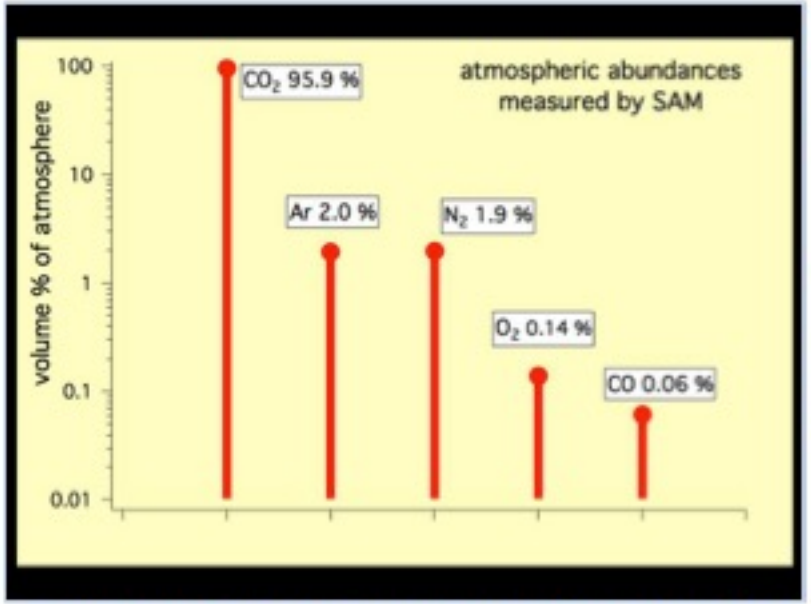
a

Product	T_{delay}, fs
CO+O	16
$C+O_2$	43
C+O+O	14/45



Yao, Y., Shushkov, P., Miller, T.F. et al. Direct dioxygen evolution in collisions of carbon dioxide with surfaces. Nat Commun 10, 2294 (2019). https://doi.org/10.1038/s41467-019-10342-6

In order to use the oxygenator, Mark has to obtain CO_2 from the Martian atmosphere. Thankfully, much of the Martian atmosphere is made up of CO_2. However, the task of obtaining CO_2 from the Martin atmosphere isn't as simple as it seems, this is because the pressure on Mars is much lower than the pressure of earth. The Martian atmospheric pressure is 0.095 psi (compare that to the pressure at sea level on earth 14.7 psi)



Atmospheric pressure on the surface of mars: 0.095 psi

Average Temperature on Mars: - 60° C

Atmospheric abundances of gasses on mars as measured by mass spectrometry on the Sample Analysis at Mars (SAM) suite on NASA's Mars rover. Data acquired October 2012. Figure used from NASA.gov mission pages

10. Calculate the partial pressure of CO_2 on the surface of Mars in units of atm (4 pts). **Show your work.**

Final Answer:

11. What is the density of CO_2 at this pressure (show your work for credit) (6 pts)? **Show your work.**

Developed with Dr. Chelsea Gustafson

“Just in Time Teaching”

“Just in Time Teaching” (but with Context!)

COMPLETED

Dimensional Analysis in Context!

Type: Homework
Start Date: Tuesday, Oct 5, 1:51 PM
Due Date: Wednesday, Oct 6, 11:59 PM
Late Deadline: Monday, Dec 6, 11:59 PM
7 problems
14 points

Time's Up!

1

Raw milk is stored at a dairy farm in a refrigerated cylindrical vat 6.50 feet wide and 12.5 feet high.

a) How many significant digits does the number 6.50 have?

b) You measure the level of milk to be 2.75 ft from the brim. What is the depth in feet of the milk in the tank? Include appropriate significant figures in your answer.

c) The formula for the volume of a cylinder is $V=\pi r^2 h$. Given that the milk is 9.8 ft deep, what is the volume of the milk in the vat, in ft^3? Include appropriate significant figures in your answer.

d) If the vat contains 3.3×10^2 ft^3 of milk, how many kg of milk does the vat contain, given that raw milk has a density of 1030 kg/m^3 ?

e) Given that the vat contains 9600 kg of milk, what is the mass in mg of the milk the vat contains? Include appropriate significant figures in your answer. Use scientific notation.

76 out of 76 students participated

66 out of 76 students correct

The largest gem-quality diamond ever found is the Cullinan diamond, found in 1905 in South Africa. The uncut diamond weighed in at 3106.75 carats.

a) How many grams did the uncut Cullinan diamond weigh? (1 carat = 0.2 grams exactly)

b) The Great Star of Africa, weighing in at 106.08 g, was the largest of the diamonds the Cullinan diamond was divided into. How many carats is this? (1 carat = 0.2 grams exactly)

“Just in Time Teaching” (but with Context!)

Time's Up

1

A Vitamin C packet is added to a glass of water containing 500.0 mL of solution. The Vitamin C packet contains 1000.0 mg of Vitamin C. What is the concentration of Vitamin C in ppm in the resultant solution? (Assume density of solution = 1.00 g/mL)

52 out of 57 students participated

49 out of 52 students correct

COMPLETED

Concentrations Further Practice

Type: Homework
Start Date: Wednesday, Mar 9, 9:11 AM
Due Date: Friday, Mar 11, 11:59 PM
18 problems
18 points

aktiv
Chemistry

Homework

Bringing Context to Homework Everyday

12

Helium-neon lasers emit very high spectral purity red light at a wavelength of 632.8 nm, and were used in LaserDisc players and supermarket checkout barcode scanners. A large-cavity He-Ne laser has a volume of 0.785 L, and is filled with a mixture of 90.0% helium and 10.0% neon at a pressure of 1.00 torr. What is the mass of helium (in mg) in this laser at 25.0 °C? (760 torr = 1 atm)

Use Dalton's Law of Partial Pressures and the ideal gas law to calculate the moles of one component.

71 out of 76 students participated

60 out of 71 students correct

Bringing Context to Homework Everyday

29

Use the following table of bond energies to calculate the enthalpy of combustion (in kJ) of acetylene (C_2H_2) gas in oxygen, based on the following chemical equation:

$C_2H_2(g) + 2.5O_2(g) \rightarrow 2CO_2(g) + H_2O(g)$

Calculate the enthalpy of the combustion from the enthalpies of formation.

56 out of 57 students participated

42 out of 56 students correct

Bringing Context to Homework Everyday

21

A sample of seawater from a tidal estuary was found to contain a concentration of 825 mg of chloride ion per kg of seawater. If the density of the sample was 1.035 g/mL, what is the molarity of the chloride ion?

45 out of 57 students participated

27 out of 45 students correct

22

Analysis of the water content of a lake found in the desert showed that it contained 17.5 percent chloride ion, and had a density of 1.23 g/mL. What is the molarity of the chloride ion in the water?

44 out of 57 students participated

31 out of 44 students correct

23

Morphine ($C_{17}H_{19}NO_3$) is a painkiller in the opiate family. A sample of morphine was discovered that had been diluted by mixing with table salt (sodium chloride). When 2.00 g of the mixture undergoes combustion, 3.23 g of CO_2 is produced. What is the mass percent of morphine in the mixture?

39 out of 57 students participated

13 out of 39 students correct

Bringing Context to Homework Everyday

10

A barrel of crude oil has a volume of 42 gallons, only approximately 45% of which is processed into gasoline. If your car achieves 25 mi/gal, and you drive 36,000 miles in one year, how many barrels of crude oil are required to run your car for a year?

76 out of 76 students participated

61 out of 76 students correct

11

A blood sample of 2.01 milliliters is collected from a patient to be analyzed for a platelet count. Human blood should have around 1.04 kg/L platelets. What is the expected mass in grams of platelets in the blood sample?

76 out of 76 students participated

71 out of 76 students correct

12

A particular medication dosage is 20.1 mg/kg of body weight. If 1.00 mL of the medication contains 50.0 mg, what is the volume in mL of the medication a child weighing 59.0 lb. should receive?

75 out of 76 students participated

65 out of 75 students correct

Bringing Context to Homework Everyday

13

A typical human body contains between 9 and 12 pints of blood. A woman's body contains 10.01 pints of blood and the density of hemoglobin in her blood is 13.5 g/dL. What is the mass in grams of hemoglobin that would be found in 10.01 pints of her blood? (1 gallon = 3.785 L, 1 gallon = 8 pints).

75 out of 76 students participated

67 out of 75 students correct

14

One of the fastest pitches ever thrown in Major League Baseball was by Aroldis Chapman and had a velocity of 105.1 miles/hour. How many seconds did it take this pitch to travel the 60 feet and 6 inches from the pitcher's mound to home plate? (1 mile = 5280 feet)

74 out of 76 students participated

61 out of 74 students correct

15

You are working to earn enough money for a vacation which costs 1200.0 dollars. Your take-home pay is $16.50/hour, but you only work 4-hour shifts each day. How many days will it take for you to earn enough money to pay for your vacation if all the money you earn goes towards your vacation?

74 out of 76 students participated

67 out of 74 students correct

Using Real World Topical Examples

The Olympics

1. For the Tokyo 2020 Olympics, the gold, silver, and bronze metals were made from 78 tons of recycled e-waste collected between 2017 and 2019.
   a. A gold medal contained 6.000 g of gold plated on 550.0 g of silver. As of Monday, the price of gold was $1765.15 per ounce, while the price of silver was $22.75 per ounce. How much is a Tokyo 2020 gold medal worth? (1 oz = 28.3495 g)

   _____

   b. As part of the e-waste campaign, 71 lbs of gold were collected. How much would all this gold be worth? (1 lb = 16 oz)

   _____

The Olympics

_____

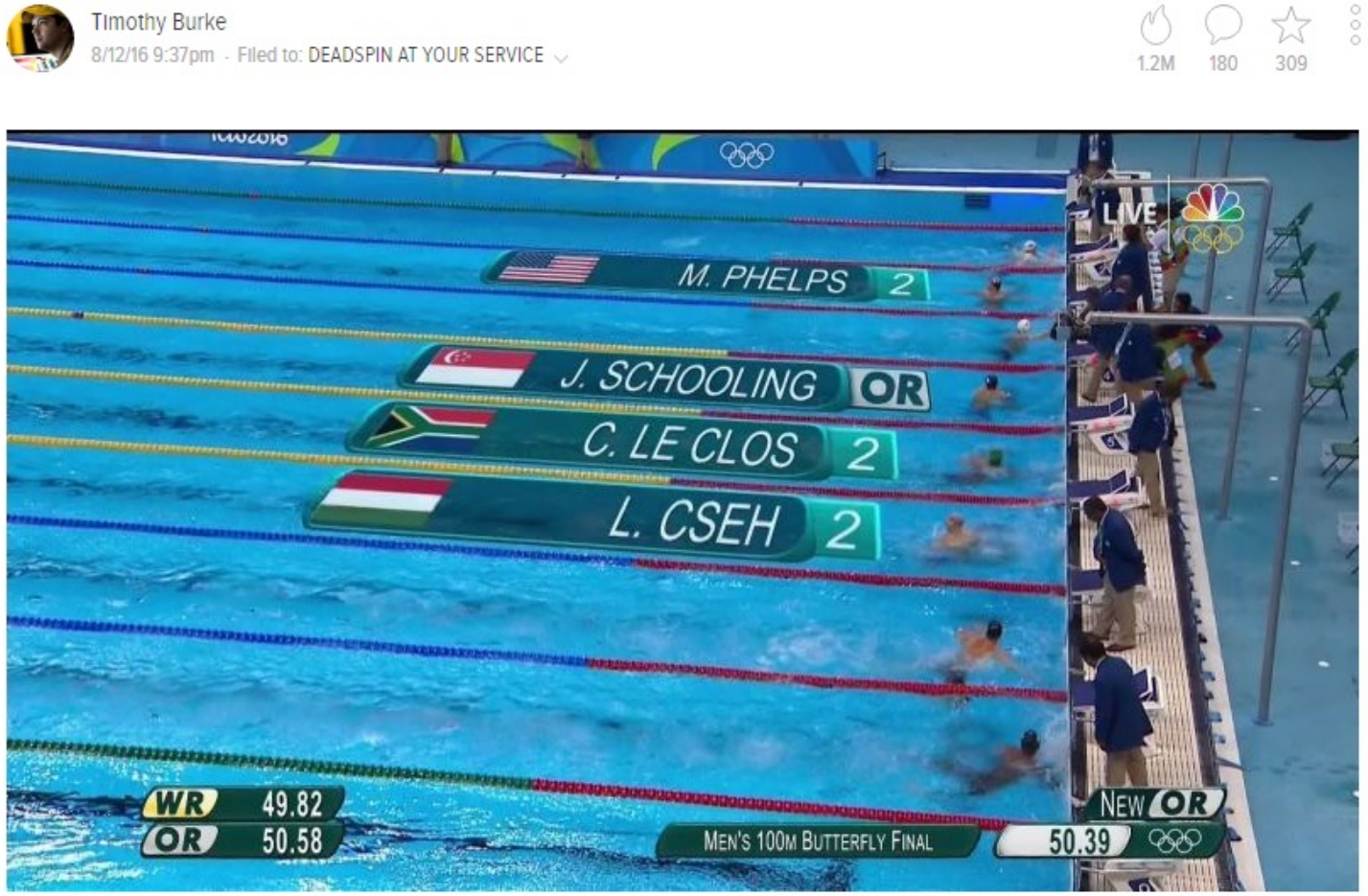
2. US Olympic swimmer Katie Ledecky is considered the greatest female swimmer of all time.
   a. While training for the 2020 Tokyo Olympics, broadcasters reported that she swam a total of 21732 miles. If Ledecky's signature distance, the 1500. m, was renamed as its own unit, the Ledecky, how many Ledecky's did she swim while training?
   (1 Ledecky = 1500 m; 1 km = 0.62 mi)

_____

   b. If Ledecky's average speed was 1.55 m/s, how many hours did she spend training?

_____

This Is Why There Are So Many Ties In Swimming



Timothy Burke
8/12/16 9:37pm · Filed to: DEADSPIN AT YOUR SERVICE

1.2M 180 309

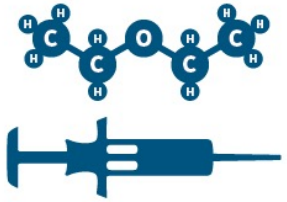
WHY?


Infographics

WHAT'S CHEMISTRY EVER DONE FOR US?

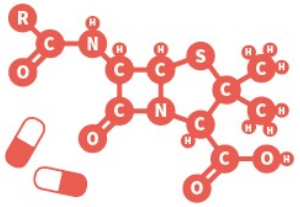
Science plays a vital role in our health, safety, economies, and governments. Here are just some of the ways chemistry impacts your everyday life.

ANAESTHETICS



We take surgery under anaesthesia for granted today, but the first anaesthetics were only discovered in the mid-1800s. Subsequently chemists have made many more.

ANTIBIOTICS

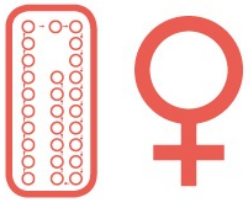


Bacterial infections were a common cause of death until antibiotics became available the 1930s. Chemists have since discovered numerous classes of antibiotics.

BATTERIES

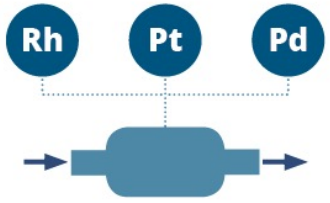
Both alkaline batteries and the lithium batteries in your phone were developed by chemists, and they're still working on making improvements to them.

BIRTH CONTROL



The first oral contraceptives became available in the 1960s after chemists developed synthetic compounds that could affect hormone levels in the body.

CATALYTIC CONVERTERS



Catalytic converters, developed in the 1960s and 70s, convert toxic gases and pollutants in car exhaust gas into less harmful emissions, helping to reduce pollution.

FERTILISERS

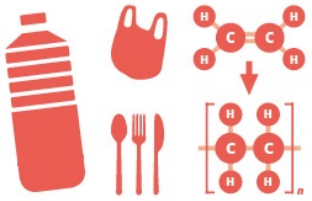
$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

The Haber process, developed in the early 1900s, creates 450 million tons of nitrogen fertiliser per year. This is vital for growing food and supporting the world's population.

FUELS

Petrol and diesel extracted from crude oil currently fuel the majority of our cars. Chemists are also investigating cleaner alternatives, such as hydrogen fuels.

PLASTICS

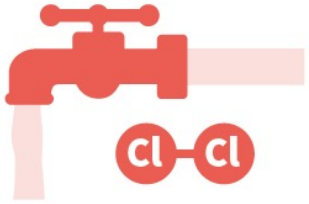


Plastics are everywhere in our day-to-day lives. Over the years chemists have developed a range of plastics for different uses, including clothing and food packaging.

SCREENS

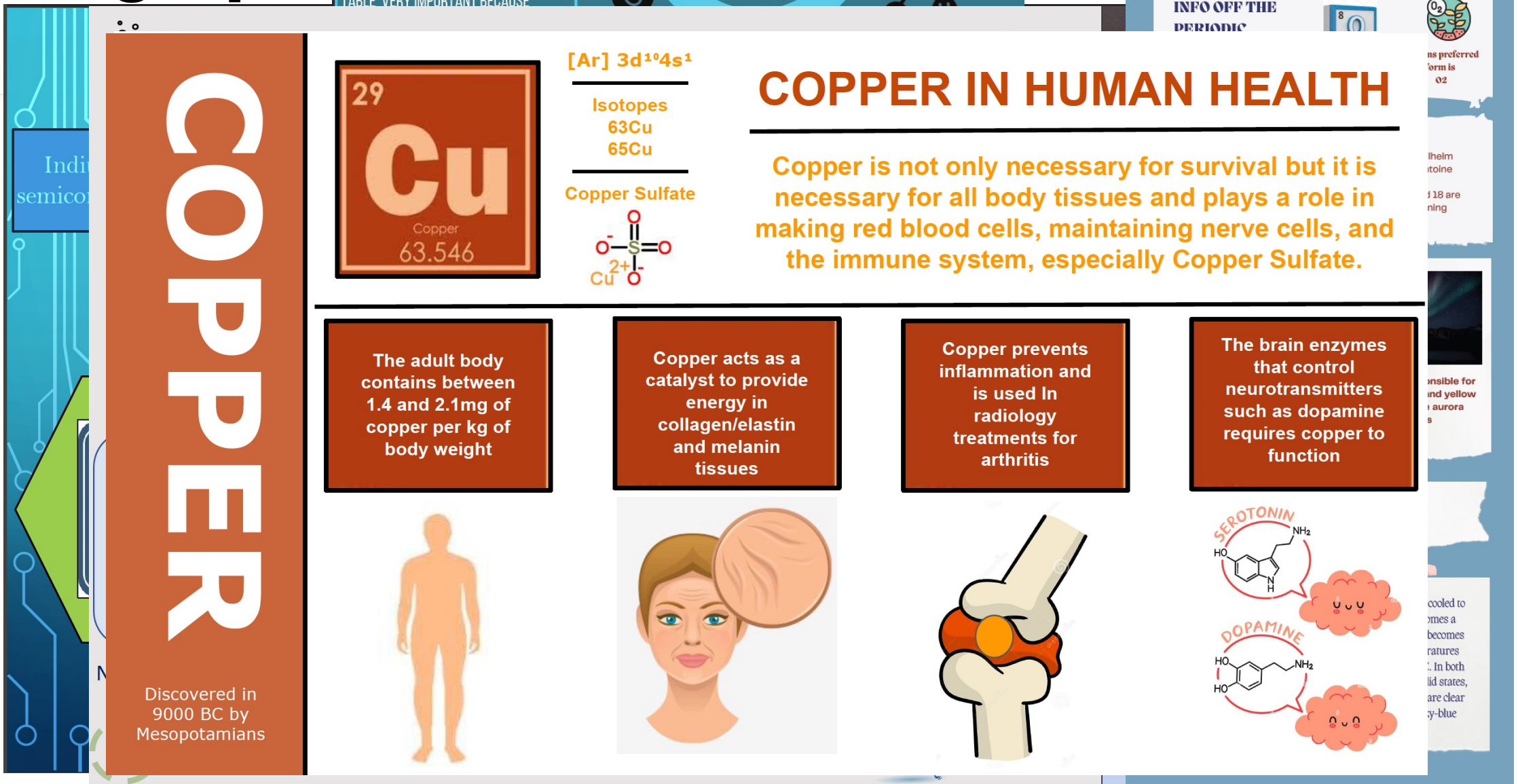
If you're reading this on a screen, you have chemists to thank. Different types of screens and touch screens all rely on materials developed by chemists to work.

WATER TREATMENT



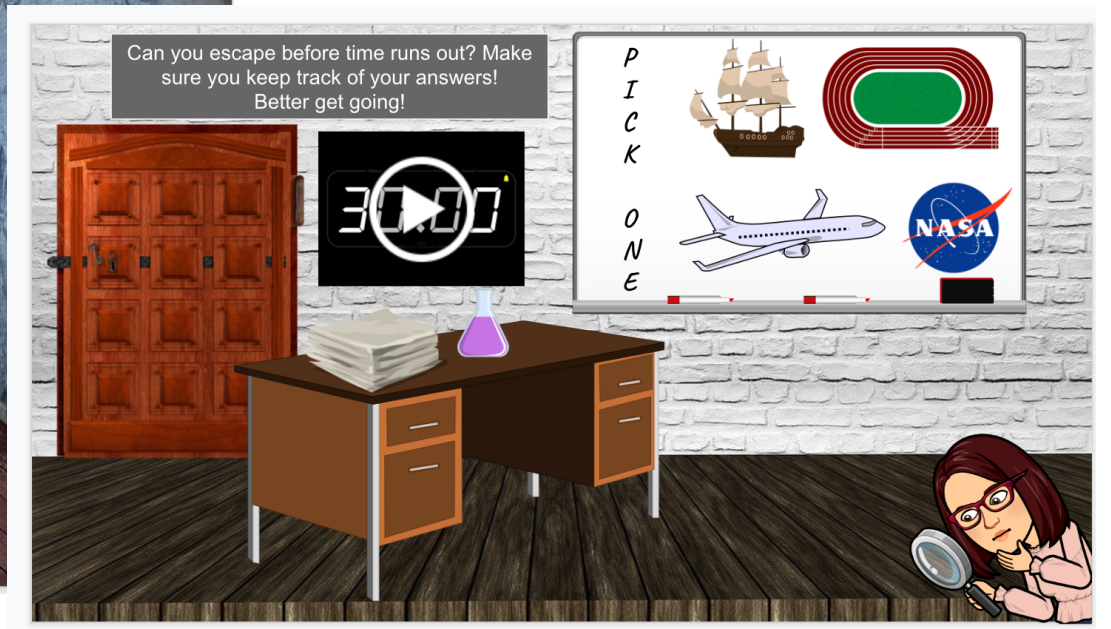
Water chlorination began in the early 1900s and kills bacteria and microbes, helping prevent the spread of diseases such as cholera. It also keeps swimming pools clear!

Infographi es



(You Can’t) Escape the Significant Figures!

Born of COVID-19



But what if it was real?

JOURNAL OF CHEMICAL EDUCATION

Laboratory Experiment

Cite This: *J. Chem. Educ.* 2019, 96, 985−991

pubs.acs.org/jchemeduc

Escape the Lab: An Interactive Escape-Room Game as a Laboratory Experiment

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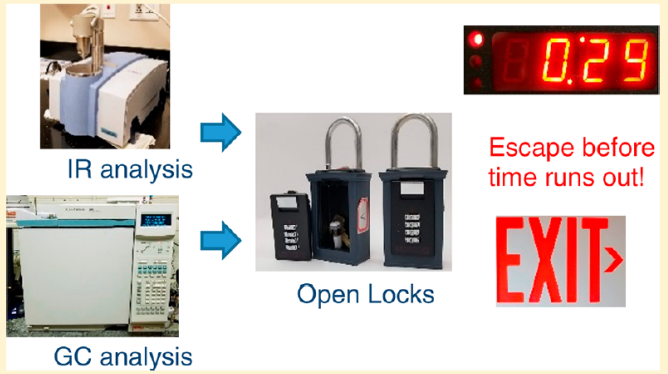
Supporting Information

ABSTRACT: An escape-room-game activity was introduced to foster team building and collaborative learning in a laboratory-experiment setting. The students were placed in a laboratory with clues and puzzles that required the students to use a sequence of analytical instruments in the laboratory in order to escape. The instruments utilized included a UV−vis spectrophotometer, an FTIR spectrometer, a gas chromatograph, and a gas chromatograph−mass spectrometer (GCMS). Student groups solved the puzzles and escaped by identifying a mystery compound at the end of the game. Student surveys indicated that the students enjoyed the lab and that they felt it was an effective review of laboratory techniques.



KEYWORDS: *General Public, Second-Year Undergraduate, Analytical Chemistry, Laboratory Instruction, Collaborative/Cooperative Learning, Humor/Puzzles/Games, UV−Vis Spectroscopy, IR Spectroscopy, Gas Chromatography, Mass Spectrometry*

Probably more complicated than it needed to be...

Probably more complicated than it needed to be...

Escape room logic

Aug 30, 2021 at 7

Clue #1

Mountain Dew Can

HW 2.1 #14 HW 2.2 #2 HW 2.3 #11

Code: 2 2 3

Leads to Money box w/ 

Campbell's Soup Can

HW 2.1 #16 HW 2.2 #1 HW 2.3 #2

Code: 3 3 3

Leads to money box w/ 

Ginger Ale Can

HW 2.1 #17 HW 2.2 #3 HW 2.3 #10

Code: 3 4 2

Leads to money box w/ 

Escape Room Planning

Jul 21, 2021 at 10:12 AM

Clue #1 - Diversion Can

- let students choose
- each type has a different Clue
- Each refers to the HW assignment from over the weekend.
  - 3 basic calculations (from weekend assignment)
  - how many sf in each?

(#1 #2 #3)

Clue #2 - Money Box (3 digit code)

- Contents
  - Digital scale (to 2 decimals)
  - Coins (6-7 per box)

need to order?

- Find average mass of coin

(#1 #2 #3 #4)

Clue #3 - Personal safe (4 digit code)

- Contents
  - Element Cubes
    - Zn, Sn, Pb, Ti, Ni, Al, C, Cu, Fe, W, Mo, Bi, Mg, Zr, Sb
  - Tape Measurer

need to order

- Find mass of block from volume + marked D

1/5

(#1 #2 #3)

But also a bit of fun...

Clue #1

The next clue you seek
is contained in a money box.
In order to get to it
you'll need to open the locks.

The prelab assignment
contains the codes you desire;
How many sig figs
did you require?

In the prelab activity
the sig figs you gave
to problem 1
is the first digit you crave

In the prelab activity
the sig figs in the answer
to problem number 3
gives the second coded chancer.

In the prelab activity
the number of digits
in problem 9
is the third and final widget.

With this code
you will be able to open
the money box you find
with this token:

Clue #1

The next clue you seek
is contained in a money box.
In order to get to it
you'll need to open the locks.

The prelab assignment
contains the codes you desire;
How many sig figs
did you require?

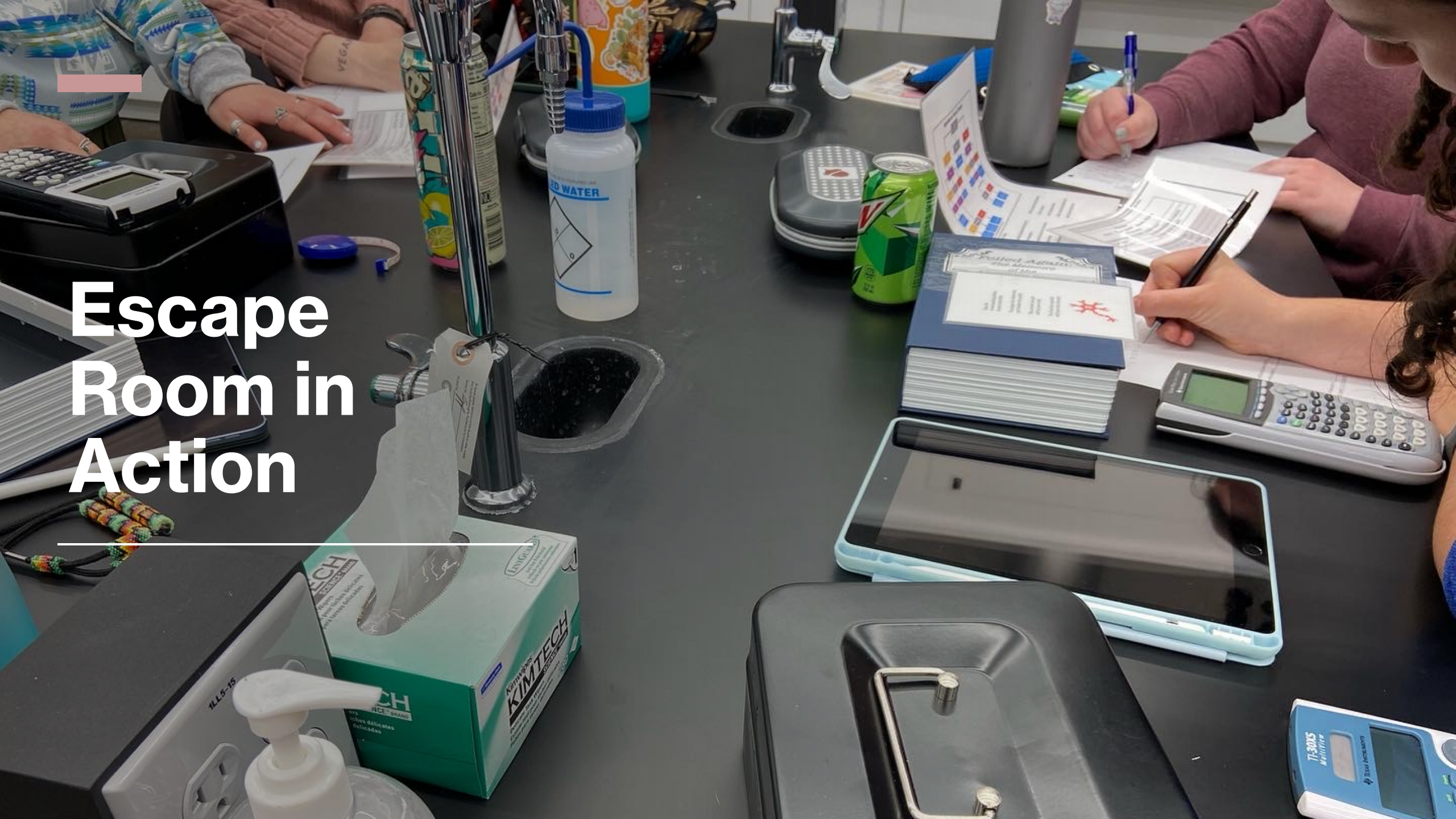
In the prelab activity
the sig figs you gave
to problem 4
is the first digit you crave

In the prelab activity
the sig figs in the answer
to problem number 6
gives the second coded chancer.

In the prelab activity
the number of digits
in problem 9
is the third and final widget.

With this code
you will be able to open
the money box you find
with this token:

But also a bit of fun...


Escape
Room in
Action
KIMTECH

questions

The Martian: https://bit.ly/3CSDGAt
Contact: addie.clark@oit.edu