Calculator Practice

Be Thankful Rome Fell, otherwise Your Calculator Might Be

607 + 108 = 715

Calculators

Calculators are tools

You still furnish the thinking

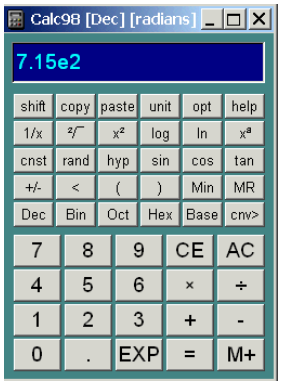
GI ➔ GO (Garbage In ==> Garbage Out)

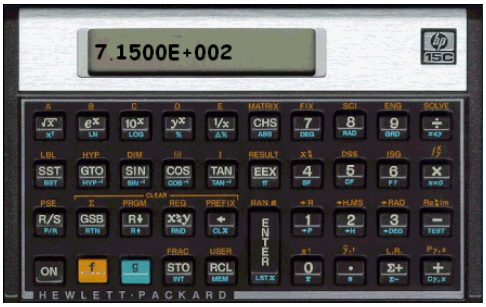
Basic
simple arithmetic

Scientific
exponents, logs, trig
scientific notation

Graphing
mathematical expressions

Algebraic	Reverse Polish Notation (RPN)
Texas Instruments (TI)	Hewlett Packard (HP)
Standard algebra	Reverse Polish Notation
Easiest to learn	Once learned, faster
Uses Brackets	No brackets
Has = sign	No =, auto display





Calculators

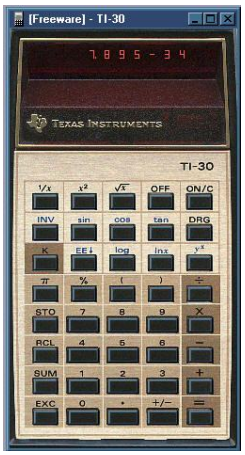
You should be able to do:

Arithmetic: +, -, x, /
Express as Scientific Notation (both + and – exponents)

Calculator circuitry requires separate entry for coefficient and exponent
User must enter data in manner that chip processes what user wants

Algebraic-Type Scientific Notation

Keystrokes for 7.15×10^2



7.15 EE 2

^
EXP
SCI
10^x
↑

NOT
7.15 x EE 2

Your Calculator's Key for exponents

Some TI calculators have both ^ and 10^x keys

Practice to ensure calculator display
Matches your input

Keystrokes for 7.895×10^{-34}

7.895 EE 34 Chs

^
EXP
SCI
10^x
↑

(+/-)

← Key for exponent

Your Calculator's Key for exponents

Practice to ensure calculator display matches your input

The "E"

Some calculators indicate exponents with an e (6.02 x e23)
This is 6.02×10^{23} (which is how it should be recorded)
It is incorrect to report this number as 6.02e23

Complex Calculations

Algebraic calculators may require ( ) to define order of operations
Need to practice with YOUR calculator to know when to use ( )
Do these as a continuous operation
Do not isolate each operation … should do as one continuous operation

Try these on YOUR calculator (the one you will use on exams at the testing center)

$10^2 + 10^2 = 2 \times 10^2$

$10^3 \times 10^5 = 10^8$

$10^5 \times 10^{-8} = 10^{-3}$

$10^9 / 10^4 = 10^5$

$10^7 / 10^{-8} = 10^{15}$

$10^{-5} / 10^{-7} = 10^2$

$10^0 / 10^3 = 10^{-3}$

$10^0 / 10^0 = 10^0$

$10^0 + 10^0 = 2$

$(15.9 \times 10^{-3}\ g) / (4.47 \times 10^{-3}\ mL) = 3.557$

$(7.24 \times 10^{-2}) \times [(2.68 \times 10^{7}) / (25.6 \times 10^{-4})] = 7.58 \times 10^{8}$

$[(125) / (4.20 \times 10^{-6})] \times [(458 \times 10^{-9})(345) / 10.3] = 4.57 \times 10^{2}$

$V_2 = \dfrac{(485\ torr)(14.7\ L)(273\ K)}{(368\ K)(760\ torr)} = 6.95922\ L \rightarrow 6.96\ L$

$\%\ Water = \dfrac{90.08}{(159.62 + 90.08)} \times 100 = 36.08\ \%$

Calculator confidence is a necessity

Compute answers for each of the following, with correct units.
Which cannot be calculated (manually) as written?

1. 15.3×10^{-7} m + 9.70×10^{-7} m **= 2.50×10^{-6} m or 25.0×10^{-7} m**
2. $(4.86 \times 10^{10}$ mm) x $(7.20 \times 10^{6}$ mm) **= 3.50×10^{17} mm^2**
3. $(6.49 \times 10^{-3}$ cm^3) / $(1.56 \times 10^{-4}$ cm^2) **= 4.16×10^{1} cm**
4. 2.33×10^{4} L + 6.18×10^{3} L **= 2.948×10^{4} L**
5. $(15.9 \times 10^{-3}$ g) / $(4.47 \times 10^{-3}$ mL) **= 3.557×10^{0} g/mL**
6. 2.14×10^{1} g/mL) x $(5.0 \times 10^{1}$ mL) **= 1.07×10^{3} g**
7. 5.22×10^{-3} g - 2.18×10^{-3} g **= 3.04×10^{-3} g**
8. 9.78×10^{4} km - 6.91×10^{2} km **= 9.71×10^{4} km**

4 & 8 cannot be calculated manually as written (addition with different exponents)

Remember ➔ Manually = exponents must be equal for + or –

Unit Conversions
Key

Write final desired unit to the right of the =
Write what units you know on the far left of the =
Is unit on the left of the = the same as the unit on the right?
    Yes, you are done … calculate result
    No, make it go away ("cancel units") with the next term
    Continue "canceling" until units on left = units on right
Write all conversions as linear "string" of fractions
Do not calculate anything until units agree!

Problems

The distance from the earth to the sun is 1.5×10^8 kilometers. Calculate this number as millimeters

Problem = mm?
We know: 1000 mm = 1 m; 1000 m = 1 km

Put known units on the left; desired units on right

1.5×10^8 km = ? mm

Add conversions ('per" expressions) to cancel units

$$1.5 \times 10^8 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1000 \text{ mm}}{1 \text{ m}} = ? \text{ mm}$$

Do the math

$$1.5 \times 10^8 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1000 \text{ mm}}{1 \text{ m}} = 1.5 \times 10^{14} \text{ mm}$$

Calculate the number of grams in 19.4×10^{-4} kilograms.

Problem = g?
We know: 1000 g = 1 kg

Put known units on the left; desired units on right

19.4×10^{-4} kg = ? g

Add conversions to cancel units

$$19.4 \times 10^{-4} \text{ kg} \times \frac{1000 \text{ g}}{1 \text{ kg}} = ? \text{ g}$$

Do the math

$$19.4 \times 10^{-4} \text{ kg} \times \frac{1000 \text{ g}}{1 \text{ kg}} = 1.94 \text{ g}$$

Calculate the number of milliliters of water in a pool that contains 5.0×10^7 L.

Problem = mL?
We know: 1000 mL = 1 L

Put known units on the left; desired units on right

5.0×10^7 L = ? mL

Add conversions to cancel units

$$5.0 \times 10^7 \text{ L} \times \frac{1000 \text{ mL}}{1 \text{ L}} = ? \text{ mL}$$

Do the math

$$5.0 \times 10^7 \text{ L} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 5.0 \times 10^{10} \text{ mL}$$

Calculate the number of ounces in 1.6×10^4 tons of coal.

Problem = oz?
We know: 16 oz = 1 lb; 2000 lb = 1 ton

Put known units on the left; desired units on right

1.6×10^4 tons = ? oz

Add conversions to cancel units

$$1.6 \times 10^4 \text{ ton} \times \frac{2000 \text{ lbs}}{1 \text{ ton}} \times \frac{16 \text{ oz}}{1 \text{ lbs}} = ? \text{ oz}$$

Do the math

$$1.6 \times 10^4 \text{ ton} \times \frac{2000 \text{ lbs}}{1 \text{ ton}} \times \frac{16 \text{ oz}}{1 \text{ lbs}} = 5.12 \times 10^8 \text{ oz}$$

Determine the number of centimeters in 8.6×10^{-9} km.

Problem = cm?
We know: 100 cm = 1 m; 1000 m = 1 km

Put known units on the left; desired units on right

8.6×10^{-9} km = ? cm

Add conversions to cancel units

$$8.6 \times 10^{-9} \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{100 \text{ cm}}{1 \text{ m}} = ? \text{ cm}$$

Do the math

$$8.6 \times 10^{-9} \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{100 \text{ cm}}{1 \text{ m}} = 8.6 \times 10^{-4} \text{ cm}$$

The human eye is most sensitive to light having a wavelength of 5.55×10^{-9} m. What is this wavelength in millimeters?

Problem = mm?
We know: 1000 mm = 1 m

Put known units on the left; desired units on right

5.55×10^{-9} m = ? mm

Add conversions to cancel units

$$5.55 \times 10^{-9} \text{ m} \times \frac{1000 \text{ mm}}{\text{m}} = ? \text{ mm}$$

Do the math

$$5.55 \times 10^{-9} \text{ m} \times \frac{1000 \text{ mm}}{1 \text{ m}} = 5.55 \times 10^{-6} \text{ mm}$$

An experiment requires 3.59×10^{-2} kg of a chemical. What is this mass in mg?

Problem = mg?
We know: 1000 mg = 1 g: 1000 g = 1 kg

Put known units on the left; desired units on right

3.59×10^{-2} kg = ? mg

Add conversions to cancel units

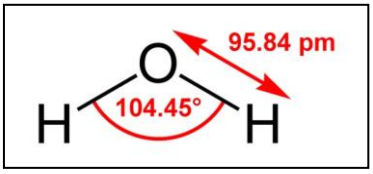
$$3.59 \times 10^{-2} \text{ kg} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1000 \text{ mg}}{1 \text{ g}} = ? \text{ mg}$$

Do the math

$$3.59 \times 10^{-2} \text{ kg} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1000 \text{ mg}}{1 \text{ g}} = 3.59 \times 10^{4} \text{ mg}$$

In a water molecule the distance between any one hydrogen atom and the oxygen atom is 9.6×10^{-11} m. What is the distance in cm?

Problem = cm?
We know: 100 cm = 1 m



Put known units on the left; desired units on right

9.6×10^{-11} m = ? cm

Add conversions to cancel units

$$9.6 \times 10^{-11} \text{ m} \times \frac{100 \text{ cm}}{1 \text{ m}} = ? \text{ cm}$$

Do the math

$$9.6 \times 10^{-11} \text{ m} \times \frac{100 \text{ cm}}{1 \text{ m}} = 9.6 \times 10^{-9} \text{ cm}$$

Static Electricity is ~ 10, 000 volts per inch. The longest documented lightning strike is 118 miles. What voltage is associated with this lightning strike?

$$118 \text{ miles} \times \frac{5{,}280 \text{ ft}}{1 \text{ mi}} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{10{,}000 \text{ volts}}{1 \text{ in}} = 7.48 \times 10^{10} \text{ volts}$$

This lightning strike covered the 118 miles in 1.93 seconds.
What is the lightning speed in miles / hour?

$$\frac{118 \text{ miles}}{1.93 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} = 2.20 \times 10^{5} \text{ mph}$$

Practice, Practice, Practice

NASA Says
Perfect Practice Prevents Poor Performance

Assignment

Continue Taking Unit 2 Practice Test
Blackboard only records highest score
Take until multiple 100's have been scored (questions are variable)
(Gives sense of test exam format and content)

The Practice Quiz is very similar to the Unit Exam
Success on Unit exam is directly related to practice exam experiences

Continue memorizing:
Conversion factors
Polyatomic Ions
Elemental Symbols

Units 4 & 5 have an enormous amount of memorization
… best to continue memorizing now!

In the Optional Software Folder (course Documents),

there are several Windows based (not tested beyond XP) calculator emulators.

These allow you to experiment (play with) different calculator formats.