

ANSWERS TO SIGNIFICANT FIGURES, EXPONENTS, AND SCIENTIFIC NOTATION

©2004, 1990 by David A. Katz. All rights reserved.
Permission for classroom use as long as the original copyright is included.

1. SIGNIFICANT FIGURES

Problems: Significant Figures

State the number of significant figures in each of the following measurements.

- | | | |
|----------------|------|------|
| a) 230 cm | ans. | a) 2 |
| b) 34.0 mL | | b) 3 |
| c) 0.625 g | | c) 3 |
| d) 56.0030 g | | d) 6 |
| e) 83400 km | | e) 3 |
| f) 4200. mL | | f) 4 |
| g) 0.000 620 m | | g) 3 |
| h) 0.0004 g | | h) 1 |

2. ROUNDING-OFF NUMBERS

Problems: Rounding-off numbers

Round off each of the following numbers to three significant figures.

- | | | |
|-----------------|------|-------------------|
| a) 63.351 | ans. | a) 63.4 |
| b) 0.0000004399 | | b) 0.000 000 440 |
| c) 10249000 | | c) 10 200 000 |
| d) 555.50 | | d) 556 |
| e) 0.0020285 | | e) 0.002 03 |
| f) 90960 | | f) 91 <u>0</u> 00 |
| g) 3.79745 | | g) 3.80 |
| h) 7296.38 | | h) 73 <u>0</u> 0 |

3. NUMERICAL OPERATIONS WITH SIGNIFICANT FIGURES

Problems: Numerical operations with significant figures

Perform the indicated mathematical operations in each of the following. Round off the answers to the proper number of significant figures.

- | | | |
|---|----------|-----------------------|
| a) $501.2 \text{ g} + 32.346 \text{ g} + 12.33 \text{ g}$ | answers: | a) 545.9 g |
| b) $14.25 \text{ cm} - 2.234 \text{ cm}$ | | b) 12.02 cm |
| c) $75.5 \text{ m} \times 8.66 \text{ m} \times 44 \text{ m}$ | | c) 29 000 m |
| d) $96.435 \text{ g} / 3.45 \text{ g}$ | | d) 28.0 g |
| e) $2334 \text{ cm} \times 1.020 \text{ cm} \times 21.2 \text{ cm}$ | | e) 50 500 cm |
| f) $8.6 \text{ mL} + 0.3520 \text{ mL} + 70.55 \text{ mL}$ | | f) 79.5 mL |
| g) $0.00164 \text{ L} / 0.0004 \text{ L}$ | | g) 4 L |
| h) $9.450 \text{ cm} - 0.3 \text{ mm}$ | | h) 94.2 mm or 9.42 cm |

4. EXPONENTS

Problems: Exponents

Evaluate the following exponential numbers:

- | | | |
|---------------------------------|----------|---------------------|
| a) 3^4 | answers: | a) 81 |
| b) 5^3 | | b) 125 |
| c) 10^2 | | c) 100 |
| d) 10^5 | | d) 100 000 |
| e) 10^8 | | e) 100 000 000 |
| f) $\left(\frac{3}{4}\right)^2$ | | f) $\frac{81}{256}$ |
| g) 3^{-2} | | g) 1/9 |
| h) 2^{-5} | | h) 1/32 |
| i) 10^{-2} | | i) 0.01 |
| j) 10^{-5} | | j) 0.000 01 |
| k) 10^{-8} | | k) 0.000 000 01 |

$$l) \left(\frac{3}{4}\right)^{-2}$$

$$m) 64^{2/3}$$

$$o) 4^{-3/2}$$

$$l) \frac{16}{9}$$

$$m) 16$$

$$n) 1/8$$

5. MATHEMATICAL OPERATIONS WITH EXPONENTIAL NUMBERS

Problems: Mathematical operations with exponential numbers

Evaluate each of the following:

$$a) 2^3 \times 2^2$$

$$b) 4^5 \times 4^{-3}$$

$$c) 2^{-5} / 2^{-3}$$

$$d) 4^3 / 4^5$$

$$e) (2^{-2})^2$$

$$f) (4^2)^5$$

$$g) 10^2 \times 10^6$$

$$h) 10^3 \times 10^5 \times 10^{-4}$$

$$i) 10^{-3} \times 10^{-2}$$

$$j) 10^4 / 10^7$$

$$k) 10^2 / 10^{-5}$$

$$l) 10^{-4} / 10^{-7}$$

$$m) (10^3)^2$$

$$n) (10^3)^{-4}$$

$$o) (10^{-3})^{-2}$$

$$p) \frac{(10^{-2} \times 10^6)}{10^8}$$

answers:

$$a) 2^5 = 32$$

$$b) 4^2 = 16$$

$$c) 2^{-2} = 1/4$$

$$d) 4^{-2} = 1/16$$

$$e) 2^{-4} = 1/16$$

$$f) 4^{10} = 1048576 \text{ (not rounded)}$$

$$g) 10^8 = 100\,000\,000$$

$$h) 10^4 = 10\,000$$

$$i) 10^{-5} = 0.00001$$

$$j) 10^{-3} = 0.001$$

$$k) 10^7 = 10\,000\,000$$

$$l) 10^3 = 1000$$

$$m) 10^6 = 1\,000\,000$$

$$n) 10^{-12} = 0.000\,000\,000\,001$$

$$o) 10^6 = 1\,000\,000$$

$$p) 10^{-4} = 0.0001$$

6. SCIENTIFIC NOTATION

Problems: Scientific notation

1. Write the following numbers in proper scientific notation form:

- | | |
|----------------------------|--------------------------------|
| a) 662 500 000 000 | ans. a) 6.625×10^{11} |
| b) 0.000 000 035 60 | b) 3.560×10^{-8} |
| c) 0.025 | c) 2.5×10^{-2} |
| d) 9800 | d) 9.8×10^3 |
| e) 2025×10^3 | e) 2.025×10^6 |
| f) 0.0980×10^{-2} | f) 9.80×10^{-4} |

2. Round off the following numbers as indicated and write the answer in scientific notation form:

- | | |
|---|--------------------|
| a) Round off 45 379 662 to 3 significant figures | ans. a) 45 400 000 |
| b) Round off 739966 to 4 significant figures | b) <u>740</u> 000 |
| c) Round off 0.025988 to 3 significant figures | c) 0.0260 |
| d) Round off 0.000 098 726 to 3 significant figures | d) 0.000 098 7 |

3. Express the following exponential numbers in non-exponential form:

- | | |
|---------------------------|------------------------|
| a) 7.90×10^5 | ans. a) 790 000 |
| b) 5.70×10^{-4} | b) 0.000 570 |
| c) 4.550×10^{-9} | c) 0.000 000 004 550 |
| d) 3.000×10^8 | d) 300 <u>0</u> 00 000 |
| e) 9.09×10^{-3} | e) 0.00909 |

7. NUMERICAL OPERATIONS WITH SCIENTIFIC NOTATION NUMBERS

Problems: Numerical operations with scientific notation numbers

Evaluate each of the following and express the answers in proper scientific notation form.

- | | |
|---|---|
| a) $(4.50 \times 10^6) \times (2.1 \times 10^{-2})$ | answers: a) 9.4×10^4 (sig fig) |
| b) $(5.50 \times 10^{-3}) \times (3.50 \times 10^{-4})$ | b) 1.92×10^{-6} |

- | | |
|---|---------------------------|
| c) $(1.5 \times 10^3) \times (6.6 \times 10^4)$ | c) 9.9×10^7 |
| d) $9000 / (2.5 \times 10^2)$ | d) 40 (1 sig fig) |
| e) $(4.48 \times 10^{-3}) / (6.60 \times 10^2)$ | e) 6.79×10^{-6} |
| f) $(8.5 \times 10^{-5}) / (3.5 \times 10^{-8})$ | f) 2.4×10^3 |
| g) $(2.00 \times 10^{-3})^4$ | g) 1.60×10^{-11} |
| h) $(3.0 \times 10^4)^3$ | h) 2.7×10^{13} |
| i) $(1.60 \times 10^{-5})^{-3}$ | io 2.44×10^{14} |
| j) $\frac{136\,000 \times 0.00030 \times 150}{0.080 \times 4200 \times 75000}$ | j) 2.4×10^{-4} |
| k) $(8\,000\,000)^{2/3}$ | k) 4×10^4 |
| l) $\frac{(0.000\,000\,4)^3 \times (6000)^2}{(0.000\,02)^4 \times (400)^{1/2}}$ | l) 7×10^5 |
| m) $(\sqrt[3]{8\,000\,000\,000}) \times (\sqrt[3]{0.027})$ | m) 6×10^2 |
| n) $4000 / (2.12 \times 10^{-3})^0$ | n) 4×10^3 |