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| 1. Which of the following numbers are *correctly* expressed in exponential notation? i. 43,200,000 = 4.32 × 107 ii. 0.000977 = 9.77 × 104 iii. 606,000 = 6.06 × 10–5 iv. 0.00000175 = 1.75 × 10–6   |  |  |  | | --- | --- | --- | |  | a. | i and iv | |  | b. | ii and iii | |  | c. | i and iii | |  | d. | ii and iv | |  | e. | All are incorrect |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.2, Goal 1. C. Incorrect. See Section 3.2, Goal 1. D. Incorrect. See Section 3.2, Goal 1. E. Incorrect. See Section 3.2, Goal 1. | | *POINTS:* | 1 | |

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| 2. Which of the following numbers are *correctly* expressed in ordinary decimal form? i. 6.21 × 105 = 621,000 ii. 7.28 × 106 = 0.00000728 iii. 9.03 × 10–4 = 0.000903 iv. 1.12 × 10–3 = 1120   |  |  |  | | --- | --- | --- | |  | a. | i and ii | |  | b. | i and iii | |  | c. | ii and iv | |  | d. | iii and iv | |  | e. | All are incorrect |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.2, Goal 1. B. Correct. C. Incorrect. See Section 3.2, Goal 1. D. Incorrect. See Section 3.2, Goal 1. E. Incorrect. See Section 3.2, Goal 1. | | *POINTS:* | 1 | |

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| 3. Which of the following numbers are *correctly* expressed in both exponential notation and ordinary decimal form? i. 4.09 × 10–3 = 4090 ii. 3.72 × 10–5 = 0.0000372 iii. 62,800 = 6.28 × 104 iv. 5,910,000 = 5.91 × 10–6   |  |  |  | | --- | --- | --- | |  | a. | i and ii | |  | b. | i and iii | |  | c. | ii and iii | |  | d. | iii and iv | |  | e. | All are incorrect |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.2, Goal 1. B. Incorrect. See Section 3.2, Goal 1. C. Correct. D. Incorrect. See Section 3.2, Goal 1. E. Incorrect. See Section 3.2, Goal 1. | | *POINTS:* | 1 | |

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| 4. Complete the following operation: 8.36 × 106 + 1.320 × 107   |  |  |  | | --- | --- | --- | |  | a. | 8.492 × 107 | |  | b. | 8.492 × 108 | |  | c. | 9.68 × 1013 | |  | d. | 2.156 × 108 | |  | e. | 2.156 × 107 |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.2, Goal 2. B. Incorrect. See Section 3.2, Goal 2. C. Incorrect. See Section 3.2, Goal 2. D. Incorrect. See Section 3.2, Goal 2. E. Correct. | | *POINTS:* | 1 | |

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| 5. Complete the following operation: 9.370 × 10–5 – 2.25 × 10–6   |  |  |  | | --- | --- | --- | |  | a. | 7.12 × 101 | |  | b. | 7.12 × 10–11 | |  | c. | –9.145 × 10–5 | |  | d. | 9.145 × 10–5 | |  | e. | 9.145 × 10–4 |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.2, Goal 2. B. Incorrect. See Section 3.2, Goal 2. C. Incorrect. See Section 3.2, Goal 2. D. Correct. E. Incorrect. See Section 3.2, Goal 2. | | *POINTS:* | 1 | |

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| 6. Complete the following operation:   |  |  |  | | --- | --- | --- | |  | a. | 4.07 | |  | b. | 0.246 | |  | c. | 2.46 × 10–6 | |  | d. | 1.24 × 10–4 | |  | e. | 1.24 × 10–15 |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.2, Goal 2. B. Correct. C. Incorrect. See Section 3.2, Goal 2. D. Incorrect. See Section 3.2, Goal 2. E. Incorrect. See Section 3.2, Goal 2. | | *POINTS:* | 1 | |

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| 7. Consider a situations in which where you are walking at 3.7 miles per hour. Which of the following is true of the **Per** expression given in this statement?   |  |  |  | | --- | --- | --- | |  | a. | 3.7 mi = 1 hr | |  | b. |  | |  | c. |  | |  | d. | Distance in miles is directly proportional to time in hours. | |  | e. | All of these are true for the given **Per** expression. |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.3, Goal 3. B. Incorrect. See Section 3.3, Goal 3. C. Incorrect. See Section 3.3, Goal 3. D. Correct. E. Incorrect. See Section 3.3, Goal 3. | | *POINTS:* | 1 | |

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| 8. How many fluid ounces are in a 2.5 gallon container? By definition, there are 4 qt/gal and 32 fl oz/qt.   |  |  |  | | --- | --- | --- | |  | a. | 0.0031 fl oz | |  | b. | 0.31 fl oz | |  | c. | 0.020 fl oz | |  | d. | 20 fl oz | |  | e. | 3.2 × 102 fl oz |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.3, Goal 3. B. Incorrect. See Section 3.3, Goal 3. C. Incorrect. See Section 3.3, Goal 3. D. Incorrect. See Section 3.3, Goal 3. E. Correct. | | *POINTS:* | 1 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 9. What will be the cost in dollars for photocopies if you have 32 pages in a booklet, you need 175 booklets, and copies are 4.5 cents each?   |  |  |  | | --- | --- | --- | |  | a. | $12.44 | |  | b. | $24.61 | |  | c. | $39.68 | |  | d. | $252 | |  | e. | $25,200 |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.3, Goal 3. B. Incorrect. See Section 3.3, Goal 3. C. Incorrect. See Section 3.3, Goal 3. D. Correct. E. Incorrect. See Section 3.3, Goal 3. | | *POINTS:* | 1 | |

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| 10. A 60-kg astronaut travels from the earth to the moon. If the gravitational attraction on the moon is of that on earth, what will be her mass on the moon?   |  |  |  | | --- | --- | --- | |  | a. | 0 kg | |  | b. | 10 kg | |  | c. | 60 kg | |  | d. | 360 kg | |  | e. | 3600 kg |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 4. B. Incorrect. See Section 3.4, Goal 4. C. Correct. D. Incorrect. See Section 3.4, Goal 4. E. Incorrect. See Section 3.4, Goal 4. | | *POINTS:* | 1 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 11. Which of the following would be the best unit to measure the mass of a molecule of sugar?   |  |  |  | | --- | --- | --- | |  | a. | pg | |  | b. | Mg | |  | c. | kg | |  | d. | g | |  | e. | mg |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.4, Goal 5. C. Incorrect. See Section 3.4, Goal 5. D. Incorrect. See Section 3.4, Goal 5. E. Incorrect. See Section 3.4, Goal 5. | | *POINTS:* | 1 | |

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| 12. Which of the following is/are metric units of *mass*? i. Pound ii. Gram iii. Ounce iv. Kilogram v. Centigram   |  |  |  | | --- | --- | --- | |  | a. | ii only | |  | b. | iv only | |  | c. | ii and iv | |  | d. | i and iii | |  | e. | ii, iv, and v |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 5. B. Incorrect. See Section 3.4, Goal 5. C. Incorrect. See Section 3.4, Goal 5. D. Incorrect. See Section 3.4, Goal 5. E. Correct. | | *POINTS:* | 1 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 13. Which of the following is/are metric units of *volume*? i. mL ii. L iii. cm3 iv. m v. kg   |  |  |  | | --- | --- | --- | |  | a. | i and ii | |  | b. | i, ii, and iii | |  | c. | ii only | |  | d. | iv and v | |  | e. | All are metric units of volume |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 5. B. Correct. C. Incorrect. See Section 3.4, Goal 5. D. Incorrect. See Section 3.4, Goal 5. E. Incorrect. See Section 3.4, Goal 5. | | *POINTS:* | 1 | |

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| 14. Convert 32.7 m to km, cm, and mm.   |  |  |  | | --- | --- | --- | |  | a. | 0.0327 km, 3270 cm, 32,700 mm | |  | b. | 3270 km, 32,700 cm, 0.0327 mm | |  | c. | 32,700 km, 0.0327 cm, 3270 mm | |  | d. | 32,700 km, 0.327 cm, 0.0327 mm | |  | e. | 32,700 km, 0.0327 cm, 0.327 mm |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.4, Goal 6. C. Incorrect. See Section 3.4, Goal 6. D. Incorrect. See Section 3.4, Goal 6. E. Incorrect. See Section 3.4, Goal 6. | | *POINTS:* | 1 | |

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| 15. Convert 1.57 g to kg, cg, and mg.   |  |  |  | | --- | --- | --- | |  | a. | 1570 kg, 0.0157 cg, 0.00157 mg | |  | b. | 0.00157 kg, 0.0157 cg, 1570 mg | |  | c. | 0.00157 kg, 157 cg, 1570 mg | |  | d. | 157 kg, 1570 cg, 0.00157 mg | |  | e. | 1570 kg, 0.00157 cg, 157 mg |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 6. B. Incorrect. See Section 3.4, Goal 6. C. Correct. D. Incorrect. See Section 3.4, Goal 6. E. Incorrect. See Section 3.4, Goal 6. | | *POINTS:* | 1 | |

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| 16. Convert 373 liters to milliliters, centiliters, and kiloliters.   |  |  |  | | --- | --- | --- | |  | a. | 0.373 mL, 373,000 cL, 37,300 kL | |  | b. | 37,300 mL, 0.373 cL, 373,000 kL | |  | c. | 373,000 mL, 37,300 cL, 0.373 kL | |  | d. | 0.373 mL, 3.73 cL, 373,000 kL | |  | e. | 3.73 mL, 0.373 cL, 373,000 kL |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 6. B. Incorrect. See Section 3.4, Goal 6. C. Correct. D. Incorrect. See Section 3.4, Goal 6. E. Incorrect. See Section 3.4, Goal 6. | | *POINTS:* | 1 | |

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| 17. Convert 17.4 nm to Mm, Gm, and Tm. 1 nm = 10–9 m, 1 Mm = 106 m, 1 Gm = 109 m, 1 Tm = 1012 m   |  |  |  | | --- | --- | --- | |  | a. | 1.74 × 10–14 Mm, 1.74 × 10–17 Gm, 1.74 × 10–20 Tm | |  | b. | 1.74 × 10–16 Mm, 1.74 ×10–19 Gm, 1.74 × 10–22 Tm | |  | c. | 1.74 × 1016 Mm, 1.74 × 1019 Gm, 1.74 × 1022 Tm | |  | d. | 1.74 × 1018 Mm, 1.74 ×1021 Gm, 1.74 × 1024 Tm | |  | e. | 1.74 × 104 Mm, 1.74 × 101 Gm, 1.74 × 10–2 Tm |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.4, Goal 7. C. Incorrect. See Section 3.4, Goal 7. D. Incorrect. See Section 3.4, Goal 7. E. Incorrect. See Section 3.4, Goal 7. | | *POINTS:* | 1 | |

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| 18. Convert 9.16 kg to Gg, hg, and µg. 1 Gg = 109 g, 1 hg = 102 g, 1 µg = 10–6 g   |  |  |  | | --- | --- | --- | |  | a. | 9.16 × 1012 Gg, 9.16 × 105 hg, 9.16 × 10–3 µg | |  | b. | 9.16 × 10–12 Gg, 9.16 × 10–5 hg, 9.16 × 103 µg | |  | c. | 9.16 × 106 Gg, 9.16 × 10–1 hg, 9.16 × 10–9 µg | |  | d. | 9.16 × 10–6 Gg, 9.16 × 101 hg, 9.16 × 109 µg | |  | e. | 9.16 × 10–9 Gg, 9.16 × 10–2 hg, 9.16 × 106 µg |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 7. B. Incorrect. See Section 3.4, Goal 7. C. Incorrect. See Section 3.4, Goal 7. D. Correct. E. Incorrect. See Section 3.4, Goal 7. | | *POINTS:* | 1 | |

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| 19. Convert 3.77 × 108 pL to mL, daL, and dL. 1 pL = 10–12 L, 1 dL = 10–1 L, 1 daL = 101 L   |  |  |  | | --- | --- | --- | |  | a. | 3.77 × 1023 mL, 3.77 × 1019 daL, 3.77 × 1021 dL | |  | b. | 3.77 × 1017 mL, 3.77 × 1021 daL, 3.77 × 1019 dL | |  | c. | 3.77 × 10–1 mL, 3.77 × 10–5 daL, 3.77 × 10–3 dL | |  | d. | 3.77 × 10–4 mL, 3.77 × 10–5 daL, 3.77 × 10–3 dL | |  | e. | 3.77 × 10–7 mL, 3.77 × 10–3 daL, 3.77 × 10–5 dL |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 7. B. Incorrect. See Section 3.4, Goal 7. C. Correct. D. Incorrect. See Section 3.4, Goal 7. E. Incorrect. See Section 3.4, Goal 7. | | *POINTS:* | 1 | |

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| 20. Convert 275 kg to g, cg, and mg.   |  |  |  | | --- | --- | --- | |  | a. | 2.75 × 10–1 g, 2.75 × 10–3 cg, 2.75 × 10–4 mg | |  | b. | 2.75 ×10–1 g, 2.75 × 101 cg, 2.75 × 102 mg | |  | c. | 2.75 × 105 g, 2.75 × 103 cg, 2.75 × 102 mg | |  | d. | 2.75 × 105 g, 2.75 × 108 cg, 2.75 × 107 mg | |  | e. | 2.75 × 105 g, 2.75 × 107 cg, 2.75 × 108 mg |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.4, Goal 8. B. Incorrect. See Section 3.4, Goal 8. C. Incorrect. See Section 3.4, Goal 8. D. Incorrect. See Section 3.4, Goal 8. E. Correct. | | *POINTS:* | 1 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 21. Convert 5.01 × 103 cm to km, m, and mm.   |  |  |  | | --- | --- | --- | |  | a. | 5.01 × 10–2 km, 5.01 × 101 m, 5.01 × 104 mm | |  | b. | 5.01 × 10–2 km, 5.01 × 101 m, 5.01 × 103 mm | |  | c. | 5.01 × 102 km, 5.01 × 105 m, 5.01 × 108 mm | |  | d. | 5.01 × 104 km, 5.01 × 101 m, 5.01 × 10–2 mm | |  | e. | 5.01 × 108 km, 5.01 × 105 m, 5.01 × 102 mm |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.4, Goal 8. C. Incorrect. See Section 3.4, Goal 8. D. Incorrect. See Section 3.4, Goal 8. E. Incorrect. See Section 3.4, Goal 8. | | *POINTS:* | 1 | |

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| 22. Consider the following measured number.  640,000 m  If this measurement were made to the nearest km (± 1 km), how should the answer be expressed in exponential notation?   |  |  |  | | --- | --- | --- | |  | a. | 6.4 × 105 m | |  | b. | 6.40 × 105 m | |  | c. | 6.400 × 105 m | |  | d. | 6.4000 × 105 m | |  | e. | 6.40000 × 105 m |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 9. B. Correct.. C. Incorrect. See Section 3.5, Goal 9 D. Incorrect. See Section 3.5, Goal 9. E. Incorrect. See Section 3.5, Goal 9. | | *POINTS:* | 1 | |

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| 23. How many significant figures are in each of the following quantities? i. 0.00062 kg ii. 0.720 in. iii. 4.150 × 103 lb iv. 0.305 m3   |  |  |  | | --- | --- | --- | |  | a. | i. 2 ii. 2 iii. 3 iv. 3 | |  | b. | i. 2 ii. 2 iii. 4 iv. 3 | |  | c. | i. 5 ii. 3 iii. 4 iv. 3 | |  | d. | i. 2 ii. 3 iii. 4 iv. 3 | |  | e. | i. 5 ii. 3 iii. 4 iv. 3 |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 9. B. Incorrect. See Section 3.5, Goal 9. C. Incorrect. See Section 3.5, Goal 9. D. Correct. E. Incorrect. See Section 3.5, Goal 9. | | *POINTS:* | 1 | |

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| 24. The meter stick in the image is being used to measure the length of a piece of wood.  How many significant figures should be used to express this measured length?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 9. B. Incorrect. See Section 3.5, Goal 9. C. Correct, D. Incorrect. See Section 3.5, Goal 9. E. Incorrect. See Section 3.5, Goal 9. | | *POINTS:* | 1 | |

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| 25. Round off each of the following quantities to two significant figures: i. 32,175,000 µm ii. 3.3000 × 107 kg iii. 0.04721 m iv. 8751 cm3   |  |  |  | | --- | --- | --- | |  | a. | i. 3.2 µm ii. 3.3 × 107 kg iii. 0.047 m iv. 8.8 × 103 cm3 | |  | b. | i. 3.2 × 107 µm ii. 3.3 × 107 kg iii. 0.047 m iv. 8.8 × 103 cm3 | |  | c. | i. 3.2 × 107 µm ii. 3.3 × 107 kg iii. 0.047 m iv. 8.7 × 103 cm3 | |  | d. | i. 3.2 × 107 µm ii. 3.3 × 107 kg iii. 0.05 m iv. 8.8 × 103 cm3 | |  | e. | i. 3.2 × 107 µm ii. 3.3 kg iii. 0.047 m iv. 8.8 × 103 cm3 |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 10. B. Correct. C. Incorrect. See Section 3.5, Goal 10. D. Incorrect. See Section 3.5, Goal 10. E. Incorrect. See Section 3.5, Goal 10. | | *POINTS:* | 1 | |

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| 26. Which of the following quantities is/are correctly rounded to three significant figures? i. 0.0277 mL = 0.028 mL ii. 2.1295 km = 2.12 km iii. 3.986 × 104 cm3 = 3.99 × 104 cm3 iv. 0.003398216 in = 0.003 in   |  |  |  | | --- | --- | --- | |  | a. | i, ii, and iv | |  | b. | ii and iii | |  | c. | iii only | |  | d. | All are correctly rounded to three significant figures | |  | e. | None is correctly rounded to three significant figures |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 10. B. Incorrect. See Section 3.5, Goal 10. C. Correct. D. Incorrect. See Section 3.5, Goal 10. E. Incorrect. See Section 3.5, Goal 10. | | *POINTS:* | 1 | |

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| 27. A solution is prepared by adding 1.77 grams of sodium nitrate, 2.4 grams of potassium chloride, and 0.973 gram of ammonium nitrite to 255 grams of water. Calculate the total mass of the solution and express the sum in the proper number of significant figures.   |  |  |  | | --- | --- | --- | |  | a. | 2.6 × 102 g | |  | b. | 2.60 × 102 g | |  | c. | 2.601 × 102 g | |  | d. | 2.6014 × 102 g | |  | e. | 2.60143 × 102 g |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 11. B. Correct. C. Incorrect. See Section 3.5, Goal 11. D. Incorrect. See Section 3.5, Goal 11. E. Incorrect. See Section 3.5, Goal 11. | | *POINTS:* | 1 | |

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| 28. An empty crucible has a mass of 25.70 g. After some copper(II) sulfate pentahydrate is added, the mass is 28.855 g. What is the mass of the copper(II) sulfate pentahydrate in the crucible?   |  |  |  | | --- | --- | --- | |  | a. | 3 g | |  | b. | 3.2 g | |  | c. | 3.16 g | |  | d. | 3.155 g | |  | e. | 3.1550 g |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 11. B. Incorrect. See Section 3.5, Goal 11. C. Correct. D. Incorrect. See Section 3.5, Goal 11. E. Incorrect. See Section 3.5, Goal 11. | | *POINTS:* | 1 | |

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| 29. Assuming that all are measured quantities, complete the following operation and express the result in the correct number of significant figures.   |  |  |  | | --- | --- | --- | |  | a. | 3.27 × 102 | |  | b. | 3.271 × 102 | |  | c. | 5.4 × 104 | |  | d. | 5.38 × 104 | |  | e. | 5.380 × 104 |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.5, Goal 12. B. Incorrect. See Section 3.5, Goal 12. C. Incorrect. See Section 3.5, Goal 12. D. Correct. E. Incorrect. See Section 3.5, Goal 12. | | *POINTS:* | 1 | |

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| 30. Consider that . If 1559 cm is converted to inches, how many significant figures should be in the answer?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Sections 3.3 and 3.5, Goals 3 and 12. B. Incorrect. See Sections 3.3 and 3.5, Goals 3 and 12. C. Incorrect. See Sections 3.3 and 3.5, Goals 3 and 12. D. Correct. E. Incorrect. See Sections 3.3 and 3.5, Goals 3 and 12. | | *POINTS:* | 1 | |

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| 31. A filled shipping box weighs 12 lb. How many kilograms is this? 1 lb = 453.59237 g   |  |  |  | | --- | --- | --- | |  | a. | 5.4 kg | |  | b. | 5.4 × 103 kg | |  | c. | 5.4 × 106 kg | |  | d. | 26 kg | |  | e. | 2.6 × 10–5 kg |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.6, Goal 13. C. Incorrect. See Section 3.6, Goal 13. D. Incorrect. See Section 3.6, Goal 13. E. Incorrect. See Section 3.6, Goal 13. | | *POINTS:* | 1 | |

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| 32. The Willis Tower in Chicago is 1451 ft tall. How high is this in meters? 1 in. = 2.54 cm   |  |  |  | | --- | --- | --- | |  | a. | 68.55 m | |  | b. | 0.4760 m | |  | c. | 4.423 × 106 m | |  | d. | 4.423 × 104 m | |  | e. | 442.3 m |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.6, Goal 13. B. Incorrect. See Section 3.6, Goal 13. C. Incorrect. See Section 3.6, Goal 13. D. Incorrect. See Section 3.6, Goal 13. E. Correct. | | *POINTS:* | 1 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. A small gasoline can has a capacity of 0.50 gal. Express this in milliliters. 1 gal = 3.785411784 L   |  |  |  | | --- | --- | --- | |  | a. | 1.9 × 103 mL | |  | b. | 1.9 × 10–3 mL | |  | c. | 1.9 mL | |  | d. | 1.3 × 102 mL | |  | e. | 1.3 × 10–4 mL |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.6, Goal 13. C. Incorrect. See Section 3.6, Goal 13. D. Incorrect. See Section 3.6, Goal 13. E. Incorrect. See Section 3.6, Goal 13. | | *POINTS:* | 1 | |

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| 34. The melting point of iron is 1535.0°C. What is the Fahrenheit equivalent of this temperature?   |  |  |  | | --- | --- | --- | |  | a. | 821.0°F | |  | b. | 885.0°F | |  | c. | 2731.0°F | |  | d. | 2795.0°F | |  | e. | 2821.0°F |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.7, Goal 14. B. Incorrect. See Section 3.7, Goal 14. C. Incorrect. See Section 3.7, Goal 14. D. Correct. E. Incorrect. See Section 3.7, Goal 14. | | *POINTS:* | 1 | |

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| 35. Consider the three thermometers shown in the image.  Which of the following equations correctly represents the equation relating reading on the A thermometer to the B thermometer?   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. |  |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.7, Goal 14. B. Correct. C. Incorrect. See Section 3.7, Goal 14. D. Incorrect. See Section 3.7, Goal 14. E. Incorrect. See Section 3.7, Goal 14. | | *POINTS:* | 1 | |

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| 36. Acetone boils at 56 °C. Express this temperature in kelvins.   |  |  |  | | --- | --- | --- | |  | a. | –329 K | |  | b. | –217 K | |  | c. | 133 K | |  | d. | 217 K | |  | e. | 329 K |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.7, Goal 15. B. Incorrect. See Section 3.7, Goal 15. C. Incorrect. See Section 3.7, Goal 15. D. Incorrect. See Section 3.7, Goal 15. E. Correct. | | *POINTS:* | 1 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 37. The temperature in the laboratory is posted as 295 K. What is this temperature in degrees Celsius?   |  |  |  | | --- | --- | --- | |  | a. | 22 °C | |  | b. | –22 °C | |  | c. | 568 °C | |  | d. | –568 °C | |  | e. | 563 °C |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.7, Goal 15. C. Incorrect. See Section 3.7, Goal 15. D. Incorrect. See Section 3.7, Goal 15. E. Incorrect. See Section 3.7, Goal 15. | | *POINTS:* | 1 | |

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| 38. Which of the following is the best mathematical expression to represent the fact that the pressure of a gas (P), at constant volume and temperature, is directly proportional to the mass of that gas (m)?   |  |  |  | | --- | --- | --- | |  | a. | P ∝ m | |  | b. | P = m | |  | c. | P  m | |  | d. | P ≈ m | |  | e. | P ∈ m |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.8, Goal 16. C. Incorrect. See Section 3.8, Goal 16. D. Incorrect. See Section 3.8, Goal 16. E. Incorrect. See Section 3.8, Goal 16. | | *POINTS:* | 1 | |

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| 39. Consider the following graph.  For the relationship shown on the graph, what are the values of m and b, respectively, in the equation, y = mx + b?   |  |  |  | | --- | --- | --- | |  | a. | 8.00, 5.00 | |  | b. | 8.00, –1.60 | |  | c. | 1.60, 5.00 | |  | d. | 0.625, 8.00 | |  | e. | –1.60, 8.00 |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 19. B. Incorrect. See Section 3.8, Goal 19. C. Incorrect. See Section 3.8, Goal 19. D. Incorrect. See Section 3.8, Goal 19. E. Correct. | | *POINTS:* | 1 | |

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| 40. Examine the following graph.  What is the value of x when y = 2.00?   |  |  |  | | --- | --- | --- | |  | a. | 2.00 | |  | b. | 3.75 | |  | c. | 11.3 | |  | d. | 5.00 | |  | e. | 4.00 |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 18. B. Correct. C. Incorrect. See Section 3.8, Goal 18. D. Incorrect. See Section 3.8, Goal 18. E. Incorrect. See Section 3.8, Goal 18. | | *POINTS:* | 1 | |

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| 41. Faraday’s Law of Electrolysis states that the mass of a substance produced at an electrode during electrolysis (m) is directly proportional to the number of moles of electrons transferred at that electrode (n). Which of the following equations correctly characterizes the relation?   |  |  |  | | --- | --- | --- | |  | a. | m = k × n | |  | b. | As the number of electrons transferred increases the mass deposited decreases. | |  | c. | There is one conversion factor possible that relates m and n. | |  | d. |  | |  | e. | All of the above correctly describe this relation. |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct. B. Incorrect. See Section 3.8, Goal 17. C. Incorrect. See Section 3.8, Goal 17. D. Incorrect. See Section 3.8, Goal 17. E. Incorrect. See Section 3.8, Goal 17. | | *POINTS:* | 1 | |

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| 42. The energy of a photon of light is directly proportional to the frequency of that photon. Calculate the value of the proportionality constant, given that a photon of energy 4.4 × 10–19 J has a frequency of 6.7 × 1014/s.   |  |  |  | | --- | --- | --- | |  | a. | 2.9 × 10–4 J/s | |  | b. | 2.9 × 10–4 J . s | |  | c. | 2.9 × 10–4 s/J | |  | d. | 6.6 × 10–34 J/s | |  | e. | 6.6 × 10–34 J . s |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 18. B. Incorrect. See Section 3.8, Goal 18. C. Incorrect. See Section 3.8, Goal 18. D. Incorrect. See Section 3.8, Goal 18. E. Correct. | | *POINTS:* | 1 | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 43. Distance and time are directly proportional for an object moving a constant speed. What is the value of the proportionality constant for a car that travels 133 miles in 2.5 hours?   |  |  |  | | --- | --- | --- | |  | a. | 3.3 × 102 mi • hr | |  | b. | 1.4 × 102 mi • hr | |  | c. | 1.3 × 102 mi • hr | |  | d. | 53 mi/hr | |  | e. | 0.019 hr/mi |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 18. B. Incorrect. See Section 3.8, Goal 18. C. Incorrect. See Section 3.8, Goal 18. D. Correct. E. Incorrect. See Section 3.8, Goal 18. | | *POINTS:* | 1 | |

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| 44. The defining equation for density (D) is D = .  Which of the following represents units in which density might be expressed?   |  |  |  | | --- | --- | --- | |  | a. | liters/seconds | |  | b. | liters/grams | |  | c. | milligrams/miles | |  | d. | kilograms/pints | |  | e. | density/cubic centimeters |  |  |  | | --- | --- | | *ANSWER:* | d | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 19. B. Incorrect. See Section 3.8, Goal 19. C. Incorrect. See Section 3.8, Goal 19. D. Correct. E. Incorrect. See Section 3.8, Goal 19. | | *POINTS:* | 1 | |

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| 45. For a fixed amount of a gas at constant volume, the pressure (P) of the gas is directly proportional to its absolute temperature (T). Which of the following is the best choice for units of the proportionality constant that relates P and T in an equation?   |  |  |  | | --- | --- | --- | |  | a. | atm/K | |  | b. | atm/°C | |  | c. | K/atm | |  | d. | °C/atm | |  | e. | °C • atm |  |  |  | | --- | --- | | *ANSWER:* | a | | *RATIONALE:* | Analysis: A. Correct B. Incorrect. See Section 3.8, Goal 19. C. Incorrect. See Section 3.8, Goal 19. D. Incorrect. See Section 3.8, Goal 19. E. Incorrect. See Section 3.8, Goal 19. | | *POINTS:* | 1 | |

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| 46. Pay is directly proportional to hours worked. What units would be appropriate for the proportionality constant in an equation that relates pay and hours worked?   |  |  |  | | --- | --- | --- | |  | a. | dollars × hours | |  | b. | hours × dollars | |  | c. | dollars/hour | |  | d. | hours/dollar | |  | e. | hours2/dollar |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 19. B. Incorrect. See Section 3.8, Goal 19. C. Correct. D. Incorrect. See Section 3.8, Goal 19. E. Incorrect. See Section 3.8, Goal 19. | | *POINTS:* | 1 | |

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| 47. Calculate the density of copper, given that a 35.4 cm3 block of the pure metal has a mass of 316 g.   |  |  |  | | --- | --- | --- | |  | a. | 0.112 g/cm3 | |  | b. | 1.00 g/cm3 | |  | c. | 8.93 g/cm3 | |  | d. | 8.94 × 10–5 g/cm3 | |  | e. | 1.12 × 104 g/cm3 |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 20. B. Incorrect. See Section 3.8, Goal 20. C. Correct. D. Incorrect. See Section 3.8, Goal 20. E. Incorrect. See Section 3.8, Goal 20. | | *POINTS:* | 1 | |

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| 48. What is the volume of a 5.00 g pure aluminum cylinder if its density is 2.70 g/cm3?   |  |  |  | | --- | --- | --- | |  | a. | 5.00 cm3 | |  | b. | 1.85 cm3 | |  | c. | 13.5 cm3 | |  | d. | 0.540 cm3 | |  | e. | 7.41 × 10–2 cm3 |  |  |  | | --- | --- | | *ANSWER:* | b | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 20. B. Correct. C. Incorrect. See Section 3.8, Goal 20. D. Incorrect. See Section 3.8, Goal 20. E. Incorrect. See Section 3.8, Goal 20. | | *POINTS:* | 1 | |

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| 49. What is the volume of 22 g of gold, which has a density of 19.3 g/cm3?   |  |  |  | | --- | --- | --- | |  | a. | 21 cm3 | |  | b. | 3 cm3 | |  | c. | 1.1 cm3 | |  | d. | 0.88 cm3 | |  | e. | 4.2 × 102 cm3 |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 20. B. Incorrect. See Section 3.8, Goal 20. C. Correct. D. Incorrect. See Section 3.8, Goal 20. E. Incorrect. See Section 3.8, Goal 20. | | *POINTS:* | 1 | |

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| 50. Find the mass of 35.7 mL of benzene if its density is 0.877 g/mL.   |  |  |  | | --- | --- | --- | |  | a. | 2.46 × 10–2 g | |  | b. | 3.19 × 10–2 g | |  | c. | 40.7 g | |  | d. | 35.7 g | |  | e. | 31.3 g |  |  |  | | --- | --- | | *ANSWER:* | e | | *RATIONALE:* | Analysis: A. Incorrect. See Section 3.8, Goal 20. B. Incorrect. See Section 3.8, Goal 20. C. Incorrect. See Section 3.8, Goal 20. D. Incorrect. See Section 3.8, Goal 20. E. Correct. | | *POINTS:* | 1 | |