



## **SECTION 6**

### **ASSESSMENT REFERENCE MATERIALS**

PERIODIC TABLE OF THE ELEMENTS

|                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 18                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VIIIA</b>             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>He</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4.00                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>F</b>                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19.00                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 17                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VIIA</b>              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>O</b>                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16.00                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VIA</b>               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>N</b>                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14.01                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VA</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>C</b>                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12.01                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>IVA</b>               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>B</b>                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10.81                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>IIIA</b>              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Al</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 27.0                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>IIIB</b>              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 31                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ga</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 69.7                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Zn</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65.4                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 29                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Cu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 63.5                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>IB</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ni</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 58.7                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VIIB</b>              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 27                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Co</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 58.9                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VIII</b>              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Fe</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55.8                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VIB</b>               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Mn</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 54.9                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>VIIIB</b>             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 44                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ru</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 101.1                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 45                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Rh</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 102.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 46                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pd</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 106.4                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 47                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ag</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 107.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 48                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Cd</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 112.4                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 77                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ir</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 192.2                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 75                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Re</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 186.2                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 76                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Os</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 190.2                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 108                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Hs</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (277)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 109                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Mt</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (268)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 110                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ds</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (271)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 111                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Hg</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 200.6                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 80                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pt</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 195.1                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 81                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Au</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 197.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 82                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pb</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 207.2                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 83                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Bi</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 209.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 84                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Po</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (209)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 85                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>At</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (210)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 86                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Rn</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (222)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 112                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Cf</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (251)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 97                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Bk</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (247)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 98                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Fm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (257)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 99                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Es</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (252)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>No</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (259)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 101                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Md</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (258)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 102                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Lr</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (262)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 103                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Lu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 175.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Yb</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 173.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 69                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Tm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 168.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 68                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Er</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 167.3                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 67                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ho</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 164.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 66                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Dy</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 162.5                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Tb</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 158.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 64                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Gd</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 157.3                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 63                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Eu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 152.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 62                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Sm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 150.4                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 61                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (145)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Nd</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 144.2                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 59                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pr</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 140.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 58                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ce</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 140.1                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 57                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>La</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 138.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 91                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pa</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 231.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 90                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Th</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 232.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 89                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ac</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (227)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 88                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ra</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (226)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 87                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Fr</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (223)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 89–103                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Lanthanide Series</b> |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 57                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>La</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 138.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 58                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ce</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 140.1                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 59                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pr</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 140.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Nd</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 144.2                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 61                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (145)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 62                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Sm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 150.4                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 63                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Eu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 152.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 64                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Gd</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 157.3                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Tb</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 158.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 66                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Dy</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 162.5                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 67                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ho</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 164.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 68                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Er</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 167.3                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 69                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Tm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 168.9                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Yb</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 173.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 71                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Lu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 175.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 89                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Ac</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (227)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 90                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Th</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 232.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 91                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pa</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 231.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 92                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>U</b>                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 238.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 93                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Np</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (237)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 94                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Pu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (244)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 95                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Am</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (243)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 96                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Cm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (247)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 97                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Bk</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (247)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 98                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Fm</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (257)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 99                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Es</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (252)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>No</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (259)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 101                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Md</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (258)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 102                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Lr</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| (262)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 103                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Lu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 175.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 71                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Lu</b>                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 175.0                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Some of the elements 111 and above have been reported but not fully authenticated and named.

## CONSTANTS

| Description                                    | Value  |
|--|--|
| Avogadro's number                              | $6.02 \times 10^{23}$                                    |
| Molar gas volume at STP                        | 22.4 L   |
| Ideal gas constant ( $R$ )                     | 8.31 J/K = 0.0821 L•atm/mol•K                            |
| Heat of fusion of water ( $\Delta H_f$ )       | 334 J/g = 80 calories/g                                  |
| Heat of vaporization of water ( $\Delta H_v$ ) | 2260 J/g = 540 calories/g                                |
| Specific heat of water (liquid)                | 4.18 J/g•°C = 1.0 calorie/g•°C                           |
| Specific heat of water (solid or vapor)        | 2.09 J/g•°C = 0.50 calorie/g•°C                          |
| Standard atmospheric pressure (STP)            | 101.325 kPa (kiloPascals) = 760 mm Hg                    |
| Acceleration of gravity on Earth ( $g$ )       | 9.8 m/s <sup>2</sup>                                     |
| Speed of light in a vacuum ( $c$ )             | $3.00 \times 10^8$ m/s                                   |
| Planck's constant ( $h$ )                      | $6.63 \times 10^{-34}$ J•s = $4.14 \times 10^{-15}$ eV•s |
| Charge of electron                             | $-1.60 \times 10^{-19}$ C                                |
| Coulomb's constant ( $k_e$ )                   | $9.0 \times 10^9$ N•m <sup>2</sup> /C <sup>2</sup>       |
| Gravitational constant ( $G$ )                 | $6.67 \times 10^{-11}$ N•m <sup>2</sup> /kg <sup>2</sup> |

## FORMULAS

| Description           | Formula   |
|-----------------------|---|
| Ideal gas law         | $PV = nRT$  |
| Boyle's law           | $\frac{V}{V'} = \frac{p'}{p}$                         |
| Charles' law          | $\frac{V}{V'} = \frac{T}{T'}$                         |
| Constant acceleration | $v = v_i + at$<br>$x = x_i + v_i t + \frac{1}{2}at^2$ |
| Mechanics             | $F = ma$<br>$P = mv$<br>$J = F\Delta t$               |

**Section 6: Assessment Reference Materials**

**FORMULAS (continued)**

| Description                | Formula   |
|----------------------------|---|
| Circular motion            | $a = \frac{v^2}{r}$   |
| Spring                     | $F = -kx$<br>$PE = \frac{1}{2}kx^2$                             |
| Pendulum                   | $T = 2\pi\sqrt{\frac{L}{g}}$                                    |
| Wave relationship          | $v = f\lambda$  |
| Speed of waves in a string | $v = \sqrt{\frac{T}{\mu}}$                                      |
| Energy                     | $\Delta Q = mc\Delta T$<br>$KE = \frac{1}{2}mv^2$<br>$PE = mgh$ |
| Ohm's law                  | $V = IR$  |

**NOTES FOR SCIENCE TEST**

Not all formulas necessary are listed, nor are all formulas listed used on this test.

In questions on electricity and magnetism, the term *current* refers to "conventional current" and the use of the right-hand rule is assumed.

While attention has been paid to significant figures, no answer should be considered incorrect solely because of the number of significant figures.