1. What's the packing efficiency of the face-centered cubic structure?

a) 52% b) 68% c) 74% d) 78.5% e) 90.7%

2. Choose the substance that corresponds to an n-type semiconductor

a) As doped with Si
b) Ge doped with As
c) Si doped with Al
d) Sn doped with Ga
e) P doped with Ge

3. What is the net number of atoms in the body-centered cubic unit cell adopted by a metal?

a) 1 b) 2 c) 4 d) 7 e) 14

4. The allotropes of carbon are

a) CO_2; CO; CO_3^{2-}
b) diamond; graphite; fullerene
c) ^{12}C; ^{13}C; ^{14}C
d) CO_2; graphite; ^{12}C
e) C; Si; Ge; Sn; Pb

5. Which type(s) of intermolecular forces need to be overcome to convert methanol (CH_3OH) from liquids to gases?

i. dispersion; ii. dipole-dipole; iii) H-bonding

a) i only b) ii only c) iii only d) i and ii; e) all of them

6. In assembling a Lewis Dot diagram of PO_4^{3-}, there are ____ total electrons to use in the model.

a) 50 b) 48 c) 40 d) 32 e) 29

7. Predict the decreasing order of vapor pressure for the following compounds

i) $HOCH_2CH_2OH$;   ii) FCH_2CH_2OH;   iii) FCH_2CH_2F

a) i > ii >iii   b) i > iii >ii   c) ii > i >iii   d) ii > iii >i   e) iii > ii >i

8. Select the correct statement when comparing the properties of acetone [$(CH_3)_2CO$] with those of water (H_2O)

a) Water and acetone have the same vapor pressure.
b) Water has a lower boiling point.
c) Acetone has a higher surface tension, since it is heavier.
d) Water has a higher surface tension.
e) Acetone has a lower vapor pressure, because it has a larger molar mass.

9. Calculate ΔE for the system in which 16 J of work is done on a gas by the surroundings and the gas releases 51 J of heat?

a) -67 J   b) -35 J   c) +35 J   d) +51 J   e) +67 J

10. If the enthalpy of condensation, ΔH_{cond}, of a substance is -4.07×10^4 J/mol, what is its enthalpy of vaporization, ΔH_{vap}?

a) $3 \times \Delta H_{cond}$
b) $+4.07\times10^4$ J/mol
c) -4.07×10^4 J/mol divided by the molar mass of the substance
d) $+4.07\times10^4$ J/mol multiplied by the molar mass of the substance
e) Cannot be determined from the information given

11. The heat of fusion of pure silicon is 43.4 kJ/mol. How much energy is needed to melt a 2.78 g-sample of silicon at its melting point of 1693 K?

a) 8.10 kJ   b) 693 kJ   c) 1.98 kJ   d) 4.30 kJ   e) 28.1 kJ

12. Copper wires used to transport electrical current heat up because of the resistance in the wire. If a 140-g wire gains 280 J of heat, what is the change in temperature of the wire? Specific heat of Cu = 0.384 J/g°C

a) 39 °C b) 14 °C c) 9.8 °C d) 5.2 °C e) 1.1 °C

13. Using these two equations,

$$C_{(graphite)} + PbO_{(s)} \rightarrow Pb(s) + CO(g) \qquad \Delta H° = 106.8\ kJ$$
$$2C_{(graphite)} + O_2(g) \rightarrow 2CO(g) \qquad \Delta H° = –221.0\ kJ$$

find the standard enthalpy change for the formation of 1 mol PbO(s) from lead metal and oxygen gas.

$$Pb(s) + ½\ O_2(g) \rightarrow PbO_{(s)} \qquad \Delta H° = ?$$

a) +327 kJ b) +262 kJ c) 0.99 kJ d) -217.3 kJ e) -262 kJ

14. For the reaction, how much energy is needed to generate 582 g of NO(g)?

$$N_2(g) + O_2(g) \rightarrow 2\ NO(g) \qquad \Delta H = 180.5\ kJ$$

a) 1.3×10^4 kJ b) 180.5 kJ c) 1750 kJ d) 9.7×10^3 kJ e) 3.2×10^3 kJ

15. Use provided data to find the heat of combustion of one mole of propane, C_3H_8, to form gaseous carbon dioxide and liquid water.

$$C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(l)$$

$\Delta H_f^0[C_3H_8(g)]$= -103.8 kJ/mol, $\Delta H_f^0[CO_2(g)]$= -393.5 kJ/mol, $\Delta H_f^0[H_2O(l)]$= -285.8 kJ/mol

a) -2219.9 kJ b) -575.5 kJ c) 0.0 kJ d) +575.5 kJ e) +2219.9 kJ

16. Which bond is likely to be the most polar?

a) C-H b) N-H c) O-H d) F-H e) F-F

17. Choose the compound below that should has the largest lattice energy.

a) KF b) KCl c) KBr d) KI e) KAt

18. Select the bond below that is the strongest.

a) C-C b) O=O c) C-O d) C-N e) N≡N

19. Which of the following compounds illustrates sp^3 hybridization?

a) C_2H_4 b) BeF_2 c) CCl_4 d) V_2O_5 e) SO_2

20. Which of the following molecule(s) has(have) a trigonal bipyramidal geometry?

BrF_5 SF_4 PCl_5

a) BrF_5, SF_4, PCl_5 b) PCl_5 c) BrF_5, SF_4
d) SF_4 e) BrF_5

Answers:

1 (c), 2 (b), 3 (b), 4 (b), 5 (e), 6 (d), 7 (e), 8 (d), 9 (b), 10 (b), 11 (d), 12 (d), 13 (d), 14 (c), 15 (a), 16 (d), 17 (a), 18 (e), 19 (c), 20 (b)

Atomic Number → 1
Symbol → H
Atomic Mass → 1.008
Name → Hydrogen

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H 1.0079 Hydrogen																	2 He 4.0026 Helium
2	3 Li 6.941 Lithium	4 Be 9.0122 Beryllium											5 B 10.811 Boron	6 C 12.011 Carbon	7 N 14.0067 Nitrogen	8 O 15.9994 Oxygen	9 F 18.9984 Fluorine	10 Ne 20.1797 Neon
3	11 Na 22.9898 Sodium	12 Mg 24.3050 Magnesium											13 Al 26.9815 Aluminium	14 Si 28.0855 Silicon	15 P 30.9738 Phosphorus	16 S 32.065 Sulfur	17 Cl 35.453 Chlorine	18 Ar 39.948 Argon
4	19 K 39.0983 Potassium	20 Ca 40.078 Calcium	21 Sc 44.9559 Scandium	22 Ti 47.87 Titanium	23 V 50.9415 Vanadium	24 Cr 51.9961 Chromium	25 Mn 54.9380 Manganese	26 Fe 55.85 Iron	27 Co 58.9332 Cobalt	28 Ni 58.6934 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.64 Germanium	33 As 74.9216 Arsenic	34 Se 78.96 Selenium	35 Br 79.904 Bromine	36 Kr 83.80 Krypton
5	37 Rb 85.4678 Rubidium	38 Sr 87.62 Strontium	39 Y 88.9059 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.9064 Niobium	42 Mo 95.96 Molybdenum	43 Tc 98 Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.9055 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.8682 Silver	48 Cd 112.411 Cadmium	49 In 114.82 Indium	50 Sn 118.710 Tin	51 Sb 121.76 Antimony	52 Te 127.60 Tellurium	53 I 126.9045 Iodine	54 Xe 131.29 Xenon
6	55 Cs 132.9055 Caesium	56 Ba 137.327 Barium	**57/71**	72 Hf 178.49 Hafnium	73 Ta 180.9479 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	76 Os 190.2 Osmium	77 Ir 192.22 Iridium	78 Pt 195.08 Platinum	79 Au 196.9665 Gold	80 Hg 200.59 Mercury	81 Tl 204.3833 Thallium	82 Pb 207.2 Lead	83 Bi 208.9804 Bismuth	84 Po 209 Polonium	85 At 210 Astatine	86 Rn 222 Radon
7	87 Fr 223 Francium	88 Ra 226 Radium	**89/103**	104 Rf 267 Rutherfordium	105 Db 268 Dubnium	106 Sg 269 Seaborgium	107 Bh 270 Bohrium	108 Hs 269 Hassium	109 Mt 278 Meitnerium	110 Ds 281 Darmstadtium	111 Rg 281 Roentgenium	112 Cn 285 Copernicium	113 Uut 286 Ununtrium	114 Fl 289 Flerovium	115 Uup 289 Ununpentium	116 Lv 293 Livermorium	117 Uus 294 Ununseptium	118 Uuo 294 Ununoctium

Lanthanide Series	57 La 138.9055 Lanthanum	58 Ce 140.116 Cerium	59 Pr 140.9076 Praseodymium	60 Nd 144.24 Neodymium	61 Pm 145 Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.9253 Terbium	66 Dy 162.50 Dysprosium	67 Ho 164.9303 Holmium	68 Er 167.26 Erbium	69 Tm 168.9342 Thulium	70 Yb 173.054 Ytterbium	71 Lu 174.967 Lutetium
Actinide Series	89 Ac 227 Actinium	90 Th 232.0381 Thorium	91 Pa 231.0359 Protactinium	92 U 238.0289 Uranium	93 Np 237 Neptunium	94 Pu 244 Plutonium	95 Am 243 Americium	96 Cm 247 Curium	97 Bk 247 Berkelium	98 Cf 251 Californium	99 Es 252 Einsteinium	100 Fm 257 Fermium	101 Md 258 Mendelevium	102 No 259 Nobelium	103 Lr 262 Lawrencium

SOME USEFUL CONSTANTS

(a more complete list appears in Appendix B)

Atomic mass unit	$1 \text{ amu} = 1.6606 \times 10^{-24}$ g
Avogadro's number	$N = 6.02214179 \times 10^{23}$ particles/mol
Electronic charge	$e = 1.60218 \times 10^{-19}$ coulombs
Faraday constant	$F = 96{,}485.3399$ coulombs/mol e^-
Gas constant	$R = 0.08206 \dfrac{\text{L atm}}{\text{mol K}} = 1.987 \dfrac{\text{cal}}{\text{mol K}} = 8.314472 \dfrac{\text{J}}{\text{mol K}} = 8.314472 \dfrac{\text{kPa dm}^3}{\text{mol K}}$
Pi	$\pi = 3.1415927$
Planck's constant	$h = 6.62606896 \times 10^{-34}$ J s
Speed of light (in vacuum)	$c = 2.99792458 \times 10^8$ m/s

SOME USEFUL RELATIONSHIPS

Mass and Weight

SI Base Unit: Kilogram (kg)

1 kilogram = 1000 grams = 2.205 pounds
1 gram = 1000 milligrams
1 pound = 453.59 grams
1 amu = 1.6606×10^{-24} grams
1 gram = 6.022×10^{23} amu
1 ton = 2000 pounds

Length

SI Base Unit: Meter (m)

1 inch = 2.54 centimeters (exactly)
1 meter = 100 centimeters = 39.37 inches
1 yard = 0.9144 meter
1 mile = 1.609 kilometers
1 kilometer = 1000 meters = 0.6215 mile
1 Ångstrom = 1.0×10^{-10} meters = 1.0×10^{-8} centimeters

Volume

SI Base Unit: Cubic Meter (m^3)

1 liter = 0.001 cubic meter
1 liter = 1000 cubic centimeters = 1000 mL
1 liter = 1.056 quarts
1 quart = 0.9463 liter
1 milliliter = 0.001 liter = 1 cubic centimeter
cubic foot = 7.475 gallons = 28.316 liters
1 gallon = 4 quarts

Energy

SI Base Unit: Joule (J)

1 calorie = 4.184 joules = 4.129×10^{-2} L atm
1 joule = $1 \dfrac{\text{kg m}^2}{\text{s}^2}$ = 0.23901 calorie
1 joule = 1×10^7 ergs
1 electron volt = 1.6022×10^{-19} joule
1 electron volt = 96.485 kJ/mol
1 L atm = 24.217 calories = 101.325 joules

Pressure

SI Base Unit: Pascal (Pa)

1 pascal = $\dfrac{\text{kg}}{\text{m s}^2}$ = 1 Newton/m^2
1 atmosphere = 760 torr
= 760 millimeters of mercury
= 1.01325×10^5 pascals
= 1.01325 bar
= 14.70 pounds per square inch
1 torr = 1 millimeter of mercury

Temperature

SI Base Unit: Kelvin (K)

0 K = −273.15°C
K = °C + 273.15°
°F = 1.8(°C) + 32°
$°C = \dfrac{°F - 32°}{1.8°}$