1. Which of the following relationships are true for gases?

   i) The number of moles of a gas is inversely proportional to its volume (at constant pressure and temperature).
   ii) The pressure of a gas is directly proportional to its temperature in kelvins (at constant volume).
   iii) The volume of a gas is inversely proportional to its pressure (at constant temperature).

   a) i only b) ii only c) iii only d) i and ii e) ii and iii

2. A mixture of He and O_2 is placed in a 4.00 L flask at 32 °C. The partial pressure of the He is 3.0 atm and the partial pressure of the O_2 is 2.0 atm. What is the mole fraction of O_2?

   a) 0.224 b) 0.43 c) 0.40 d) 0.57 e) 0.60

3. At constant temperature, 14.0 L of O_2 at 2.70 atm is compressed to 5.35 L. What is the final pressure of O_2?

   a) 0.110 atm b) 0.142 atm c) 7.06 atm d) 21.6 atm e) 27.8 atm

4. What volume of O_2, measured at 91.2 °C and 743 mm Hg, will be produced by the decomposition of 4.88 g $KClO_3$? (R = 0.08206 L·atm/mol·K)

   $$2\ KClO_3(s) \rightarrow 2\ KCl(s) + 3\ O_2(g)$$

   a) 0.305 L b) 1.22 L c) 1.83 L d) 24.0 L e) 37.4 L

5. Which of the followings are not generally true of gases?

1) Gases expand to fill the volume of a container.
2) Gases have higher densities than solids or liquids.
3) Gas particles collide with each other.
4) Lighter gas particles tend to move slower at the same temperature.
5) At a fixed temperature, as pressure increases, average speed increases.

a) 1, 2 and 4 b) 2, 4 and 5 c) 3, 4 and 5 d) 3 and 5 e) 2 and 5

6. The ideal gas law begins to break down:

1) at low temperatures
2) at high temperatures
3) at low pressures
4) at high pressures
5) at low volume

a) 1 and 3 b) 1 and 4 c) 2 and 3 d) 2 and 4 e) 5

7. When a hydrogen atom undergoes a transition from $n = 2$ to $n = 1$, it emits a photon with wavelength $\lambda = 121.6$ nm. What is the energy of a 1 mole of photons of this light?

a) 9.838×10^{2} kJ/mol b) 1.602×10^{22} kJ/mol c) 7.602×10^{4} kJ/mol
d) 1.633×10^{-18} kJ/mol e) 4.540×10^{2} kJ/mol

8. Write the ground state electron configuration for manganese.

a) [Ar] $4s^2 4p^5$ b) [Ar] $4s^2 3d^5$ c) [Ar] $3d^7$
d) [Ar] $3d^5 4p^2$ e) [Kr] $4s^2 3d^5$

9. How many valence electrons are in carbon?

a) 1 b) 2 c) 4 d) 6 e) 8

10. Which of the following represents invalid set of quantum numbers?

a) $n = 3$, $l = 3$, $m_l = 3$, b) $n = 2$, $l = 1$, $m_l = 0$, c) $n = 3$, $l = 0$, $m_l = 0$,
d) $n = 4$, $l = 3$, $m_l = 3$, e) $n = 5$, $l = 1$, $m_l = -1$

11. Which element has the electron configuration [Ar] $4s^2 3d^{10}$?

a) Co b) Zn c) Ga d) Ag e) Cu

12. What is the maximum number of electrons in an atom that can have the quantum number n=3 and l=2?

a) 2 b) 4 c) 6 d) 10 e) 12

13. Which one is the correct ranking of the atomic radii?

a) K > S > Mg > F b) S > K > F > Mg c) K > Mg > S > F
d) Mg > K > F > S e) S > F > K > Mg

14. A 10.00 mL sample of nitric acid, HNO_3, requires 0.216 g of barium hydroxide, $Ba(OH)_2$ for titration to the equivalence point. What is the concentration of the nitric acid?

$$2\ HNO_3(aq)\ +\ Ba(OH)_2(aq)\ \rightarrow\ Ba(NO_3)_2(aq)\ +\ 2\ H_2O(l)$$

a) 0.045 M
b) 0.126 M
c) 0.252 M
d) 0.510 M
e) 0.064 M

15. The combustion of methane (CH_4) produces carbon dioxide (CO_2) and steam (H_2O).

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2\,H_2O(g)$$

All of the following statements concerning this reaction are correct EXCEPT

a) one molecule of carbon dioxide is formed per one molecule of methane consumed.
b) two molecules of oxygen are consumed per one molecule of methane consumed.
c) two moles of steam are formed per two moles of oxygen consumed.
d) the combined mass of reactants consumed equals the mass of products formed.
e) 1 gram of carbon dioxide are formed per two grams of oxygen consumed.

16. A mixture of 10.0 g of NO and 14.0 g of NO_2 results in the production of 8.52 g of N_2O_3. What is the percentage yield?

$$NO(g) + NO_2(g) \rightarrow N_2O_3(l)$$

a) 36.9 %
b) 60.2 %
c) 71.4 %
d) 85.6 %
e) 100 %

17. Which is the general formula of alkanes?

a) C_nH_n b) C_nH_{2n} c) C_nH_{n+2} d) C_nH_{2n+2} e) C_nH_{2n-2}

18. If 2.5 moles of each of these compounds are burned completely in O_2, which will produce the largest amount of CO_2?

a) CH_4 b) C_2H_6 c) C_2H_5OH d) C_2H_4 e) C_3H_8

19. If the binding energy of an electron is 6.41×10^{-19} J, what frequency of photon is required to liberate it from the atom?

a) $9.67 \times 10^{14}\ s^{-1}$ b) 310 nm c) 9.67×10^{14} nm d) $310\ s^{-1}$ e) 0

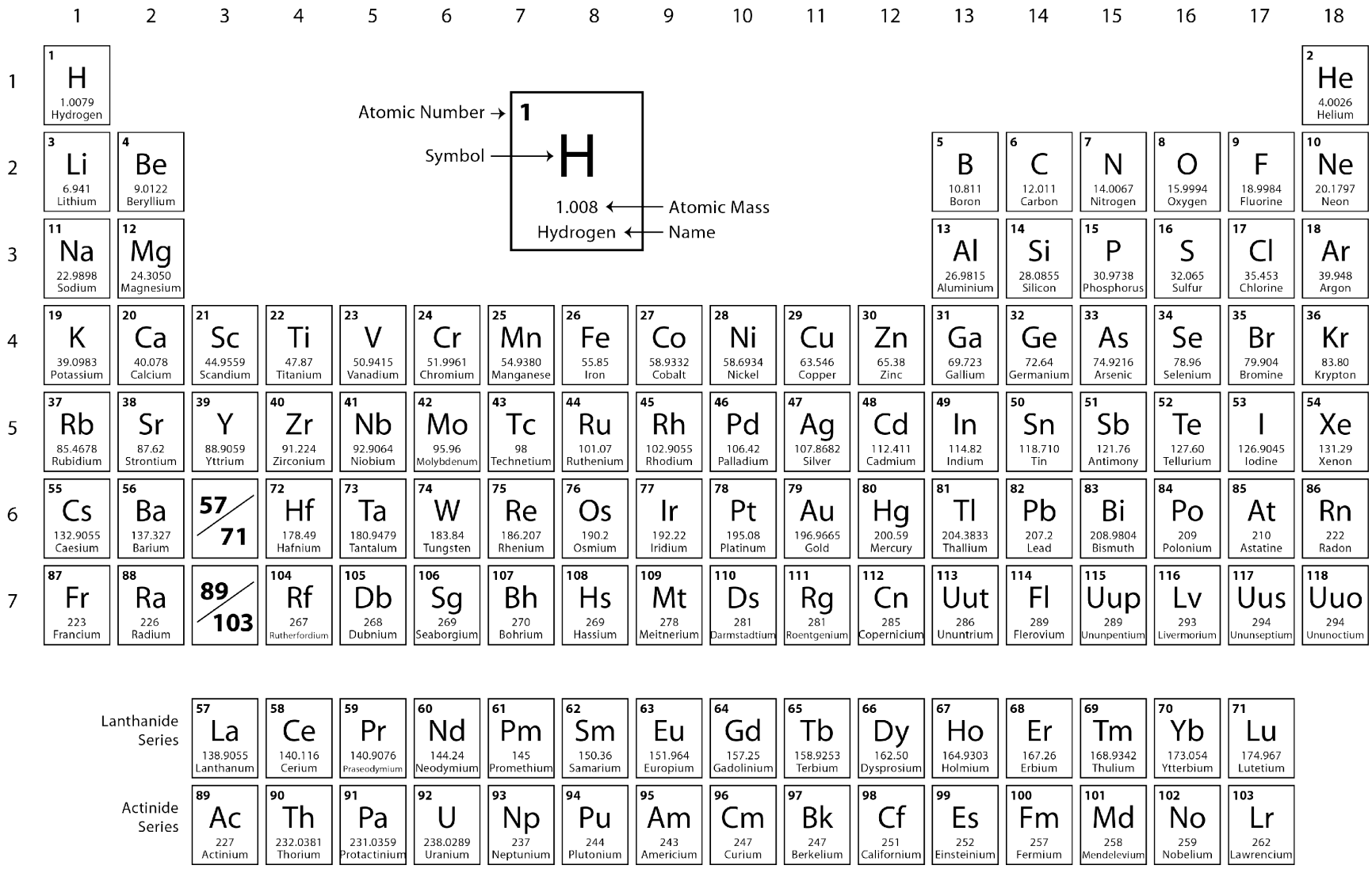
20. What's the purpose of an indicator in a titration?

a) It helps produce the desired product in the reaction
b) Changes color to indicate when the reaction is complete
c) To make the solution pretty
d) As a reactant
e) None of the answers provided

End……

Answers:

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


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Atomic Number → 1
Symbol → H
1.008 ← Atomic Mass
Hydrogen ← Name
1 H 1.0079 Hydrogen
2 He 4.0026 Helium
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
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
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
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
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
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	$1 \text{ amu} = 1.6606 \times 10^{-24} \text{ g}$
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

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

Pressure

SI Base Unit: Pascal (Pa)

$1 \text{ pascal} = \dfrac{\text{kg}}{\text{m s}^2} = 1 \text{ Newton/m}^2$
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

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

Energy

SI Base Unit: Joule (J)

1 calorie = 4.184 joules = 4.129×10^{-2} L atm
$1 \text{ joule} = 1 \dfrac{\text{kg m}^2}{\text{s}^2} = 0.23901 \text{ calorie}$
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

Temperature

SI Base Unit: Kelvin (K)

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

The atomic and ionic radii table