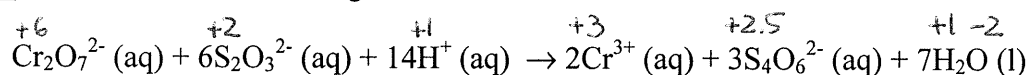


(1) The loss of electrons is called

- a) reduction
- b) oxidation**
- c) disproportionation
- d) fractionation
- e) sublimation

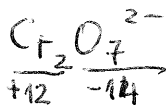
(2) _____ is reduced in the following reaction



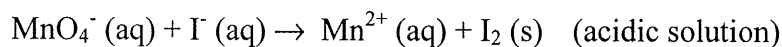
- a) Cr₂O₇²⁻**
- b) S₂O₃²⁻
- c) H⁺
- d) Cr³⁺
- e) S₄O₆²⁻

(3) What is the oxidation state of chromium in the dichromate ion (Cr₂O₇²⁻)?

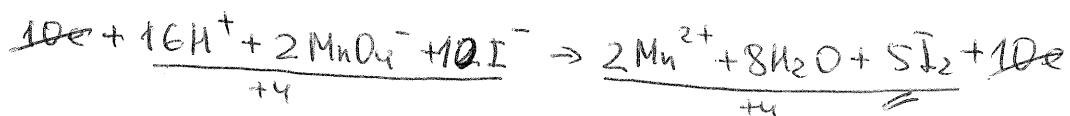
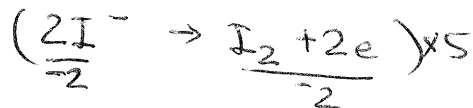
- a) +3
- b) +12
- c) +7
- d) +6**
- e) +14



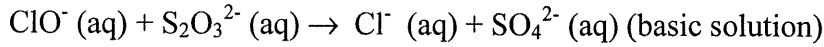
(4) What is the coefficient of iodine (I₂) when the following equation is correctly balanced?



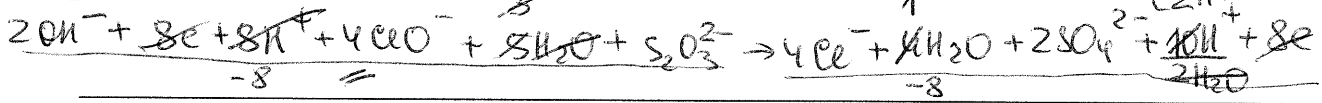
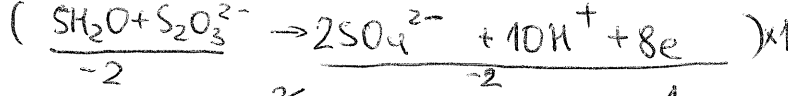
- a) 1
- b) 2
- c) 3
- d) 5**
- e) 4



(5) What is the coefficient of ClO^- when the following equation is correctly balanced?



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



(6) What is the purpose of the salt bridge in a voltaic cell?

- a) it provides ions to be oxidized at the anode
- b) it provides ions to be reduced at the cathode
- c) it allows solution from two compartments to flow back and forth
- d) it maintains electrical neutrality between the compartments
- e) the purpose of the salt bridge in a voltaic cell is to make solution salty

(7) The electrode at which reduction occurs is called the

- a) oxidizing agent
- b) cathode
- c) reducing agent
- d) anode
- e) voltaic cell

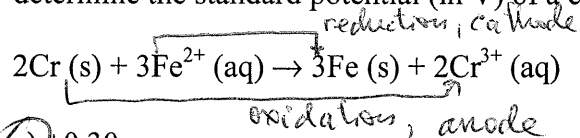
(8) Which of the following transformations could take place at the cathode of an electrochemical cell?

- a) $\overset{+4}{\text{MnO}_2} \rightarrow \overset{+7}{\text{MnO}_4^-} \rightarrow \text{oxidation}$
- b) $\overset{0}{\text{Br}_2} \rightarrow \overset{+5}{\text{BrO}_3^-} \rightarrow \text{oxidation}$
- c) $\overset{+2}{\text{NO}} \rightarrow \overset{+3}{\text{HNO}_2} \rightarrow \text{oxidation}$
- d) $\overset{+6}{\text{HSO}_4^-} \rightarrow \overset{+4}{\text{H}_2\text{SO}_3} \rightarrow \text{reduction}$
- e) $\text{Mn}^{2+} \rightarrow \text{MnO}_4^- \rightarrow \text{oxidation}$

(9) Given the following information

Half-reaction	E°_{red}
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Fe}(\text{s})$	-0.44 V
$\text{Cr}^{3+}(\text{aq}) + 3\text{e}^{-} \rightarrow \text{Cr}(\text{s})$	-0.74 V

determine the standard potential (in V) of a cell based on the reaction:



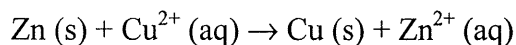
- a) +0.30
- b) +1.18
- c) -1.18
- d) +2.80
- e) -0.30

$$E^{\circ} = E^{\circ}_{\text{red}}(\text{cathode}) - E^{\circ}_{\text{red}}(\text{anode}) = -0.44\text{V} - (-0.74\text{V}) = +0.30\text{V}$$

(10) A nonspontaneous electrochemical reaction has

- a) $\Delta G=0$, $E>0$
- b) $\Delta G<0$, $E>0$
- c) $\Delta G>0$, $E<0$
- d) $\Delta G>0$, $E>0$
- e) $\Delta G<0$, $E<0$

(11) The value of E° for the following reaction is 1.10 V. What is the value of E (in V) for this reaction when the concentration of Cu^{2+} is 1.0×10^{-5} M and the concentration of Zn^{2+} is 1.0 M?



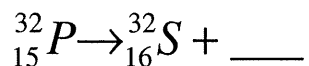
- a) 1.40
- b) 1.25
- c) 0.95
- d) 0.80
- e) 1.10

$$E = E^{\circ} - \frac{0.0592}{2} \log \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} = 1.10\text{V} - 0.15\text{V} = 0.95\text{V}$$

(12) What is the mass number of an alpha particle?

- a) 0
 - b) 1
 - c) 2
 - d) 3
 - e) 4
-

(13) What is the missing product from this reaction?



- a) ${}^4_2\text{He}$
 - b) ${}^0_{-1}\text{e}$
 - c) ${}^0_0\gamma$
 - d) ${}^0_1\text{e}$
 - e) ${}^1_1\text{p}$
-

(14) Which of the following correctly represents the transmutation wherein neptunium-239 is produced via bombardment of uranium-238 with a neutron?

- a) ${}_{92}^{238}\text{U}({}^1_0\text{n}, {}^0_{-1}\text{e}){}_{93}^{239}\text{Np}$
- b) ${}_{92}^{238}\text{U}({}^1_0\text{n}, {}^1_1\text{p}){}_{93}^{239}\text{Np}$
- c) ${}_{92}^{238}\text{U}({}^1_0\text{n}, \gamma){}_{93}^{239}\text{Np}$
- d) ${}_{92}^{238}\text{U}({}^1_0\text{n}, {}^4_2\alpha){}_{93}^{239}\text{Np}$
- e) ${}_{92}^{238}\text{U}({}^1_0\text{n}, {}^1_0\text{n}){}_{93}^{239}\text{Np}$

(15) What order process is radioactive decay?

- a) zeroth
- b) first
- c) second
- d) third
- e) fourth

(16) The half-life for the process $^{238}\text{U} \rightarrow ^{206}\text{Pb}$ is 4.5×10^9 years. A mineral sample contains 50.0 mg of ^{238}U and 14.0 mg of ^{206}Pb . The age of the mineral is ___ years

- a) 850
 - b) 1.2×10^9
 - c) 1.8×10^9
 - d) 180
 - e) 2.1×10^9
- $\ln \frac{M_t}{N_0} = -kt$; $k = \frac{0.693}{t_{1/2}} = 1.54 \times 10^{-10} \text{ y}^{-1}$ $M_t = 50.0 \text{ mg}$
 $14.0 \text{ mg of } ^{206}\text{Pb} \rightarrow 16.17 \text{ mg of } ^{238}\text{U}$; $N_0 = 50.0 + 16.2 = 66.2 \text{ mg}$
 $t = -\frac{\ln \frac{M_t}{N_0}}{k} = 1.8 \times 10^9 \text{ y}$

(17) The respective masses in amu of the proton, the neutron, and the nickel-60 atom are 1.00728, 1.00867, and 59.9308. What is the binding energy in J of $^{60}_{28}\text{Ni}$ nucleus?

- a) 2.759×10^{-16}
 - b) 9.211×10^{-28}
 - c) 4.964×10^{-13}
 - d) 2.773×10^{-19}
 - e) 8.230×10^{-11}
- $28(1.00728) + 32(1.00867) = 60.48128$
 $\Delta m = 0.55048$
 $\Delta E = \Delta m c^2 = 0.55048 \text{ amu} \cdot \frac{1.6605 \times 10^{-24} \text{ g}}{1 \text{ amu}} \cdot \frac{1 \text{ kg}}{1000 \text{ g}} \cdot (3.0 \times 10^8)^2 \frac{\text{m}^2}{\text{s}^2}$
 $= 8.230 \times 10^{-11} \text{ J}$

(18) What exposure level to radiation is fatal to most humans?

- a) 100 rem
- b) 200 rem
- c) 600 rem
- d) 300 rem
- e) 50 rem

(19) What is the F-Xe-F bond angle in XeF₂?

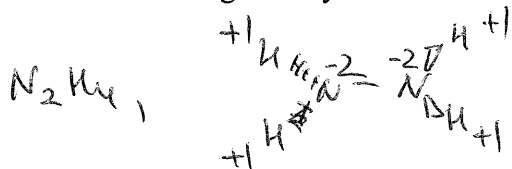
- a) 90°
 - b) 109°
 - c) 180°
 - d) 120°
 - e) 60°
-

(20) Which compound would produce a basic aqueous solution?

- a) CaO
 - b) CO₂
 - c) SO₃
 - d) NO₂
 - e) H₂O₂
-

(21) What is the oxidation state of nitrogen in hydrazine?

- a) -3
- b) 2
- c) +1
- d) 0
- e) +4



(22) Which one of the following compound is a peroxide?

- a) H₂O₂
 - b) CaO
 - c) CaO₂
 - d) NaO₂
 - e) Al₂O₃
-

(23) P₄O₆⁺³ is the anhydride of

- a) H₃PO₃⁺³
- b) H₃PO₄⁺³
- c) P₄O₁₀⁺³
- d) white phosphorus
- e) red phosphorus.



(24) Which group 6A element is a metalloid?

- a) O
 - b) S
 - c) Se
 - d) Te
 - e) Po
-

(25) Diborane is

- a) $B_{10}H_{14}$
- b) B_2O_3
- c) BH_3
- d) B_2H_6
- e) H_3BO_3