NUNAVUT CHEMISTRY 30 · FINAL EXAM · 50 QUESTIONS

Final Exam — Practice Test

This practice test was made by AI and there may be mistakes. If a question or answer looks wrong, use the Flag a mistake button to let Brett know so he can fix it.

1 **The reaction of nitrogen gas with oxygen gas to form nitrogen monoxide gas is represented by the following equation.**

$N_2(g) + O_2(g) \rightarrow 2\ NO(g) \quad \Delta H = +180.6\ kJ$

Which of the following statements about this reaction is correct?

- **A** The reaction is exothermic, and energy is released to the surroundings.
- **B** The reaction is endothermic, and the products have less potential energy than the reactants.
- **C** The reaction is endothermic, and energy would be written as a reactant in the equation.
- **D** The reaction is endothermic, and the value of ΔH is -180.6 kJ.

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2 **In the reaction represented by the equation $Mg(s) + 2\ HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ the species that is oxidized is**

- **A** $Mg(s)$
- **B** $H^+(aq)$
- **C** $Cl^-(aq)$
- **D** $H_2(g)$

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3 **A hydrocarbon has a five-carbon parent chain with methyl groups on carbons 2 and 4. Its IUPAC name is**

- **A** 2,4-dimethylpentane
- **B** 2,4-dimethylhexane
- **C** 3,4-dimethylpentane
- **D** 2,4-dimethylbutane

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4 **The synthesis of methanol is represented by the equation**
$CO(g) + 2\ H_2(g) \rightleftharpoons CH_3OH(g) + heat$
Which of the following changes will increase the amount of $CH_3OH(g)$ at equilibrium?

A Increasing the temperature

B Adding a catalyst

C Increasing the pressure

D Increasing the volume of the container

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5 **A catalyst increases the rate of a chemical reaction by**

A increasing the potential energy of the products

B decreasing the enthalpy change of the reaction

C increasing the activation energy of the reaction

D providing an alternative pathway with a lower activation energy

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6 **The oxidation number of nitrogen in $HNO_2(aq)$ is +____ Record the single digit that completes the oxidation number.**

ANSWER _____

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7 **Aqueous bromine is added to separate samples of cyclohexane and cyclohexene. The sample that causes the bromine solution to lose its colour rapidly, in the absence of light, is**

A cyclohexane

B cyclohexene

C both samples

D neither sample

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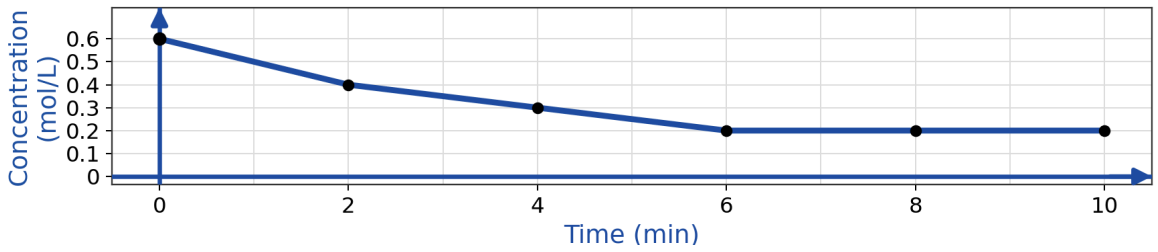
8 **Consider the following equilibrium system.**

$N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$

The graph shows the concentration of $N_2O_4(g)$ over time. The equilibrium concentration of $N_2O_4(g)$, in mol/L, is ____.



ANSWER

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9 **Use the following equations to answer this question.**

I $C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H = -393.5\ kJ$

II $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g) \quad \Delta H = -283.0\ kJ$

The enthalpy change for the reaction $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$ is

A -676.5 kJ

B +110.5 kJ

C -55.3 kJ

D -110.5 kJ

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10 **A voltaic cell is constructed from the following half reactions.**

$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$ $E° = -0.74$ V

$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$ $E° = -0.14$ V

The standard cell potential, $E°c_{ell}$, is

- A +0.60 V
- B +0.88 V
- C -0.60 V
- D -0.88 V

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11 **The ester ethyl methanoate can be formed by the reaction of**

- A ethanol and methanoic acid
- B methanol and ethanoic acid
- C ethanol and ethanoic acid
- D methanol and methanoic acid

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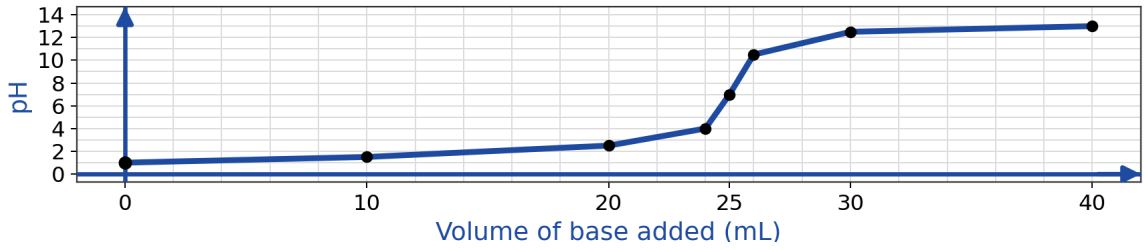
12 **The graph shows the pH during the titration of a strong acid with a strong base. The volume of base added at the equivalence point, in millilitres, is**



A 20 mL

B 24 mL

C 25 mL

D 26 mL

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13 **Use the following equations to answer this question.**

I $C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H = -393.5\ kJ$

II $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l) \quad \Delta H = -285.8\ kJ$

III $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l) \quad \Delta H = -890.3\ kJ$

The molar enthalpy of formation of methane, $CH_4(g)$, is

A -965.1 kJ/mol

B +74.8 kJ/mol

C -74.8 kJ/mol

D -1855.4 kJ/mol

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14 **When the half reaction**
$MnO_4^-(aq) \rightarrow Mn^{2+}(aq)$
is balanced in acidic solution using the lowest whole number coefficients, the coefficient of $H^+(aq)$ is

A 4

B 5

C 10

D 8

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15 **The monomer used to produce the polymer polypropene is**

A propane

B propan-2-ol

C propanoic acid

D propene

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16 **Consider the following equilibrium system.**

$2\,SO_2(g) + O_2(g) \rightleftharpoons 2\,SO_3(g) + heat$

If the temperature of the system is increased, then the equilibrium position i and the value of Kc ii.

A i: shifts toward the products ii: increases

B i: shifts toward the reactants ii: decreases

C i: shifts toward the reactants ii: increases

D i: shifts toward the products ii: decreases

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17 **A student designs an experiment to compare the molar enthalpies of combustion of three different fuels. In each trial, a sample of fuel is burned to heat the same mass of water in the same calorimeter. The variables in this experiment are shown in row**

A. Manipulated variable: the mass of water Responding: temperature change of the water; Controlled: the type of fuel

B. Manipulated variable: the type of fuel Responding: temperature change of the water; Controlled: the mass of water

C. Manipulated variable: the type of fuel Responding: the mass of water; Controlled: the temperature change of the water

D. Manipulated variable: the temperature change of the water Responding: the type of fuel; Controlled: the mass of water

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18 **A current of 2.50 A is passed through molten aluminum chloride for 30.0 min.**
The half reaction is $Al^{3+}(l) + 3e^- \rightarrow Al(l)$, and $F = 9.65 \times 10^4$ C/mol e^-, with the molar mass of aluminum equal to 26.98 g/mol. The mass of aluminum produced, in grams, is

ANSWER _____

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19 **When methane reacts with chlorine gas in the presence of ultraviolet light, the reaction is classified as**

A addition

B substitution

C elimination

D esterification

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20 **Indicator data:**

methyl orange changes colour over the pH range 3.1 to 4.4

methyl red, 4.4 to 6.2

bromothymol blue, 6.0 to 7.6

phenolphthalein, 8.2 to 10.0

A strong acid is titrated with a strong base, and the pH at the equivalence point is 7.0.

The most suitable indicator for this titration is

A methyl orange

B phenolphthalein

C bromothymol blue

D methyl red

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21 **Ammonia gas reacts with oxygen gas as represented by the following equation.**

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$

The molar enthalpy of formation for $NH_3(g)$: -45.9 kJ/mol, for NO(g): +90.3 kJ/mol, and for $H_2O(g)$: -241.8 kJ/mol. The enthalpy change for the reaction is

A -1089.6 kJ

B -1273.2 kJ

C +906.0 kJ

D -906.0 kJ

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22 **The standard reduction potential of $Cu^{2+}(aq)/Cu(s)$ is +0.34 V when the standard hydrogen electrode is assigned a potential of 0.00 V. If the hydrogen electrode were instead assigned +0.50 V, the reduction potential of $Cu^{2+}(aq)/Cu(s)$ would be**

A -0.16 V

B +0.34 V

C +1.18 V

D +0.84 V

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23 **An acyclic hydrocarbon with the molecular formula C_7H_{12} is an alkene and contains no triple bonds. The number of carbon-carbon double bonds in this hydrocarbon is**

ANSWER _____

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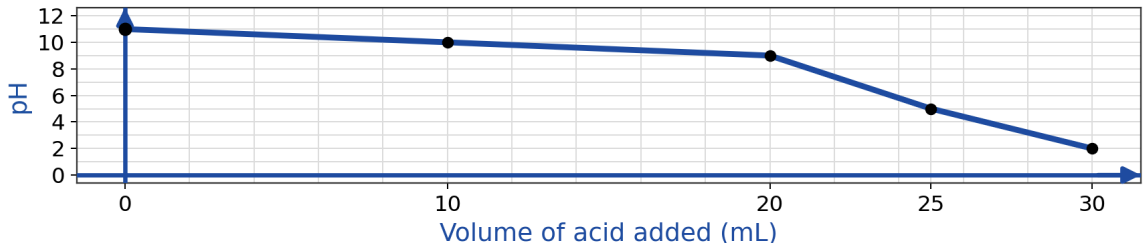
24 **The graph shows the pH during the titration of a weak base with a strong acid. The pH at the equivalence point is**



A 9.0

B 5.0

C 2.0

D 11.0

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25 **Use the following equations to answer this question.**

I $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\Delta H = -285.8$ kJ

II $H_2O_2(l) \rightarrow H_2O(l) + \frac{1}{2}O_2(g)$ $\Delta H = -98.0$ kJ

The enthalpy change for the formation of hydrogen peroxide, $H_2(g) + O_2(g) \rightarrow H_2O_2(l)$, is

A -383.8 kJ

B +187.8 kJ

C -187.8 kJ

D -98.0 kJ

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26 **A voltaic cell is based on the reduction of $X^{2+}(aq)$ at the cathode and the oxidation of tin at the anode, where $Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$ has $E° = -0.14$ V. If $E°c_{ell} = +0.59$ V, then the standard reduction potential of $X^{2+}(aq)/X(s)$, in volts, is**

ANSWER _____

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27 **Methyl butanoate is an ester that has an apricot-like odour. It can be produced by the reaction of**

A butanoic acid and methanol

B methanoic acid and butan-1-ol

C butanoic acid and ethanol

D methanoic acid and ethanol

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28 **Ammonia, $NH_3(aq)$, has a Kb value of 1.8×10^{-5}. The pH of a 0.050 mol/L $NH_3(aq)$ solution, to the nearest hundredth, is**

ANSWER _____

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29 **A chemical reaction has an enthalpy change of +120 kJ and an activation energy of 240 kJ for the forward reaction. The activation energy for the reverse reaction is**

- **A** 360 kJ
- **B** 240 kJ
- **C** 60 kJ
- **D** 120 kJ

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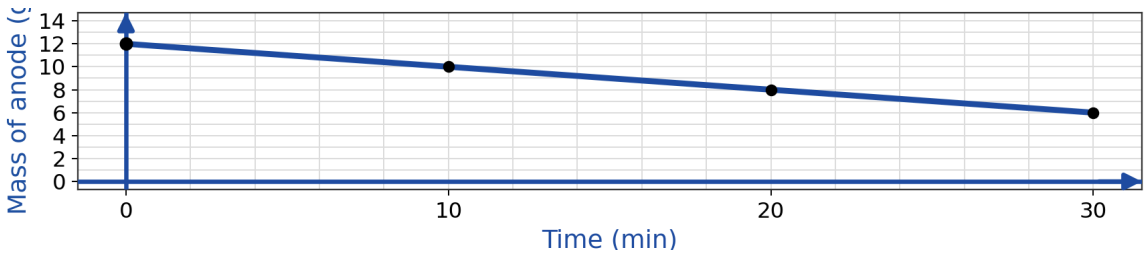
30 **The graph shows the mass of the anode during electrolysis over time. The mass of the anode after 20 minutes, in grams, is ____.**



ANSWER _____

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31 **The general molecular formula for an alkyne with n carbon atoms is**

- **A** C_nH_{2n+2}
- **B** C_nH_{2n}
- **C** C_nH_{2n-2}
- **D** C_nH_n

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32 **The equilibrium law expression for the reaction $N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g)$ is**

- **A** $\frac{[N_2][H_2]^3}{[NH_3]^2}$
- **B** $\frac{[NH_3]^2}{[N_2][H_2]^3}$
- **C** $\frac{[NH_3]}{[N_2][H_2]}$
- **D** $\frac{[2NH_3]}{[N_2][3H_2]}$

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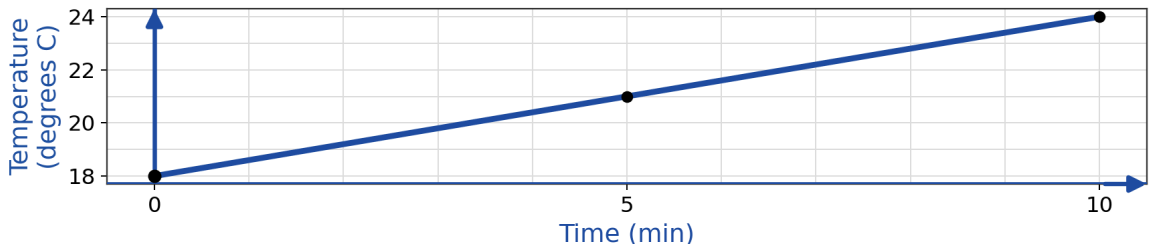
33 **The graph shows the temperature of water in a calorimeter as energy is transferred to the water. The water has a mass of 150.0 g, and c = 4.184 J/(g· ° C). The energy transferred to the water, in kJ, is _____.**



ANSWER

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34 **In the reaction represented by the equation**
$Cu(s) + 2\ Ag^{+}(aq) \rightarrow Cu^{2+}(aq) + 2\ Ag(s)$
the species that is reduced is

A Cu(s)

B $Ag^{+}(aq)$

C $Cu^{2+}(aq)$

D Ag(s)

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35 **The compound CH_3CH_2COOH is classified as**

- A a carboxylic acid
- B an ester
- C an alcohol
- D an alkane

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36 **Which of the following statements correctly describes a system at dynamic equilibrium?**

- A The rates of the forward and reverse reactions are equal, and the concentrations of all species remain constant.
- B The concentrations of the reactants and the products are equal.
- C The forward reaction stops, while the reverse reaction continues.
- D No reactions occur at the molecular level.

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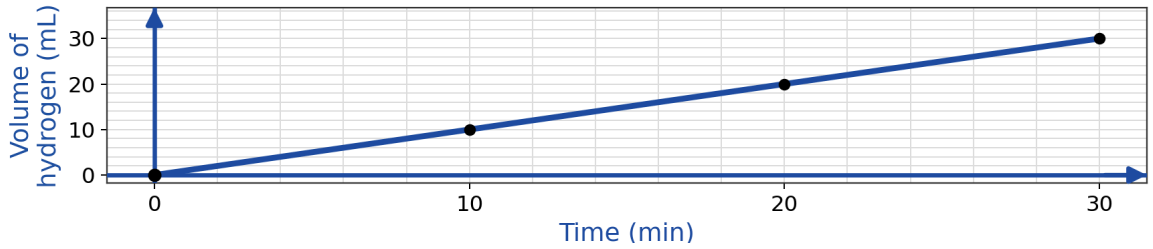
37 **A student burns a fuel sample beneath a metal can of water and calculates the molar enthalpy of combustion of the fuel. The calculated value is less negative than the accepted value. The main reason for this difference is that**

- **A** some water evaporated from the can during heating
- **B** the thermometer was read before the maximum temperature was reached
- **C** the mass of the fuel was recorded after burning
- **D** some of the energy released by the burning fuel heated the air and the can instead of the water

Understand It with Pulse | Flag a mistake

38 **The graph shows the volume of hydrogen gas collected during electrolysis over time. The volume collected after 20 minutes, in millilitres, is ____.**



ANSWER _____

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39 **When one molecule of ethene undergoes complete combustion, the number of oxygen molecules required is**

ANSWER

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40 **A buffer solution contains HF(aq) and NaF(aq). When a small amount of HCl(aq) is added to the buffer, the added hydronium ions react primarily with**

A $F^-(aq)$

B $HF(aq)$

C $H_2O(l)$

D $Na^+(aq)$

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41 **Use the following equations to answer this question.**

I $S(s) + O_2(g) \rightarrow SO_2(g)$ $\Delta H = -296.8$ kJ
II $2\ SO_2(g) + O_2(g) \rightarrow 2\ SO_3(g)$ $\Delta H = -197.8$ kJ

The enthalpy change for the reaction $2\ S(s) + 3\ O_2(g) \rightarrow 2\ SO_3(g)$, in kJ, is ____.

ANSWER

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42 **When the half reaction**
$NO_3^-(aq) \rightarrow NO(g)$
is balanced in acidic solution using the lowest whole number coefficients, the number of electrons that must be added is

A 3

B 2

C 4

D 5

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43 **The number of hydrogen atoms in one molecule of cyclopentane is**

ANSWER _____

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44 **A solution of nitrous acid, $HNO_2(aq)$, is at equilibrium. When solid $NaNO_2$ is dissolved in the solution, the pH of the solution will**

A decrease, because the ionization of $HNO_2(aq)$ increases

B increase, because the ionization of $HNO_2(aq)$ is suppressed

C remain the same, because $NaNO_2$ is a neutral salt

D become exactly 7.0

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45 **Use the following equations to answer this question.**

I $C_2H_4(g) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 2\ H_2O(l)$ $\Delta H = -1411.2$ kJ

II $C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -393.5$ kJ

III $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\Delta H = -285.8$ kJ

The molar enthalpy of formation of ethene, $C_2H_4(g)$, is

A -1358.6 kJ/mol

B -52.6 kJ/mol

C +52.6 kJ/mol

D +1358.6 kJ/mol

Understand It with Pulse | Flag a mistake

46 **Use the following standard reduction potentials to answer this question.**

$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ $E° = -0.45$ V

$Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$ $E° = -2.37$ V

Blocks of magnesium are attached to the steel hull of a ship to protect the hull from corrosion. This method of protection works because

A magnesium has a more positive standard reduction potential than iron

B magnesium is a stronger reducing agent than iron and is oxidized instead of the iron

C magnesium is a stronger oxidizing agent than iron

D magnesium is reduced at the surface of the iron

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47 **Ethyne undergoes complete hydrogenation to form ethane. The number of hydrogen atoms in the product molecule is**

ANSWER _____

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48 **Hydrofluoric acid, HF(aq), has a K_a value of 3.5×10^{-4}. The pH of a buffer solution that contains 0.30 mol/L HF(aq) and 0.30 mol/L NaF(aq), to the nearest hundredth, is**

ANSWER

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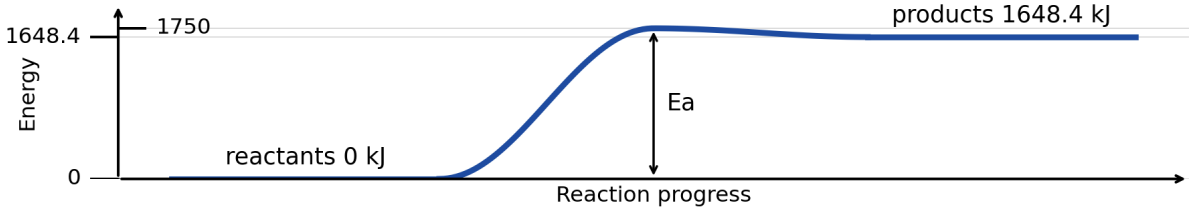
49 **The diagram shows the potential energy profile for the reaction**
$2\ Fe_2O_3(s) \rightarrow 4\ Fe(s) + 3\ O_2(g)$
The enthalpy change and the classification of the reaction are shown in row



A Enthalpy change: +1648.4 kJ; Classification: endothermic

B Enthalpy change: -1648.4 kJ; Classification: exothermic

C Enthalpy change: +1648.4 kJ; Classification: exothermic

D Enthalpy change: -1648.4 kJ; Classification: endothermic

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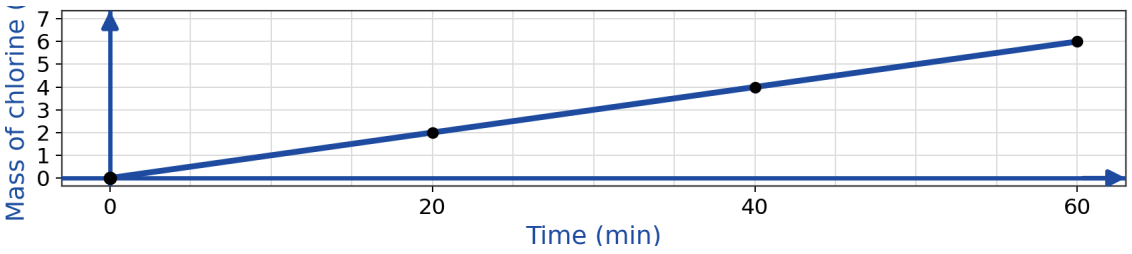
50 **The graph shows the mass of chlorine gas produced during electrolysis over time. The mass of chlorine gas produced after 60 minutes, in grams, is ____.**



ANSWER

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ANSWER KEY

1. C
2. A
3. A
4. C
5. D
6. 3
7. B
8. 0.2
9. D
10. A
11. A
12. C
13. C
14. D
15. D
16. B
17. B
18. 0.419
19. B
20. C
21. D
22. D
23. 2
24. B
25. C
26. 0.45
27. A
28. 10.97
29. D
30. 8
31. C
32. B
33. 3.77
34. B
35. A
36. A
37. D
38. 20
39. 3
40. A
41. -791.4
42. A
43. 10
44. B
45. C
46. B
47. 6
48. 3.46
49. A
50. 6

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