

# CHEM 118-03 Midterm Exam

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Summer 2025 (37 points)

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## Question 1

Which state of matter can be compressed to occupy a smaller volume? (1 point)

- A) Solid
- B) Liquid
- C) Gas
- D) Plasma

**Solution:**

- C) Gas
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## Question 2

What phase of matter has neither a definite shape or definite volume? (1 point)

- A) Solid
- B) Liquid
- C) Gas
- D) Plasma

**Solution:**

- C) Gas
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## Question 3

What is the formula to calculate volume from density? (1 point)

- A)  $V = m \times D$
- B)  $V = \frac{m}{D}$
- C)  $V = D \times m$
- D)  $V = \frac{D}{m}$

**Solution:**

- B)  $V = \frac{m}{D}$
- 

## Question 4

Convert  $5.7 \times 10^1$  to a decimal number. (1 point)

- A) 5.7
- B) 57
- C) 570
- D) 0.57

**Solution:**

B) 57

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## Question 5

**Convert  $4.5 \times 10^{-3}$  to a decimal number.** (1 point)

- A) 0.45
- B) 4.5
- C) 0.0045
- D) 0.00045

**Solution:**

C) 0.0045

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## Question 6

**Convert  $6.80 \times 10^{-4}$  to a decimal number.** (1 point)

- A) 0.0680
- B) 680.00
- C) 0.000680
- D) 0.00068

**Solution:**

C) 0.000680

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## Question 7

**Convert 0.00047 to scientific notation.** (1 point)

- A)  $4.7 \times 10^{-4}$
- B)  $4.7 \times 10^{-3}$
- C)  $4.7 \times 10^{-5}$
- D)  $4.7 \times 10^4$

**Solution:**

A)  $4.7 \times 10^{-4}$

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## Question 8

Convert 252.00 to scientific notation. (1 point)

- A)  $2.5200 \times 10^3$
- B)  $2.5200 \times 10^2$
- C)  $2.520 \times 10^3$
- D)  $2.5200 \times 10^{-2}$

**Solution:**

- B)  $2.5200 \times 10^2$
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## Question 9

How many significant figures are in the measurement 0.005080? (1 point)

- A) 2
- B) 3
- C) 4
- D) 5

**Solution:**

- C) 4
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## Question 10

How many significant figures are in the number 250.40? (1 point)

- A) 2
- B) 3
- C) 4
- D) 5

**Solution:**

- D) 5
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## Question 11

What is the sum of  $7.26 + 1.753$  with the correct number of significant figures? (1 point)

- A) 9.013
- B) 9.01
- C) 9.0
- D) 9.0133

**Solution:**

- B) 9.01
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## Question 12

**Calculate  $0.00285 \times 1200.0$  and express the answer using the correct number of significant figures.** (1 point)

- A) 3.42
- B) 3.420
- C) 3.4
- D) 3.4200

**Solution:**

- A) 3.42
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## Question 13

**Convert 15.2 pounds to kilograms.** (1 pound = 0.453592 kilograms) (1 point)

- A) 6.69 kilograms
- B) 6.89 kilograms
- C) 7.20 kilograms
- D) 33.5 kilograms

**Solution:**

$15.2 \text{ lbs} \times 0.453592 \text{ kg/lb} = 6.89 \text{ kg}$   
Therefore, approximately 6.89 kilograms.

**Correct Answer:** B) 6.89 kilograms

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## Question 14

**Convert 500.0 milliliters to cubic inches.** (1 cubic inches = 16.387 milliliter ) (1 point)

- A) 53.53 cubic inches
- B) 8190 cubic inches
- C) 30.51 cubic inches
- D) 0.03277 cubic inches

**Solution:**

$500 \text{ ml} \times 0.0610237 \text{ in}^3/\text{ml} = 30.51 \text{ in}^3$   
Therefore, approximately 30.51 cubic inches.

**Correct Answer:** C) 30.51 cubic inches

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## Question 15

**Convert 55.0°C to Fahrenheit.** (1 point)

- A) 133°F
- B) 12.7°F
- C) 131°F
- D) 100°F

**Solution:**

C) 131°F

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## Question 16

**Convert 104°F to Celsius.** (1 point)

- A) 40.0°C
- B) 36.6°C
- C) 38.1°C
- D) 42.5°C

**Solution:**

A) 40°C

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## Question 17

**What type of matter is table salt (NaCl)?** (1 point)

- A) Element
- B) Compound
- C) Homogeneous mixture
- D) Heterogeneous mixture

**Solution:**

B) Compound

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## Question 18

**What type of mixture is ocean water?** (1 point)

- A) Element
- B) Compound
- C) Homogeneous mixture
- D) Heterogeneous mixture

**Solution:**

C) Homogeneous mixture

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## Question 19

What is chocolate chip cookie dough? (1 point)

- A) Element
- B) Compound
- C) Homogeneous mixture
- D) Heterogeneous mixture

**Solution:**

- D) Heterogeneous mixture
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## Question 20

Which of the following is an example of a chemical change? (1 point)

- A) Ice melting
- B) Sawing wood
- C) Paper burning
- D) Salt dissolving in water

**Solution:**

- C) Paper burning
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## Question 21

What is the type of change when sugar dissolves in water? (1 point)

- A) Physical change
- B) Chemical change
- C) No change
- D) Reversible change

**Solution:**

- A) Physical change
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## Question 22

What is the formula to calculate the change in temperature? (1 point)

- A)  $m = \frac{q}{c\Delta T}$
- B)  $c = \frac{q}{m\Delta T}$
- C)  $\Delta T = \frac{q}{mc}$
- D)  $\Delta T = \frac{q}{c}$

**Solution:**

- C)  $\Delta T = \frac{q}{mc}$
-

## Question 23

A 100.0 g sample of copper (specific heat capacity,  $c = 0.385 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$ , is heated from 25.0°C to 75.0°C. How much heat is absorbed by the copper? (2 points)

- A. 1985 J
- B. 1920 J
- C. 2890 J
- D. 962 J

**Solution:**

Using  $q = mc\Delta T$ , where  $\Delta T = 75 - 25 = 50^\circ\text{C}$ :

$$q = (100 \text{ g}) \times (0.385 \text{ J/g}^\circ\text{C}) \times (50^\circ\text{C}) = 1920 \text{ J}$$

- B. 1920 J
- 

## Question 24

If 2005 J of heat is added to a 25.0 g sample of copper (specific heat capacity,  $c = 0.385 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}$ ), by how many degrees Celsius will the temperature increase? (2 points)

- A. 521°C
- B. 30.9°C
- C. 208°C
- D. 80°C

**Solution:**

Using  $q = mc\Delta T$ , solve for  $\Delta T$ :

$$2000 \text{ J} = (25 \text{ g}) \times (0.385 \text{ J/g}^\circ\text{C}) \times \Delta T$$
$$\Delta T = \frac{2000 \text{ J}}{(25 \text{ g}) \times (0.385 \text{ J/g}^\circ\text{C})} \approx 207.79^\circ\text{C} \approx 208^\circ\text{C}$$

So, C) 208°C

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## Question 25

An element has an atomic number of 12 and a mass number of 24. Identify its atomic symbol. (1 point)

- A) Mg
- B) Ca
- C) Be
- D) B

**Solution:**

- A) Mg
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## Question 26

Which atomic symbol represents an ion with 20 protons, 19 neutrons, and 18 electrons? (1 point)

- A)  $^{39}\text{Mg}^{2+}$
- B)  $^{39}\text{Ca}^{2+}$
- C)  $^1\text{Be}^{2+}$
- D)  $^{38}\text{Ne}^{2+}$

**Solution:**

- B)  $\text{Ca}^{2+}$
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## Question 27

An ion has 29 protons, 27 electrons, and 35 neutrons. Identify its atomic symbol. (1 point)

- A)  $^{63}_{29}\text{Cu}^{2-}$
- B)  $^{62}_{29}\text{Zn}^{2+}$
- C)  $^{64}_{29}\text{Cu}^{2+}$
- D)  $^{64}_{29}\text{Zn}^{2+}$

**Solution:**

- C)  $^{64}_{29}\text{Cu}^{2+}$
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## Question 28

An ion has an atomic number of 31, a charge of 3+, and a mass number of 70. Identify its atomic symbol. (1 point)

- A)  $^{70}_{13}\text{Al}^{3+}$
- B)  $^{31}_{14}\text{Al}^{3-}$
- C)  $^{70}_{31}\text{Ga}^{3+}$
- D)  $^{70}_{31}\text{Ga}^{3-}$

**Solution:**

- C)  $^{70}_{31}\text{Ga}^{3+}$
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## Question 29

An ion has 16 protons, 18 electrons, and a mass number of 32. Identify the atomic symbol of this ion. (1 point)

- A)  $^{32}_{17}\text{S}^{2+}$
- B)  $^{34}\text{S}^{2-}$
- C)  $^{32}\text{P}^{2-}$
- D)  $^{32}_{16}\text{S}^{2-}$



**Solution:**

D)  ${}_{16}^{32}\text{S}^{2-}$

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## Question 30

**Chemical Formula:**  $\text{H}_2\text{SO}_4$

**How many atoms of each element are present?** (1 point)

A) H: 2, S: 1, O: 4

B) H: 1, S: 1, O: 4

C) H: 2, S: 4, O: 1

D) H: 4, S: 1, O: 2

**Solution:**

A) H: 2, S: 1, O: 4

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## Question 31

**Chemical Formula:**  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$

**How many atoms of each type are present?** (1 point)

A) C: 11, H: 12, O: 22

B) C: 22, H: 11, O: 12

C) C: 11, H: 12, O: 12

D) C: 12, H: 22, O: 11

**Solution:**

D) C: 12, H: 22, O: 11

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## Question 32

**Calculate the formula mass of sodium phosphate,  $\text{Na}_3\text{PO}_4$ . You must use proper mathematical notation and units throughout your calculations.** (3 points)

**Solution:**

- Sodium (Na): 3 atoms,  $3 \times 22.99 = 68.97 \text{ amu}$
  - Phosphorus (P): 1 atoms,  $1 \times 30.97 = 30.97 \text{ amu}$
  - Oxygen (O): 4 atoms,  $4 \times 16.00 = 64.00 \text{ amu}$
  - Total formula mass =  $68.97 + 30.97 + 64.00 = 163.94 \text{ amu}$
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## Question 33

Boron has two isotopes:  $^{10}_5\text{B}$  with a mass of 10.0129 amu (19.90% abundance) and  $^{11}_5\text{B}$  with a mass of 11.0093 amu (80.10% abundance). Calculate the average atomic mass of boron in amu. You must use proper mathematical notation and units throughout your calculations. (3 points)

**Solution:**

The average atomic mass is calculated using:

$$\begin{aligned}\text{Average atomic mass} &= (10.0129 \text{ amu} \times 0.199) + (11.0093 \text{ amu} \times 0.801) \\ &= 10.811 \text{ amu}\end{aligned}$$

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## Question 34

Answer the following questions in your own words. What determines the charge of an ion? How does the mass number of an isotope differ from its atomic number? What information does the formula mass of a compound convey? (3 points extra credit)

**Solution:**

1. The charge of an ion is determined by the difference between the number of protons and electrons: more protons result in a positive charge, and more electrons result in a negative charge.
2. The mass number of an isotope is the sum of its protons and neutrons, while the atomic number is the count of protons alone.
3. The formula mass of a compound indicates the total mass of all the atoms present in a single molecule of the compound, expressed in atomic mass units (amu).