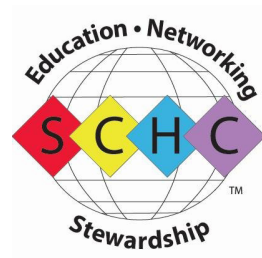


SDS & Label Authoring Registry

PROFICIENCY STUDY GUIDE



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DISCLAIMER

This Study Guide provides information regarding (1) identified knowledge areas, to supplement what is outlined in the Body of Knowledge for the SDS and Label Authoring Registry Program, and (2) the format of the current examination. This Study Guide is not intended to teach the competencies measured by the examination, but rather to give you an understanding of test content, structure and procedure so that you may approach the examination with the confidence that comes with knowing what to expect.

The authors make no claims to know what will be on the exam or that this study guide contains all critical information. The material herein is not intended to be a comprehensive handling of the subject matter. It is intended to provide one means for you to self-assess your knowledge and competencies, and to provide guidance into those areas where review may be necessary.

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SDS & Label Authoring Registry Proficiency Study Guide

The purpose of this study guide is to assist the prospective registrant in preparing for the exam. This proficiency is currently based on Revision 5 of the GHS.

The proficiency assessment takes four hours to complete. You are allowed 2 hours for the knowledge and 2 hours for the practical skills assessment. They are scored separately. You must pass both to become registered. If you do not pass one part but pass the other, you will only need to re-take the part you did not pass again.

The Knowledge Test

The knowledge test consists of 75 multiple choice questions that evaluate your knowledge in areas in which a SDS and label authoring specialist should be proficient. These questions involve basic concepts in toxicology, ecotoxicology, industrial hygiene, chemistry, and emergency response for chemicals. You will be expected to perform mathematical calculations and conversions related to hazard classification and SDS. A formula sheet will be provided. It will contain all the formulas that you will need and all the Globally Harmonized System of Classification and Labeling of Chemicals international standard (GHS) classification tables or decision logic charts needed for substance and mixture classification questions. To do well on this part of the exam, you need a solid knowledge in the rubrics below. This guide provides an overview of the type of questions you can expect in each rubric area.

- | | |
|--------------------------|---|
| 1. Math and Science | 5. Environmental Hazards |
| 2. Hazard Communications | 6. Industrial Hygiene and Safety |
| 3. Physical Hazards | 7. Risk Analysis |
| 4. Health Hazards | 8. International GHS Implementation, Associated Regulations and Consensus standards |

Rubric 1 – Math and Science

There are two types of questions that involve this rubric. The first kind are those specifically designed to test your understanding of important math and chemistry concepts related to hazard communication. The second kind are those that are testing another proficiency, but require knowledge of math and chemistry to answer them correctly. You should be able to:

- Calculate composition percentages
- Calculate percentages of pure substances in mixtures of mixtures
- Understand calculating molar solutions
- Understand parts per million (ppm), parts per billion (ppb), and parts per trillion (ppt)
- Be able to convert and calculate ppm, ppb, and ppt
- Convert ppm to mg/L, mg/mL, and g/L; and vice versa for liquids and solids
- Convert ppm to mg/L or mg/m³ and vice versa for gases and vapors
- Understand the relationship between density and specific gravity
- Calculate density or specific gravity
- Convert Temperature in Celsius to Fahrenheit and vice versa
- Understand standard units/metric system
- Understand the differences between atoms and molecules, and elements and compounds

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- Know the subatomic particles (electrons, protons, and neutrons)
- Know the major types of chemical identifiers and their use (ex. CAS numbers, UN Numbers, EINECS, etc.)
- Know the main types of compounds (organic, inorganic, monomers, polymers, surfactants, solvents)
- Know key characteristics of the main types of organic compounds (Alkanes, Alkenes, Alkynes, Aromatic Hydrocarbons, Alcohols, Amines, Acids, Amides, Esters, Ethers, Halogens, Nitros, Aldehydes, Ketones, Isocyanates, Peroxides)
- Know the differences between acids and bases
- Understand oxidizing reactions and what makes a chemical an oxidizer
- Understand reducing reactions and what makes a chemical a reducing agent
- Know the definitions of the three physical forms (gas, liquid, solid)
- Understand the route of exposure potential for the different physical forms
- Know the main physical properties included on a SDS under the GHS
- Understand the meaning of physical properties and their test methods to determine the end point (e.g. vapor pressure, boiling point, flash point)
- Know the various types of solubility (highly soluble, soluble, slightly soluble, nonsoluble)
- Understand what pH is and how it is calculated
- Understand the difference between mixtures and compounds
- How to identify data sources on the SDS (mixture testing versus component data)
- Understand and identify reaction products
- Understand the differences between stability and reactivity and how they relate to a SDS

Examples of a more general concept question might be:

Q: What is the definition of a polymer?

A: A large molecule made up of chains or rings of linked monomer units.

Q: A millimeter of mercury (mmHg) is a unit of measure for which of the following?

A: Vapor Pressure

An example of a calculation question might be:

Q: A substance is 10% of a raw material, and the raw material is 20% of a product. What percent of the product is the substance? Assume both the raw material and the product are simple mixtures.

A: 2%

Q: Convert 45°C to degrees F (formula will be provided)

A: 113°F

Rubric 2 – Hazard Communication

The questions in this topic area are intended to test your knowledge of the general concepts of hazard communication found in the GHS purple book. Specifically you should be knowledgeable of Part 1 of the GHS. You should be able to answer questions on:

- The history of the GHS
- The structure of the purple book
- The scope, application and limitations of the GHS
- Concepts in the GHS including the building block approach and application
- GHS definitions like hazard class, hazard category, weight of evidence, etc.
- Which elements of the GHS are applicable to the different sectors (transport, workplace, consumer products)
- GHS Classification Principles for substances and mixtures
- The use of cut-off values
- Bridging principles
- Labeling concepts (use of label tables, elements of a compliant label)
- Understand the general guidelines for SDS reader comprehension
- SDS content – know the various Sections of the SDS and what information appears in each Section
- Understand how different sections of the SDS interrelate to form a cohesive whole
- Understand the term article
- Understand and identify the harmonized GHS label elements
- Identify alternative labeling systems (NFPA, HMIS, etc.)

Examples of questions in this section might be:

Q: What is the correct pictogram for a pyrophoric solid?

A: Flame

Q: Which of the bridging principles refers to the situation where a mixture is assumed to be substantially equivalent to a previously manufactured lot of the same mixture?

A: Batching

Q: What Section of the SDS includes the product labeling?

A: Section 2

Rubric 3 – Physical Hazards

You must be familiar with the GHS criteria for classification for all 16 physical hazard classes. You will be given physical data for a substance or mixture and be expected to identify which hazard class would apply and assign the hazard class and category correctly. Some questions may be more general and concept based. Others will require specific classifications. When a specific classification is required, the applicable GHS classification table or flow-diagram will be provided on the formula sheet. You should be able to answer questions on:

- Identify the 17 GHS Physical Hazard classes and when to use them
- Understand the test methods and interpret the test data for various classes
- Understand the concept of “Hazards Not Otherwise Classified” and how it applies to physical hazards
- Understand the concept of combustible dust

An example of a more general concept question might be:

Q: What data elements are needed to classify flammable liquids?

A: Flash Point and Boiling Point

An example of a specific classification question might be:

Q: Provide the hazard class/category for a liquid with a boiling point of 45°C and flash point of 12°C.
(In this case the classification table for flammable liquids will be provided)

A: Flammable Liquid Category 2

Rubric 4 – Health Hazards

You must be familiar with both general toxicology concepts and the GHS criteria for classification for all 10 health hazard classes. You will be given health hazard data for a substance or mixture and be expected to identify which hazard class would apply and assign the hazard class and category correctly. Some questions may be more general and concept based. Others will require specific classifications. When a specific classification is required, the applicable GHS classification table or flow-diagram will be provided on the formula sheet.

- The general toxicology concepts you should be prepared to answer questions on include:
- The definition of toxicology and the types of toxicology
- How chemicals move into and out of the body: absorption, distribution, metabolism and excretion
- Dose-response relationship
- Threshold response concepts (NOEL, NOAEL, LOAEL)
- Adverse health effect concept
- Immediate (acute) vs. Delayed (chronic) effects
- Local vs. Systemic effects
- Reversible vs. Irreversible effects
- Toxicity tests, preferred species for classification

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- Weight of evidence
- Understand when additivity is used and when it is not
- Understand the GHS tiered approach to classifying mixtures (tested mixtures, bridging principles, untested mixture calculations, cut-off values)
- Understand the concept of “Hazards Not Otherwise Classified” and how it applies to health hazards

Some important GHS health hazard concepts

- Data conversion (1 hour to 4 hour for inhalation toxicity data, ppm to mg/L for vapor toxicity)
- Forms of matter (gas, vapor, mist, dust)
- Relevant ingredients for mixture classification
- Converting range data or acute toxicity category to a point estimate for mixture calculations
- Bridging principles
- How to handle ingredients with unknown acute toxicity

You should also be prepared to evaluate specific toxicity data provided and determine the correct GHS classification based on that data. The following are some examples of the kind of questions you might see. You will be provided all applicable classification criteria tables or flowcharts and any needed formulas.

Q: The oral LD50 of substance A in rats is 400 mg/kg. What is the classification?

A: Acute Toxicity Oral Category 4

Q: The inhalation LC50 in rats for a substance as a vapor is 0.8 mg/L/1 hour. What is the classification? (Remember to convert to a 4 hour ATE)

A: Acute Toxicity Inhalation Category 1

Q: A mixture consists of 2 substances, A and B, each present at 50%. The oral LD50 of substance A is 100 mg/kg in rats, the oral LD50 of substance B is 500 mg/kg in rats. What is the classification of the mixture? (FYI: If you are given the inhalation toxicity for vapors in ppm – remember to convert to mg/L to classify).

A: Calculated ATE Oral = 167 mg/kg; Acute Toxicity Oral Category 3

Q: A substance causes irreversible skin damage in a contact time of 2 minutes in a rabbit study. What is the classification of the substance?

A: Skin Corrosion Category 1A

Q: A mixture contains an ingredient A at 0.05% that is classified as a skin sensitizer category 1A and 0.06% of an ingredient B that is classified as a skin sensitizer category 1A. Is the mixture classified as a skin sensitizer?

A: No (unless they are chemically similar like isocyanates)

Rubric 5 – Environmental Hazards

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You must be familiar with both general ecotoxicology concepts and the GHS criteria for classification for environmental hazard classes. You will be given environmental hazard data for a substance or mixture and be expected to identify which hazard class would apply and assign the hazard class and category correctly. Some questions may be more general and concept based. Others will require specific classifications. When a specific classification is required, the applicable GHS classification table or flow-diagram will be provided on the formula sheet.

The general ecotoxicology concepts you should be prepared to answer questions on include:

- Toxicity endpoints: LC50, EC50, NOEC
- Acute aquatic toxicity testing for classification – methods, duration and organisms used
- Chronic aquatic toxicity testing for classification – methods and organisms used
- Abiotic Hazards – Global Warming Potential, Ozone Depletion, Acidification
- Physical and Chemical Properties important in understanding environmental fate
- Bioconcentration and bioaccumulation (logKow/Pow)
- Persistence Testing – Biodegradation, Hydrolysis, Photolysis
- Understand the concept of the M-factor
- Understand the GHS tiered approach to classifying mixtures (tested mixtures, bridging principles, untested mixture calculations – Summation, Additivity)
- How to handle ingredients with unknown hazards to the aquatic environment

Additional concepts included in this section are:

- Environmental considerations for accidental releases
- Disposal considerations

You should also be prepared to evaluate specific ecotoxicity, bioaccumulation and/or biodegradation data provided and determine the correct GHS classification based on that data. Knowledge of both substance and mixture classification will be tested. The following are some examples of the kind of questions you might see. You will be provided all applicable classification criteria tables or flowcharts and any needed formulas.

Q: What is the endpoint used to derive the LC50 in fish?

A: Death of half of the fish

Q: A product contains 3 chemicals. Chemical A has an Acute toxicity to fathead minnows of 1.5 mg/L/96hr and is 45% of the product. Chemical B has an Acute toxicity to fathead minnows of 110 mg/L/96hr and is 35% of the product. Chemical C has an Acute toxicity to fathead minnows of 0.2 mg/L/96hr and is 20% of the product. What is the calculated additive toxicity of the product?

A: Calculate ATE = 0.77 mg/L

Q: What is the multiplying factor for a substance with an EC50 in daphnia of 0.004 mg/L/48hr?

A: M = 100

Q: Is a chemical that exhibits a biodegradation rate of 83% in an OECD301 test readily biodegradable?

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A: Yes

Q: Using the summation method, determine the ecotoxicity classification for the following mixture.

Component A is present at 1%, is classified as acute 1 and has an M factor of 10. Component B is present at 15%, is classified as acute 1, and has an M factor of 1. Component C is present at 34% and is classified as acute 2. And component D is present at 50% and is classified as acute 3.

A: Aquatic Toxicity Acute Category 1

Rubric 6 – Industrial Hygiene and Safety

The questions in this topic area are intended to test your knowledge of the general concepts of industrial hygiene and safety as they relate to authoring SDS and labels. Topic areas for questions include:

- First aid and notes-to-physicians
 - How first aid statements on the label are selected
 - The purpose of first aid
 - First aid basics
- Firefighting and control
 - The fire tetrahedron, classification of fires and how the various extinguishing media work to extinguish the fire
 - Identifying unsuitable extinguishing media
 - Identifying hazardous combustion products
- Accidental release measures
 - Using hazards and properties to recommend procedures and clean up
- Storage and handling recommendations
 - Storage compatibility
- Stability and Reactivity Considerations related to storage and use
- Exposure limits
 - Types of limits (TWA, STEL, Ceiling Limit, IFV, Respirable Fibers, Dust Limits – total, inhalable, thoracic fraction and respirable)
 - Notations – SEN, SKIN
 - DN(M)EL, PNECs (these are limits derived from an EU REACH process and appear on SDS in some cases)
 - BEI
- Hierarchy of Control Methods
 - Elimination→Engineering Controls→Administrative Controls/Work Practices→PPE
- Engineering controls
 - Types of ventilation (general vs local exhaust)
 - Process controls
- Personal protective equipment
 - Respiratory Protection – types, selection parameters, types of filters and cartridges
 - Skin Protection – types, permeation, breakthrough time, degradation, penetration

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- Eye/Face Protection – use of types (safety glasses, goggles, faceshield, other)

Examples of questions in this section might be:

Q: What is the most appropriate place to sample when evaluating a worker exposure?

A: The worker's breathing zone

Q: What is the definition of a TWA exposure limit?

A: A time weighted average meaning average exposure over an 8-hour shift

Q: Convert a time-weighted average (TWA) concentration of 700 milligrams per cubic meter (mg/m³) to an equivalent concentration in parts-per-million (ppm). The molecular weight of the substance is 125 Daltons.

A: 137.2 ppm (137 ppm)

Q: What does the notation SEN mean when associated with an occupational exposure limit?

A: The chemical is a sensitizer

Q: Which type of engineering control is most appropriate for a volatile chemical classified as a carcinogen?

A: Enclosure

Q: For which of the following types of fires is water the most effective extinguishing agent?

A: Class A (ordinary combustibles)

Q: Would a glove with a breakthrough time of 3 minutes and permeation rate of 100 ug/cm²/min for a substance be appropriate to recommend for protection against that substance?

A: No

Rubric 7 – Risk Analysis

This is a minor rubric for the exam. Only a few questions on the test will come from this topic area. The questions in this topic area are intended to test your knowledge of the general concepts of risk analysis as they relate to authoring SDS and labels. Topic areas for questions include:

- Definition of Risk, Risk Analysis and Risk Assessment
- Relationship between risk and hazard and exposure
 - Risk = hazard x exposure
- Definition of Hazard (Toxicity)
- Definition of Exposure
- Steps in the Risk Assessment
 - Hazard Identification

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- Dose-Response Assessment
- Exposure Assessment
- Risk Characterization
- Use of Risk Assessment in the GHS
 - Limited to chronic health hazards in consumer product setting
- Risk characterization for carcinogens vs non-carcinogens
- Define the term “biologically available” and how it relates to Hazard Classification

Examples of questions in this topic area include:

Q: What hazards can risk based labeling be applied to?

A: Chronic Health hazards for consumer products

Q: What are the steps in the risk assessment process?

A: Hazard Identification -> Dose-Response Assessment -> Exposure Assessment -> Risk Characterization

Q: As a default, the unit risk for the cancer endpoint is calculated from which of the following?

A: Slope Factor (CSP) / Potency Factor (CFP)

Q: What is the correct formula for risk?

A: Risk = Hazard x Exposure or Risk = Toxicity x Exposure

Rubric 8 - International GHS Implementation, Associated Regulations and Consensus Standards

This is also a minor rubric for the exam. Only a few questions on the test will come from this topic area. The questions in this topic area are intended to test your knowledge of the general concepts GHS implementation around the world and general concepts about other chemical regulation, mainly chemical control laws.

- Understand the US-specific OSHA Hazard Classes
- Demonstrate an understanding of environmental regulations that would impact Section 15 of the GHS SDS (CERCLA, SARA, TSCA, etc)
- Demonstrate an understanding of inventory and chemical control laws (REACH, DSL, PICCS, TSCA, etc.)
- Demonstrate a basic knowledge of EU CLP Annex VI (harmonized classifications in Europe)
- Know the requirements of international GHS implementation (EU CLP, Canadian WHMIS, US HazCom 2012, etc.)
- Understand which ingredients and impurities must be disclosed on a SDS in various regions
- Understand trade secret protections in various regions

Examples of questions in this topic area include:

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Q: What government body is responsible for implementation of the GHS in the EU?

A: ECHA

Q: What hazard class is unique to the New Zealand implementation of the GHS?

A: Terrestrial Ecotoxicity

Q: What are the US OSHA specific hazard classes?

A: Combustible dust, Pyrophoric gases, Simple asphyxiants

Q: What is the purpose of a national chemical inventory?

A: To assure risk assessment of new chemicals introduced into commerce in a country

Knowledge Test Practice Exam

1. Which of the following statements about atoms is true?
 - a. A positively or negatively charged atom is known as an isotope.
 - b. The number of protons determines the chemical element.
 - c. The number of protons determines the isotope of the element.
 - d. The ratio of protons to neutrons determines the charge of an atom.

2. A substance is 5% of raw material A, 20% of raw material B, and not present in raw material C. The ratio of the raw materials is 20:20:60 (A:B:C). What percentage of the product is the substance? Assume both the raw materials and the product are simple mixtures.
 - a. 3%
 - b. 5%
 - c. 7%
 - d. 9%

3. Convert -58 degrees Fahrenheit (°F) into degrees Celsius (°C).
 - a. -32
 - b. -162
 - c. -50
 - d. -68

4. Which of the following is known as the ratio of the mass of a gas or vapor to the mass of an equal volume of air?
 - a. Vapor pressure
 - b. Vapor density
 - c. Bulk density
 - d. Saturated vapor concentration

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5. Which of the following defines a vapor?
 - a. The gaseous form of a substance or mixture released from its liquid or solid state.
 - b. An airborne dispersion of solid particles formed by the condensation of volatilized material.
 - c. A visible liquid aerosol formed by condensation.
 - d. A dispersion of microscopic solid particles and/or liquid particles in a gaseous medium.

6. Which of the following are the three primary types of hazards?
 - a. Physical, toxic, and environmental
 - b. Physical-chemical, health, and environmental
 - c. Explosive, corrosive, and acute aquatic toxicity
 - d. Physical, health, and environmental

7. Which of the following are the acceptable signal words?
 - a. Danger, warning, and caution
 - b. Poison, danger, and warning
 - c. Danger and warning
 - d. Poison and warning

8. A Safety Data Sheet (SDS) is composed of how many headings (sections)?
 - a. 16
 - b. 17
 - c. 8
 - d. 12

9. Which of the following defines a weight of evidence assessment?
 - a. All available relevant information are considered together.
 - b. Only animal studies, in vitro studies, and clinical studies are considered.
 - c. Only the most relevant study is used.
 - d. Only the most recent studies are used.

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10. For which of the following target audience is comprehensibility of particular importance?
- Workplace
 - Consumers
 - Emergency responders
 - Transport
11. Which of the following definitions best describes an oxidizing gas?
- Any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air.
 - Any gas which is flammable due to release of the oxygen in its structure upon heating.
 - Any gas which participates in a redox reaction, but does not impact the hazard of surrounding materials.
 - Any gas that is oxidized and made more flammable by the presence of another material which provides an oxygen-rich environment.
12. Which of the following substances contains a chemical group that is indicative of a self-reactive substance?
- Phenol
 - Xylene
 - Ethanol
 - Methanesulphonyl chloride
13. Which of the following data are generally not used in an evaluation strategy for skin corrosion/irritation?
- Data from structure activity relationship (SAR) analysis
 - Data from historical human experience
 - pH data
 - Data from an eye irritation/corrosion test

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14. What is the classification of an untested mixture that contains 5% of a substance classified as a Germ Cell Mutagen category 2?
- a. Germ Cell Mutagen Category 1A
 - b. Germ Cell Mutagen Category 1B
 - c. Germ Cell Mutagen Category 2
 - d. Not classified as a germ cell mutagen.
15. Calculate the acute toxicity estimate (ATE) for the following mixture. 40% of a substance with an oral lethal dose 50% [LD(50)] of 500 mg/kg, 20% of a substance with an oral LD(50) of >2000 mg/kg with no observed clinical signs of toxicity, 20% of a substance with an oral LD(50) of 3500 mg/kg, and 20% of a substance with an unknown oral LD(50).
- a. 1045 mg/kg
 - b. 836 mg/kg
 - c. 1167 mg/kg
 - d. 933 mg/kg
16. What is the classification of a substance that is known to cause transient central nervous system effects in humans that can lead to impaired judgment?
- a. Specific Target Organ Toxicity - Single Exposure Category 3
 - b. Specific Target Organ Toxicity - Repeat Exposure Category 2
 - c. Specific Target Organ Toxicity - Single Exposure Category 2
 - d. Specific Target Organ Toxicity - Single Exposure Category 1
17. Which of the following is the preferred test species for the evaluation of acute toxicity by the inhalation route?
- a. Mouse
 - b. Rat
 - c. Rabbit
 - d. Guinea Pig

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18. Which of the following statements is the most appropriate definition of the ecotoxicological endpoint No Observed Effect Concentration (NOEC)?
- a. Any test concentration that exhibits no statistically significant adverse effects.
 - b. The test concentration immediately above the lowest tested concentration with statistically significant adverse effects.
 - c. The test concentration immediately below the lowest tested concentration with statistically significant adverse effects.
 - d. The lowest test concentration that exhibits an effect relative to the control.
19. How should the following aquatic toxicity data be used to determine the acute aquatic hazard classification of a substance: 96-hr fish LC(50) = 12 mg/l; 48-hr crustacea EC(50) = 1.3 mg/l; 72-hr algal EC(50) = 0.1 mg/l?
- a. Classify based on the fish LC(50) data.
 - b. Classify based on the algal EC(50) data.
 - c. Classify based on the mathematically determined average of the three EC/LC(50) data points.
 - d. Classify based on a calculated ATE.
20. Which of the following represents the concentration to which nearly all workers can be exposed to in the workplace for an 8 hour day and 40 hour week without adverse effects?
- a. Time-weighted average limit (TWA)
 - b. Short-term exposure limit (STEL)
 - c. Ceiling limit (C)
 - d. Biological limit value (BLV)
21. A “sensitizer” notation with an occupational exposure limit indicates which of the following?
- a. The limit is set to protect against dermal sensitization.
 - b. The chemical can cause dermal and/or respiratory sensitization.
 - c. The limit is set to protect against respiratory sensitization.
 - d. Sensitization will not occur at levels below the limit.

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22. Which of the following types of local exhaust ventilation is best for laboratory scale quantities of materials or substances that are acutely toxic by inhalation?
- a. Biological Safety Cabinet
 - b. Laminar Flow Clean Bench
 - c. Laboratory Fume Hood
 - d. Canopy hood
23. Which of the following statements regarding risk based labeling is true?
- a. The risk based label communicates the likelihood of injury.
 - b. The risk based label puts hazards in perspective.
 - c. The risk based label excludes hazards based on very low risk.
 - d. Risk based labeling applies to both acute and chronic hazards.
24. European Union specific statements (EUH statements) are included under which of the following sections of the label?
- a. Supplemental information
 - b. Hazard statements
 - c. Precautionary statements
 - d. Signal word
25. In general terms, what is a national chemical inventory?
- a. A list of chemicals that may be manufactured, imported, or otherwise be used in commerce.
 - b. A list of chemicals that are available for purchase.
 - c. A list of hazardous chemicals manufactured in a specific economy.
 - d. A detailed list of chemicals known to exist.

Knowledge Test Practice Exam Answer Key

1. B
2. B
3. C
4. B
5. A
6. D
7. C
8. A
9. A
10. B
11. A
12. D
13. D
14. C
15. D
16. A
17. B
18. C
19. B
20. A
21. B
22. C
23. C
24. A
25. A

THE PRACTICAL SKILLS ASSESSMENT

This part consists of two sub-parts. It is open book in that the GHS Rev 5 will be provided electronically for you use.

In the first part you need to classify one substance and one mixture following the GHS. For the substance you will be provided a complete set of data for the substance to compare to all the GHS hazard classes and categories. For the mixture you will be provided all needed mixture test data, substance data for hazard endpoints where calculations are needed for classification along with the overall classification for each substance in the mixture and the proportion. In both cases, you will need to assign all applicable physical, health and environmental hazard classes and categories.

The following is an example of a substance data set for your practice:

Classify this Substance Following The GHS Rev 5. Write the classification clearly, both hazard class and category.

Example Substance	
Organic/Inorganic:	Organic
Form:	Solid
Color:	Purple
Odor:	None
Viscosity:	Not Applicable
Boiling Point:	Not Applicable
Freezing Point:	180 C
Decomposition temperature:	250 C
Density:	1.5
Vapor Pressure:	Not Applicable
Vapor Density:	Not Applicable
Evaporation Rate:	Not Applicable
pH:	Not Applicable
Water Solubility:	10 g/L @ 20 C
Solvent Solubility:	Soluble in acetone
Octanol/Water Partition coefficient (Log Kow):	0.7
Auto-ignition Temperature:	>300 C
Flash Point:	Not Applicable
UEL:	Not Applicable
LEL:	Not Applicable
Burning Rate:	1 mm/sec
Burning Time:	60 seconds
Corrosion Data:	<1.0 mm/year at 55 C (saturated aqueous solution)
Reactivity Data:	Reacts with oxidizers releasing heat.
Stability Data:	Stable under normal conditions of storage and use
Decomposition Products:	Oxides of carbon and sulfur

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Possibility of Hazardous Reaction:	None known
Exposure Limits:	0.5 mg/m3 TWA
Biological Limit Value:	None Established
Toxicological Information	
Oral Rat LD50:	525 mg/kg
Dermal Rabbit LD50:	>5000 mg/kg
Inhalation Rat LC50/4 hr:	>10 mg/L as dust no serious toxicity at highest dose tested
Skin Corrosion/Irritation:	In a 4 hour exposure in rabbits Mean value for erythema/eschar (from gradings at 24, 48 and 72 hours) : Rabbit 1 = 3.6, Rabbit 2 = 3.1, Rabbit 3 = 3.2 Mean value for oedema (from gradings at 24, 48 and 72 hours) : Rabbit 1 = 2.1, Rabbit 2 = 1.2, Rabbit 3 = 2.1
Eye Corrosion/Irritation:	3/3 rabbits mean scores: corneal opacity 0.5-0.9, iritis 0.5-0.9, conjunctival redness 2.0, conjunctival oedema 2.5, reversed in 14 days
Respiratory Sensitization:	No evidence of respiratory sensitization based on human experience
Skin Sensitization:	Positive guinea pig maximization test (60% responding at 0.5% intradermal dose)
Germ Cell Mutagenicity:	Negative AMES, Negative in-vivo mouse specific locus, Negative in-vitro mammalian chromosome aberration test
Carcinogenicity:	Negative in 2 year rat oral assay
Reproductive/Developmental Toxicity:	No adverse effects in studies with rats and rabbits
STOT Single Exposure:	No data available
STOT Repeat Exposure:	No adverse effects in 90 day rat oral study to a dose of 150 mg/kg/day
Ecological Toxicity Data	
Acute	
LC50 fish 96 hr:	125 mg/L
EC50 crustacea 48 hr:	280 mg/L
ErC50 algae 72 hr:	90 mg/L
Chronic	
Fish:	No data available
Crustacea:	No data available
Algae:	No data available
Degradability:	25% in 28 days OECD 302
BCF:	No data available

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A: Acute Toxicity Oral Category 4; Skin Irritation Category 2; Eye Irritation Category 2A; Skin Sensitization Category 1A; Aquatic Toxicity Acute Category 3; Aquatic Toxicity Chronic 3

The following is an example of a mixture classification for your practice:

Classify the mixture below based on the data provided and/or classification given following the GHS mixture rules. Assume that the substance meets the classification criteria only for classifications given.

Example Mixture

95% Substance A / 5% Substance B

GHS Classification

Substance A

Acute Oral Toxicity Category 3 LD50 oral rat 250 mg/kg, LD50 dermal rabbit >5000 mg/kg

Eye Irritant Category 2A

Acute Aquatic Toxicity Category 2

Chronic Aquatic Toxicity Category 2

Substance B

Acute Dermal Toxicity Category 2 LD50 oral rat >5000 mg/kg, LD50 dermal rabbit 400 mg/kg

Skin Sensitizer Category 1B

Acute Aquatic Toxicity Category 1, M=1

A: Acute Toxicity Oral Category 3 (Calculated ATE = 263 mg/kg); Eye Irritation Category 2A; Skin Sensitization Category 1B; Aquatic Toxicity Acute Category 2; Aquatic Toxicity Chronic Category 2

In the second part you will author an actual SDS using a template for a chemical whose classification has been provided along with a complete data set. The template is a multiple choice format – you will mark the correct responses on the answer sheet from the choices presented in each section. You will not actually “write” the document manually. The data set will be very similar to the substance set above but in this case, the complete classification will have been provided. This SDS proficiency is based solely on the purple book (GHS) rev 5 for SDS format and content. The guidance in the GHS should be used to determine what information is placed where on the SDS. The correct answers in most sections will be based on consistency with the classification and labeling determined following the GHS. The best answers for Sections 5 and 6 are based on the NA Emergency Response Guidebook, which will be provided. We recognize that companies have internal policies governing certain standard information that is provided on the SDS that may not be hazard driven. For this proficiency, you will be graded on creating a SDS that is consistent with the hazard classification and the data provided.

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In preparing Section 2 of the SDS template you will include ALL applicable pictograms, hazard and precautionary phrases without regard to precedence guidance.

Many sections are completed by selecting the BEST answer from the choices offered. In some cases you will be asked to indicate what type of information should be included for the field. There may be more than one correct answer.



Body of Knowledge

SDS and Label Authoring Registry



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About AIHA®

Founded in 1939, the American Industrial Hygiene Association® (AIHA®) is one of the largest international associations serving the needs of industrial/occupational hygiene professionals practicing in industry, government, labor, academic institutions, and independent organizations.

For more information, visit www.AIHA.org

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Background

AIHA® and its selected members worked collaboratively to develop the technical framework, known as the Body of Knowledge (BoK), that outlines the knowledge and skills a competent person should possess and be able to demonstrate when authoring safety data sheets (SDS) and labels. In September 2015, a panel of subject matter experts was appointed to revise the SDS & Label Authoring BoK and develop a subsequent Job/Task Analysis (JTA) survey to collect input, perspective, and feedback from relevant stakeholders to identify the essential knowledge and skills required for competent SDS and label authoring. The subject matter expert project team included a subset of SDS and label authoring Registrants.

In December 2015, the JTA survey was made available to AIHA® SDS and Label Authoring Registrants. The survey results were used to finalize the content for the SDS and Label Authoring BoK.

The BoK document was approved by the subject matter expert project team June 2016.

SDS & Label Authoring

Occupational Definition

This document provides an organized summary of the collective knowledge and skills necessary for competent SDS and label authoring. This Body of Knowledge (BoK) will be used by AIHA to establish a framework to assist the prospective registrant in preparing for the exam. Prior to sitting for the SDS and Label Authoring Registry's Competency Assessment, the applicant should ensure that they are proficient in these knowledge areas.

This BoK is not intended to define or stipulate employer hiring criteria. It is the employer's responsibility to ensure that each employee understands his or her specific job and has met the minimum criteria established by relevant regulations, standards, and the specific industry, facility, or project.

Skills

Performance-based training incorporates performance tasks (performance assessments) that build on content knowledge. These demonstrations of knowledge and skills document competence.

Knowledge Test

The knowledge test consists of 75 multiple choice questions that evaluate your knowledge in areas in which a SDS and label authoring specialist should be proficient. These questions involve basic concepts in toxicology, ecotoxicology, industrial hygiene, chemistry, and emergency response for chemicals. You will be expected to perform mathematical calculations and conversions related to hazard classification and SDS. A formula sheet will be provided. It will contain all the formulas that you will need and all the Globally Harmonized System of Classification and Labeling of Chemicals international standard (GHS) classification tables or decision logic charts needed for substance and mixture classification questions. This BoK provides a blueprint of the type of questions you can expect in each knowledge area.

Knowledge Areas

Table 1 describes the knowledge and skills that constitute competent SDS and label authoring.

1.0 Math and Science (19%)

1.A. General mathematics & computation

- 1.A.1. Calculate composition percentages
- 1.A.2. Calculate percentages of pure substances in mixtures of mixtures
- 1.A.3. Convert and calculate ppm, ppb, and ppt into weight/volume percent
- 1.A.4. Convert ppm to mg/L, mg/mL, and g/L; and vice versa for liquids and solids
- 1.A.5. Convert ppm to mg/L or mg/m³ and vice versa for gases, vapors, dust and mists
- 1.A.6. Understand the relationship between density and specific gravity
- 1.A.7. Convert temperature in Celsius to Fahrenheit and vice versa
- 1.A.8. Understand standard unit/metric system

1.B. General Chemistry

- 1.B.1. Understand the differences between atoms elements and compounds
- 1.B.2. Demonstrate an understanding of the major types of chemical identifiers and their use (ex: CAS numbers, UN Numbers, EINECS, etc.)
- 1.B.3. Demonstrate an understanding of the main types of compounds (organic, inorganic, monomers, polymers, surfactants, solvents, acid, bases)
- 1.B.4. Identify key characteristics of the main types of organic compounds (Alkanes, Alkenes, Alkynes, Aromatic Hydrocarbons, Alcohols, Amines, Acids, Amides, Esters, Ethers, Halogens, Nitros, Aldehydes, Ketones, Isocyanates, Peroxides)
- 1.B.5. Understand the main chemical and physical properties included on a SDS under the GHS
- 1.B.6. Demonstrate an understanding of the various types of solubility (highly soluble, soluble, slightly soluble, nonsoluble)
- 1.B.7. Understand what pH is and how it is calculated
- 1.B.8. Understand and identify reaction products
- 1.B.9. Understand the differences between stability and reactivity
- 1.B.10. Differentiate between the three physical forms (gas, liquid, solid) and understand the hazard potentials for each
- 1.B.11. Understand the route of exposure potential for the different physical forms

- 1.B.12. Understand the meaning of physical property with regard to the hazard of the property
- 1.B.13. Understand the meaning of physical properties and their test methods to determine the end point (e.g. vapor pressure, boiling point, flash point)
- 1.B.14. Understand the behaviors of mixtures vs substances
- 1.B.15. Understand how temperature and pressure impact other hazards outside the scope of the specifically defined hazard classes

2.0 Hazard Communication (20%)

2.A. GHS Concepts

- 2.A.1. Understand the scope of the GHS
- 2.A.2. Understand the structure of the purple book
- 2.A.3. Demonstrate an understanding of the scope, application and limitations of the GHS
- 2.A.4. Apply knowledge of GHS concepts including the building block approach and application
- 2.A.5. Understand GHS definitions like hazard class, hazard category, weight of evidence, etc.
- 2.A.6. Demonstrate an understanding of which elements of the GHS are applicable to the different sectors (transport, workplace, consumer products)
- 2.A.7. Apply knowledge of GHS Classification Principles for substances and mixtures
- 2.A.8. Demonstrate an understanding of using cut-off values
- 2.A.9. Understand labeling concepts
- 2.A.10. Demonstrate an understanding of the general guidelines for SDS reader comprehension
- 2.A.11. Demonstrate an understanding of the relationship between each section and piece of data on the SDS document so that consistency can be achieved throughout the document
- 2.A.12. Identify data sources on the SDS (mixture testing versus component data)
- 2.A.13. Understand the term article
- 2.A.14. Demonstrate an understanding of the building block approach
- 2.A.15. Understand and identify the harmonized GHS label elements

2.B. SDS Content & Label

- 2.B.1.** Demonstrate an understanding of identifying chemicals (IUPAC, common names, CAS, EC)
- 2.B.2.** Understand the concepts found on a safety data sheet and the audience(s) for each section
 - 2.B.2.a** Identification (Product Name/Manufacturer Information including Emergency Contact Information/Recommended Use/Restricted Use)
 - 2.B.2.a** Hazard Identification
 - 2.B.2.b** Composition
 - 2.B.2.c** First-aid measures
 - 2.B.2.d** Fire-fighting measures
 - 2.B.2.e** Accidental release measures
 - 2.B.2.f** Handling and storage
 - 2.B.2.g** Exposure Controls and Personal Protective Equipment
 - 2.B.2.h** Physical and chemical properties
 - 2.B.2.i** Stability and reactivity
 - 2.B.2.j** Toxicological information
 - 2.B.2.k** Ecological information
 - 2.B.2.l** Disposal considerations
 - 2.B.2.m** Transport information
 - 2.B.2.n** Regulatory Information
 - 2.B.2.o** GHS labeling requirements
 - 2.B.2.p** NFPA or HMIS ratings (Alternative labeling systems)
 - 2.B.2.q** Other information
- 2.B.3.** Know the process in which an SDS is developed (Order of section development)
- 2.B.4.** Know how to review an SDS for internal consistency
- 2.B.5.** Understand the sections, required format, and the content of a GHS Safety data sheet
- 2.B.6.** Demonstrate knowledge for the selection of label elements (pictogram(s), signal word, hazard statement(s) and precautionary statement(s) based on a GHS Classification
- 2.B.7.** Know the elements of a GHS compliant label
- 2.B.8.** Understand how a GHS label is developed using the tables in Annex 3 of the GHS

2.B.9. Know the order of precedence for the label elements in the GHS

3.0 Physical Hazards (9%)

- 3.1. Apply knowledge of the 17 physical hazard classes and when to use them
- 3.2. Understand the use of ISO 10156:2010 in calculating the flammability of gas mixtures under GHS
- 3.3. Understand how the hazard classes under the GHS physical hazards section relate to and can be used to determine the transportation information - hazard class, packing group, etc. (**Note: Formal training on transportation regulations is required before an SDS author can apply this to section 14 of an SDS.)
- 3.4. Familiarize yourself with the test methods used to determine physical hazards and how to interpret test data for the various classes
- 3.5. Demonstrate an understanding of Hazards Not Otherwise Classified (HNOC) and where they are implemented
- 3.6. Demonstrate an understanding of combustible dust

4.0 Health Hazards (21%)

4.A. General Concepts

- 4.A.1. Understand data conversion (1 hour to 4 hour for inhalation toxicity data, ppm to mg/L for vapor toxicity)
- 4.A.2. Distinguish between the different forms of matter (gas, vapor, mist, dust)
- 4.A.3. Understand the relevant ingredients concept for untested mixture classification in the hazard classes that use additivity (Acute Toxicity, Skin Corrosion/Irritation, Serious Eye Damage/Eye Irritation, Target Organ Toxicity – Single Exposure Category 3, Aspiration Hazard, and Hazardous to the Aquatic Environment)

- 4.A.4. Convert range data or acute toxicity category to a point estimate for mixture calculations
- 4.A.5. Understand how to properly handle ingredients with unknown acute toxicity
- 4.A.6. Apply knowledge of the 10 health hazard classifications and when to use them for substances
- 4.A.7. Understand the GHS tiered approach to classifying mixtures (e.g. tested mixtures, bridging principles, untested mixture calculations)
- 4.A.8. Demonstrate an understanding of HNOCs and where they are implemented

4.B. General Toxicology Concepts

- 4.B.1. Understand the term toxicology
- 4.B.2. Understand how chemicals move into and out of the body: absorption, distribution, metabolism and excretion
- 4.B.3. Understand dose-response relationship
- 4.B.4. Understand the threshold response concepts (NOEL, NOAEL, LOAEL)
- 4.B.5. Understand the adverse health effect concept
- 4.B.6. Distinguish between immediate (acute) vs. Delayed (chronic) effects
- 4.B.7. Distinguish between Local vs. Systemic effects
- 4.B.8. Distinguish between Reversible vs. Irreversible effects
- 4.B.9. Understand toxicity tests
- 4.B.10. Understand preferred species for acute toxicity tests
- 4.B.11. Understand when Additivity is used and when it is not (skin corrosion/irritation, serious eye damage/eye irritation)
- 4.B.12. Understand weight of evidence

4.C. General Biology

- 4.C.1. Demonstrate an understanding of the structure and function of target organs (e.g. respiratory system, kidney, liver, nervous system)

5.0 Environmental Hazards (8%)

5.A General Ecotoxicology Concepts

- 5.A.1. Understand the toxicity endpoints: LD50, LC50, EC50, NOEC
- 5.A.2. Understand and identify the different methods and durations for acute aquatic toxicity testing and the organisms used
- 5.A.3. Understand and identify the different methods of classification for chronic aquatic toxicity testing and the organisms used
- 5.A.4. Demonstrate an understanding of persistence testing (i.e., biodegradation, hydrolysis, photolysis)
- 5.A.5. Demonstrate an understanding of bioconcentration and bioaccumulation (logKow/Pow)
- 5.A.6. Demonstrate an understanding of degradation
- 5.A.7. Understand the concept of M factor
- 5.A.8. Understand how to apply the criteria for Ozone Depleting Potential under the GHS
- 5.A.9. Apply criteria for classifying substances for acute and chronic aquatic toxicity potential including the concept of different trophic levels (fish, aquatic invertebrates, aquatic plants)
- 5.A.10. Understand the GHS tiered approach to classifying mixtures (e.g. tested mixtures, bridging principles, untested mixture calculations) (i.e. Summation and Additivity)
- 5.A.11. Understand how to properly handle ingredients with unknown hazards to the aquatic environment

6.0 Industrial Hygiene & Safety (12%)

- 6.1. Determine which exposure limit to include in the SDS based on the exposure limits given
- 6.2. Understand the types of threshold limit values (i.e., TWA, STEL, Ceiling Limit, IFV, Excursions, BEI, Respirable Fibers, Dust Limits – total, inhalable, thoracic fraction and respirable)
- 6.3. Understand significant routes of exposure for various physical states
- 6.4. Understand the applicability of engineering controls (i.e., ventilation)

- 6.5. Demonstrate an understanding of the PPE recommendations related to hazards, quantity, and conditions of use
- 6.6. Understand and apply appropriate first-aid measures based on classification
- 6.7. Demonstrate an understanding of special treatments for exposure
- 6.8. Consider special needs that a physician should be made aware of when completing the first-aid section (section 4) of the SDS
- 6.9. Differentiate between suitable/unsuitable controls for fire types
- 6.10. Understand and identify the specific hazards arising from burning chemical fires
- 6.11. Demonstrate an understanding of compatible and incompatible chemical placement
- 6.12. Select precautionary statements for safe handling based on classification and physical properties
- 6.13. Recommend personal precautions, protective equipment and protective measures for spilled product(s)
- 6.14. Understand how stability and reactivity relate to an SDS
- 6.15. Identify the drivers behind chemical incompatibility
- 6.16. Apply knowledge of chemical incompatibility

7.0 Risk Analysis (2%)

- 7.1. Understand the relationship between risk, hazard, and exposure
- 7.2. Understand how consumer product labeling can be based on the likelihood of injury (see GHS Annex 5)
- 7.3. Understand how the term “biologically available” can be considered when performing hazard classification

8.0 International GHS Implementation, Associated Regulations & Consensus Standards (8%)

- 8.1. Understand the US OSHA specific hazard classes
- 8.2. Demonstrate an understanding of environmental regulations that would impact Section 15 of the SDS sheet (i.e., CERCLA, SARA, TSCA, etc.)
- 8.3. Understand SDS content required by EPCRA (SARA 313)
- 8.4. Demonstrate an understanding of dangerous goods transportation
- 8.5. Identify and list OEL/BEI for different areas/countries (i.e. PEL, TLV, MAK, REL)
- 8.6. Demonstrate understanding of Right to Know Laws
- 8.7. Apply general understanding of disposal regulations
- 8.8. Demonstrate an understanding of Inventory and chemical control laws (US TSCA, Canadian DSL, NDSL, etc.)
- 8.9. Demonstrate basic knowledge of EU CLP Annex VI
- 8.10. Understand the characteristics of a study that adds to its weight of evidence for classification (e.g., Good Laboratory Practice (GLP), statistical significance, etc.)
- 8.11. Know requirements for OSHA's Hazard Communication Standard 2012
- 8.12. Understand which ingredients or impurities must be disclosed in an OSHA HCS 2012 SDS
- 8.13. Understand what information may be claimed as trade secret under OSHA HCS 2012
- 8.14. Be familiar with the comprehensibility concepts for SDSs and labels (e.g., ANSI Z1291/Z4001)

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