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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If you are looking for additional information about policies and process related to taking the SDS and Label Authoring Registry exam, please visit www.aiharegistries.org

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The purpose of this study guide is to assist the prospective registrant in preparing for the exam. This proficiency is currently based on Revision 8 of the GHS (https://unece.org/ghs-rev8-2019).

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. Detailed information is available at https://www.aiharegistries.org/sds-label-authoring-registry.

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 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
2. Hazard Communications
3. Physical Hazards
4. Health Hazards
5. Environmental Hazards
6. Industrial Hygiene and Safety
7. Risk Analysis
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 are those specifically designed to test your understanding of important math and chemistry concepts related to hazard communication. The second are those that are testing another proficiency and require knowledge of math and chemistry to answer them correctly. You should possess:

- Skill in calculating percentages of pure substances in mixtures of mixtures
- Skill in converting and calculating ppm, ppb, and ppt into weight/volume percentage
- Skill in converting ppm to mg/L or mg/m^3 and vice versa for gases, vapors, dust, and mists
- Skill in converting ppm to mg/L, mg/mL, and g/L; and vice versa for liquids and solids
- Skill in converting temperature in Celsius to Fahrenheit and vice versa
- Knowledge of the relationship between density and specific gravity
- Knowledge of standard unit/metric system

- Knowledge of the differences between atoms, elements, and compounds
- Knowledge of the 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)
- Knowledge of the differences between mixtures and substances
- Knowledge of basic chemical equations
- Knowledge of how temperature and pressure impact each other and on substances/mixtures (e.g., Boyle's law and Charles' law)
- Knowledge of how to obtain reaction products
- Knowledge of the definitions of each state of matter and its correct usage (e.g., a *fume* is a sublimated particle)
- Knowledge of the differences between stability and reactivity
- Knowledge of the main chemical and physical properties included on an SDS under the GHS
- Knowledge of the main types of compounds (organic, inorganic, monomers, polymers, surfactants, solvents, acids, bases)
- Knowledge of the meaning of physical properties and their test methods to determine the endpoint (e.g., vapor pressure, boiling point, flash point)
- Knowledge of the route-of-exposure potential for the different physical forms
- Knowledge of the various types of solubility (highly soluble, soluble, slightly soluble, nonsoluble)
- Knowledge of what pH is and how it measures acids and bases

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. While the whole Purple Book applies to aspects of this section, Part 1 is particularly relevant for many of the concepts listed below. You should be able to answer questions on:

- Knowledge of the structure of the Purple Book
- Knowledge of the scope, application, and limitations of the GHS
- Ability to implement GHS classification principles for substances and mixtures (including the weight of evidence and reliability of studies)
- Knowledge of GHS concepts, including the building block approach and application
- Knowledge of which elements of the GHS are applicable to the different sectors (transport, workplace, consumer products)
- Knowledge of GHS definitions (e.g., *hazard class, hazard category, weight of evidence*)
- Skill in using cut-off values to determine the classification of a mixture
- Knowledge of labeling concepts as applied to different sectors (transport, workplace, consumer products)
- Knowledge of the general guidelines for overall SDS comprehension
- Knowledge of the relationship between each section and piece of data on the SDS document so that consistency can be achieved throughout the document
- Ability to identify data sources on the SDS (mixture testing vs. component data)
- Knowledge of the term *article*
- Ability to identify the harmonized GHS label elements
- Knowledge of identifying chemicals (IUPAC, common names, CAS, EC)
- Ability to select label elements such as pictogram(s), signal word, hazard statement(s), and precautionary statement(s), based on a GHS classification
- Ability to review an SDS for internal consistency
- Knowledge of the elements of a GHS compliant label
- Knowledge of the order of precedence for the label elements in the GHS
- Knowledge of the process in which an SDS is developed (order of section development)
- Knowledge of how a GHS label is developed using the tables in Annex 3 and Annex 7 of the GHS, including labeling of small packages, sets, and kits
- Knowledge of the concepts found on an SDS and the applicable audience(s) for each section:
    - Identification (product identifier/supplier information including emergency contact information/recommended use/restricted use)
    - Hazards identification
    - Composition
    - First-aid measures
    - Fire-fighting measures
    - Accidental release measures
    - Handling and storage
    - Exposure controls/personal protection
    - Physical and chemical properties
    - Stability and reactivity

  - Toxicological information
  - Ecological information
  - Disposal considerations
  - Transport information
  - Regulatory information
  - GHS labeling requirements
  - NFPA and HMIS ratings (alternative labeling systems)
  - Other information
- Knowledge of the sections, required format, and the content of a GHS SDS

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 17 chapters in Part 2 of the Purple Book that describe the 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:

Knowledge of the GHS physical hazard classes

Knowledge of combustible dust

Knowledge of Hazards Not Otherwise Classified (HNOCs) and where they are implemented (OSHA HCS, WHMIS 2015)

Skill in classifying substances and mixtures according to the GHS physical hazard classes

Knowledge of the test methods used to determine physical hazards and how to interpret test data for the various classes

Skill in calculating the flammability of gas mixtures under the GHS

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 chapters in Part 3 of the Purple Book that describe the 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. Topic areas for questions include:

- Skill in health hazard data conversion (e.g., 1 hour to 4 hours for acute inhalation toxicity data, ppm to mg/L for vapor toxicity)
- Ability to distinguish between the different forms of matter in the determination of inhalation toxicity (gas, vapor, mist, dust)
- Knowledge of 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, and Aspiration Hazard)
- Skill in converting range data or acute toxicity category to an acute toxicity point estimate for mixture calculations
- Knowledge of how to properly handle ingredients with unknown acute toxicity when calculating the acute toxicity estimate (ATE) of an untested mixture
- Knowledge of the classification criteria of the 10 GHS health hazard endpoints and how to apply them to test data
- Knowledge of the GHS tiered approach to classifying mixtures (e.g., tested mixtures, bridging principles, untested mixture calculations)
- Knowledge of HNOCs and where they are implemented (OSHA HCS, WHMIS 2015)
- Knowledge of simple asphyxiants
- Knowledge of the structure and function of target organs (e.g., respiratory system, kidney, liver, nervous system), as well as what is generally observed when these organs are damaged due to chemical exposure
- Ability to distinguish between immediate (acute) vs. delayed (chronic) effects following chemical exposure
- Ability to distinguish between local vs. systemic adverse health effects
- Ability to distinguish between reversible vs. irreversible adverse health effects
- Ability to find authoritative, reliable information for acute toxicity endpoints (LD_{50}, LC_{50})
- Knowledge of acute toxicity endpoints (LD_{50}, LC_{50})
- Knowledge of how chemicals move into and out of the body: absorption, distribution, metabolism, and excretion (ADME)
- Knowledge of preferred species for various acute toxicity tests (e.g., oral LD_{50}, dermal LD_{50}, inhalation LC_{50}, dermal irritation, eye irritation, dermal sensitization)
- Knowledge of the adverse health effect concept
- Knowledge of the basis of toxicity tests, why they are done, and how to interpret the results
- Knowledge of the dose-response relationship
- Knowledge of the term toxicology
- Knowledge of the threshold response concepts (NOEL, NOAEL, LOAEL)
- Knowledge of weight of evidence and how it is used for health hazard classification purposes
- Knowledge of when additivity is used and when it is not.
- Skill in classifying substances/mixtures according to the GHS health hazard classes

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.

Examples of questions in this section might be:

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? (Hint: 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

You must be familiar with both ecotoxicology concepts in Part 4 of the Purple Book that describe the 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:

- Ability to apply criteria for classifying substances for acute and chronic aquatic toxicity potential, including the concept of different trophic levels (fish, aquatic inverts, aquatic plants)
- Ability to apply the criteria for Ozone Depleting Potential under the GHS
- Ability to identify the different methods and durations for acute aquatic toxicity testing and the organisms used
- Ability to identify the different methods of classification for chronic aquatic toxicity testing and the organisms used
- Knowledge of bioconcentration and bioaccumulation (log K_{ow}/ P_{ow})
- Knowledge of how to properly handle ingredients with unknown hazards to the aquatic environment
- Knowledge of persistence testing (e.g., biodegradation, hydrolysis, photolysis)
- Knowledge of the concept of M factor and application in mixture classification
- Knowledge of the GHS tiered approach to classifying mixtures (e.g., tested mixtures, bridging principles, untested mixture calculations [i.e., summation and additivity])
- Knowledge of the toxicity endpoints: LD_{50}, LC_{50}, EC_{50}, NOEC, and LOEC
- Knowledge of the relevant ingredients concept for untested mixture classification
- Skill in classifying substances/mixtures according to the GHS environmental hazard classes.

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 with applicable classification criteria table, flowchart, or formula.

Examples of questions in this section might be:

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/96 hour and is 45% of the product. Chemical B has an Acute toxicity to fathead minnows of 110 mg/L/96 hour and is 35% of the product. Chemical C has an Acute toxicity to fathead minnows of 0.2 mg/L/96 hour 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/48 hour?

A: M = 100

Q: Is a chemical that exhibits a biodegradation rate of 83% in an OECD 301 test readily biodegradable?

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:

- Ability to apply appropriate first-aid measures based on the classification
- Ability to determine which exposure limit(s) to include in the SDS based on the composition of the mixture
- Ability to differentiate between suitable/unsuitable controls for fire types
- Ability to identify the specific hazards arising from burning chemical fires
- Ability to recommend personal precautions, protective equipment, and protective measures for spilled product(s)
- Ability to select precautionary statements for safe handling based on classification and physical properties
- Knowledge of chemical incompatibility
- Knowledge of compatible and incompatible chemical placement
- Knowledge of how stability and reactivity relate to an SDS
- Knowledge of significant routes of exposure for various physical states
- Knowledge of special needs that a physician should be made aware of when completing the first-aid section (Section 4) of the SDS
- Knowledge of special treatments for exposure

- Knowledge of the applicability of engineering controls (e.g., ventilation)
- Knowledge of the PPE recommendations related to hazards, quantity, and conditions of use (e.g., type of respirator, eye protection based on applicable standards, glove permeation data, protective clothing)
- Knowledge of the types of threshold limit values (e.g., TWA, STEL, ceiling limit, IFV, excursions, BEI, respirable fibers, dust limits—total, inhalable, thoracic fraction, and respirable)

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:

- Knowledge of how consumer product labeling can be based on the likelihood of injury (see GHS Annex 5) during normal conditions of use or foreseeable misuse of a product
- Knowledge of how the term biologically available can be considered when performing hazard classification
- Knowledge of the relationship between risk, hazard, and exposure

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. The questions in this topic area are intended to test your knowledge of the general concepts GHS implementation around the world and other chemical regulations or control laws. Topic areas for questions include:

- Ability to apply general understanding of disposal regulations
- Ability to identify and list OEL/BEI for different areas or countries (e.g., PEL, TLV, MAK, REL)
- Knowledge of environmental regulations that would impact Section 15 of the SDS (e.g., CERCLA, SARA, TSCA)
- Knowledge of EU regulations (e.g., CLP Annex VI, changes to Annex II of REACH, SVHCs, Annex XVII restrictions)
- Knowledge of Inventory and chemical control laws (U.S. TSCA, Canadian DSL/NDSL, CEPA Toxic Substances List, etc.)
- Knowledge of Right-to-Know Laws and other state-specific legislation, like California Proposition 65
- Knowledge of SDS content required by EPCRA (SARA 313)
- Knowledge of the comprehensibility concepts for SDS and labels (e.g., ANSI Z129.1/Z400.1)
- Knowledge of OSHA's Hazard Communication Standard requirements
- Knowledge of which ingredients or impurities must be disclosed in an OSHA HCS SDS
- Knowledge of what information may be claimed as a trade secret under OSHA HCS and how this differs from the treatment of CBI under WHMIS 2015
- Knowledge of the differences in implementation of the GHS from the United States and Canada vs. the Purple Book (e.g., combustible dust, HNOC, PHNOC, HHNOC)
- Knowledge of the classification of hazard classes/divisions, including the similarities to the physical, health, and environmental hazards presented in the GHS and the following key differences:
  - classification of corrosive mixtures
  - classification of toxic by inhalation substances/mixtures
- Knowledge of the selection of a proper UN/NA/ID number and proper shipping name based on the order of precedence described in the regulation (listed below in order of preference):
  - Single entries for well-defined substances or articles, including solution/mixture variations (e.g., Acetone, Isopropanol)
  - Generic entries for well-defined groups of substances or articles with a specific listed use (e.g., Adhesives, Paint related material)
  - Specific not otherwise specified (n.o.s.) entries covering a group of substances or articles of a particular chemical or technical nature (e.g., Ketones, Alcohols)
  - General n.o.s. entries covering a group of substances or articles meeting the criteria of one or more hazard classes/divisions (e.g., Corrosive liquid, Toxic solid)
- Knowledge of the selection of technical names when applicable

Examples of questions in this topic area include:

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 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. If the atomic number of Pb is 82, what is the total number of neutrons in an atom of Pb-207?
    a. 125
    b. 82
    c. 207
    d. 43

2. Which law is most relevant for describing a gas in closed, rigid container in a fire situation?
    a. Boyle's law
    b. Charles' law
    c. Gay-Lussac's law
    d. First law of thermodynamics

3. Which term best describes the ability of two substances to mix in all proportions and form a homogeneous solution?
    a. Miscibility
    b. Solubility
    c. Dispersibility
    d. Saturability

4. Which of the following values is equivalent to 50°F?
    a. 10°C
    b. 28°C
    c. 2°C
    d. 50°C

5. What text should be avoided when authoring safety data sheets?

    a. Nonstandard terminology

    b. Metric units of measure without corresponding imperial units

    c. Estimated numerical data

    d. Overlapping composition ranges

6. Which of the following statements is true regarding GHS hazard statements?
    a. Hazard statements are used to describe the nature and degree of hazard (where appropriate).

    b. Hazard statement codes may be used to replace the hazard statements on small packaging labels.

    c. All hazard statements applicable to the classification of a product or substance are required to be included in Section 2 of the SDS.

    d. If no symbol or signal word is required of a hazardous chemical, the corresponding hazard statements are optional on the container label.

7. What would be excluded from the label for a small package containing a liquid that causes only serious eye damage (Category 1)?

    a. Hazard statement

    b. Signal word

    c. Dangerous goods pictogram

    d. Supplier identification

8. You are having trouble fitting all the hazard communication elements onto a label for a small vial. What information should be removed to create enough space?

    a. Company website

    b. Company address

    c. Pictograms

    d. Hazard statements

9. Which hazard statement is the most appropriate for a Type F self-reactive substance or mixture?
    a. Heating may cause an explosion.
    b. Heating may cause a fire or explosion.
    c. Heating may cause a fire in large quantities.
    d. Heating may cause a fire.

10. A chemical company plans on producing a product that requires pressurized packaging of 250 kPa at 20°C for a specialized application. The product contains 90% toluene and has an estimated flashpoint of 4°C and an estimated boiling point of 110°C. Based on this information you have requested that a heat-of-combustion test be carried out, but you need to create an SDS to send the sample to the lab. You assume a worst-case scenario of >=20 kJ/g for now. How do you classify the physical hazards for the product according to Revision 8?
    a. Chemicals Under Pressure Category 1
    b. Flammable Liquids Category 2
    c. Chemicals Under Pressure Category 1 and Flammable Liquids Category 2
    d. The product has no physical hazards.

11. A burning rate test result (Method N.1 as described in Part III, subsection 33.2 of the UN Manual of Tests and Criteria) determines the classification for which hazard class?
    a. Pyrophoric solid
    b. Flammable solid
    c. Oxidizing solid
    d. Organic peroxide

12. MEST appears to be a reliable screening test for which of the following GHS health hazards?
    a. Skin Sensitization
    b. Skin Irritation
    c. MEST is not a recommended screening test.
    d. Acute Toxicity - Dermal Route

13. Which hazard class and category apply for a substance that has this test data: (LD_{50} Oral Rat 550 mg/kg; conducted according to GLP) & (LD_{50} Oral Rabbit 275 mg/kg; no test method indicated)?

    a. Acute Oral Toxicity Category 1

    b. Acute Oral Toxicity Category 2

    c. Acute Oral Toxicity Category 3

    d. Acute Oral Toxicity Category 4

14. Which data point best supports the classification of Acute Inhalation Toxicity Category 4 for a dust/mist?

    a. 5.1 mg/l, 1 hour LC_{50} in rats

    b. 0.1 mg/l, 4 hour LC_{50} in rats

    c. 1.0 mg/l, 4 hour LC_{50} in rabbits

    d. 3.0 mg/l, 4 hour LC_{50} in cats

15. According to Revision 8, concerning an untested mixture that contains 10% ingredients classified as Eye Irrit. 2A and 90% ingredients classified as non-hazardous, what is the most appropriate overall classification for the mixture and why?

    a. Eye Irrit. 2/2A; the classification for the hazardous ingredients carries through to the classification of the mixture.

    b. Eye Irrit. 2B; the classification decreases one subcategory in a mixture.

    c. Classification not possible; the data are not sufficient to allow for classification.

    d. Not classified; the percentage is not high enough to warrant classification as an eye irritant.

16. What is the GHS classification for a powder with an oral rat LD_{50}=430 mg/kg and an inhalation rat LC_{50}=347 ppm/1 hour, and which appears on the IARC Group 1 list?

    a. Acute Oral Toxicity Category 4, Carcinogen Category 1B

    b. Acute Inhalation Category 2, Carcinogen Category 2

    c. Acute Oral Toxicity Category 4, Acute Inhalation Category 4, Carcinogen Category 1B

    d. Acute Oral Toxicity Category 3, Carcinogen Category 2

17. What is the chronic M-factor for the below data set?

	NOEC
21-d Fish	0.008 mg/L
28-d Daphnia	0.01 mg/L
72-h Algae	0.2 mg/L

a. 1

b. 10

c. 100

d. Not determinable based on available data

18. Using only the summation method, which classification applies to this mixture?

Mixture X:

- Substance C - 25% - Aquatic Chronic 2
- Substance D - 16% - Aquatic Chronic 3
- Substance E - 17% - not hazardous to aquatic environment
- Substance F - 6% - not hazardous to aquatic environment
- Substance G - 6% - not hazardous to aquatic environment
- Substance H - 5% - Aquatic Chronic 1 (M=10)
- Water - 25%

a. Aquatic Chronic 1

b. Aquatic Chronic 2

c. Aquatic Chronic 3

d. Aquatic Chronic 4

19. Which test would normally be used to determine acute aquatic toxicity?

a. 96 hour fish LC_{50}

b. 72 hour crustacea EC_{50}

c. 48 hour algae EC_{50}

d. 72 hour fish LC_{50}

20. Which of these sets of prevention phrases would be most correct for a chemical with Category 2 Skin corrosion/irritation and Category 1B Reproductive toxicity?

    a. Wash hands thoroughly after handling. Obtain, read, and follow all safety instructions before use. Wear protective gloves.

    b. If on skin: Wash with plenty of clean water. Wear protective gloves. Obtain, read, and follow all safety instructions before use.

    c. If exposed or concerned, get medical advice. Wear protective gloves when using the chemical. If skin irritation occurs, get medical help.

    d. Wash hands thoroughly after handling. Wear protective gloves when using the chemical.

21. When evaluating the need for respiratory PPE, which of the following is used?

    a. TWA

    b. LD50

    c. EC50

    d. NOECr

22. Which type of extinguishing medium is the most appropriate for a fire involving a lithium-ion battery?

    a. Water jet

    b. Wet chemical

    c. Halon

    d. Dry powder

23. All label systems should use GHS classification criteria based on hazard; however, competent authorities may authorize consumer labeling systems to use which type of analysis instead?

    a. Risk

    b. Hazard

    c. Exposure

    d. Environmental

24. In which year was GHS first adopted by Canada?

    a. 2015

    b. 1999

    c. 2008

    d. 1988

25. According to 49 CFR 172.101, which is the order for choosing a proper shipping name for a hazardous material (excluding items with a + in column 1 of the Hazardous Materials Table)?

    a. Technical name > Chemical group or family name > Generic end use name > Hazard class name

    b. Chemical group or family name > Technical Name > Generic end use name > Hazard class name

    c. Technical name > Hazard class name > Chemical group or family name > Generic end use name

    d. Technical name > Generic end use name > Chemical group or family name > Hazard class name

Knowledge Test Practice Exam Answer Key

1. a
2. c
3. a
4. a
5. a
6. a
7. c
8. a
9. d
10. a
11. b
12. a
13. d
14. a
15. a
16. a
17. d
18. a
19. a
20. c
21. a
22. c
23. a
24. a
25. d

THE PRACTICAL SKILLS ASSESSMENT

This part consists of two sub-parts. It is open book in that the GHS Rev 8 will be provided electronically for your 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 8. 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 K_{ow}):	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

Possibility of Hazardous Reaction:	None known
Exposure Limits:	0.5 mg/m3 TWA
Biological Limit Value:	None Established
Toxicological Information	
Oral Rat LD_{50}:	525 mg/kg
Dermal Rabbit LD_{50}:	>5000 mg/kg
Inhalation Rat LC_{50}/4 hour:	>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	
LC_{50} fish 96 hour:	125 mg/L
EC_{50} crustacea 48 hour:	280 mg/L
ErC_{50} algae 72 hour:	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

log K_{ow}:	0.7

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 LD_{50} oral rat 250 mg/kg, LD_{50} 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 LD_{50} oral rat >5000 mg/kg, LD_{50} 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 8 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.

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.

AIHA UNIVERSITY Frameworks

Competency Framework

SDS and Label Authoring Registry

Education • Networking
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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.

AIHA University™

AIHA University offers cutting-edge education and training developed for current and aspiring industrial hygiene and OEHS professionals. From face-to-face courses to online instruction to webinars and professional frameworks, AIHA University is your go-to-resource for affordable and accessible education at every step of your career.

Frameworks

AIHA® and its appointed members and volunteers worked collaboratively to develop the following guides, known as Frameworks, which outlines the knowledge and skills a competent person should possess and be able to demonstrate in a specific topic or specialty.

A **Competency Framework** is a structure that sets out and defines the core knowledge and skills required by an individual for effective performance in a specific area of expertise. These competency frameworks can be linked to either an assessment-based certificate program or an online self-study course.

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Version	Date	Comment
1	October 2021	Initial version approved by SME project team.
2	August 2022	Included information on SCHC and SCHC logo.

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 proficient person should possess and be able to demonstrate when authoring safety data sheets (SDS) and labels. In April 2021, a panel of subject matter experts was appointed to revise the SDS and Label Authoring BoK and to develop a subsequent job/task analysis (JTA) survey to collect input, perspective, and feedback from relevant stakeholders to identify the essential knowledge, skills and abilities required for proficient SDS and label authoring. The subject matter expert project team included a subset of Safety Data Sheet Registered Professionals® (SDSRP).

In July 2021, the JTA survey was made available to to all SDSRPs. 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 in October 2021.

The update to the SDS and Label Authoring Registry Framework would not be possible without expertise provided by members of the Society for Chemical Hazard Communication (SCHC). SCHC is a professional society committed to serving chemical hazard communication professionals and to promoting knowledge and awareness in all areas of chemical hazard communication. Areas covered include worker safety, domestic and international regulatory compliance, toxicology and other chemical and physical hazards, environmental toxicology, and risk analysis. Members are professionals who represent industrial, consumer, and specialty chemical companies, pharmaceutical firms, manufacturers, distributors and importers, government agencies, universities, and consultants.

SDS & Label Authoring Registry

Occupational Definition

This document provides an organized summary of the collective knowledge and skills necessary for proficient SDS and label authoring. While the practice of SDS authoring is often assisted by various software applications, SDSRPs have a mastery of the concepts detailed in this body of knowledge (BoK). This enables the author to perform functions such as verifying the accuracy of software outputs and to fulfill higher level activities such as exercising expert judgment and the management of a hazard communication program.

AIHA will use this BoK 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 their 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 will be based on revision 8 of the Purple Book. The knowledge test consists of 75 multiple choice questions that evaluate your knowledge in areas in which an 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 authoring. A formula sheet, with all the needed formulas, will be provided.

In addition, the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) standard classification tables or decision logic charts needed for substance and mixture classification questions will be provided. This BoK provides a blueprint of the type of questions you can expect in each knowledge area.

Knowledge Areas

There are many formats for the structure of a body of knowledge framework; however, its main purpose is to define the competencies required to work in a particular field or industry. This framework consists of a three-tiered outline.

- The top level contains the domains, the larger performance areas that work can be categorized.
- The second level contains task statements, the comprehensive statement of work activity that elaborates upon the performance domain.
- The third level contains the knowledge, skill, and ability statements to understand what is necessary to perform the tasks outlined in the framework.

The *knowledge statement* refers to the factual or procedural body of information applied directly to the performance of a function. The *skill statement* refers to the proficient manual, verbal, or mental manipulation of data or things. The *ability statement* refers to the potential to perform an observable activity at the present time. The knowledge, skills, and abilities that constitute proficient SDS and label authoring are listed below.

1.0 | Math and Science (15%)

1.A Perform general math calculations pertinent to SDS authoring.

1.A.1 Skill in calculating percentages of pure substances in mixtures of mixtures
1.A.2 Skill in converting and calculating ppm, ppb, and ppt into weight/volume percentage
1.A.3 Skill in converting ppm to mg/L or mg/m^3 and vice versa for gases, vapors, dust, and mists
1.A.4 Skill in converting ppm to mg/L, mg/mL, and g/L; and vice versa for liquids and solids
1.A.5 Skill in converting temperature in Celsius to Fahrenheit and vice versa
1.A.6 Knowledge of the relationship between density and specific gravity
1.A.7 Knowledge of standard unit/metric system

1.B Apply general chemistry principles pertinent to SDS authoring.

1.B.1 Knowledge of the differences between atoms, elements, and compounds

1.B.2 Knowledge of the 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.3 Knowledge of the differences between mixtures and substances

1.B.4 Knowledge of basic chemical equations

1.B.5 Knowledge of how temperature and pressure impact each other and on substances/mixtures (e.g., Boyle's law and Charles' law)

1.B.6 Knowledge of how to obtain reaction products

1.B.7 Knowledge of the definitions of each state of matter and its correct usage (e.g., a *fume* is a sublimated particle)

1.B.8 Knowledge of the differences between stability and reactivity

1.B.9 Knowledge of the main chemical and physical properties included on an SDS under the GHS

1.B.10 Knowledge of the main types of compounds (organic, inorganic, monomers, polymers, surfactants, solvents, acids, bases)

1.B.11 Knowledge of the meaning of physical properties and their test methods to determine the endpoint (e.g., vapor pressure, boiling point, flash point)

1.B.12 Knowledge of the route-of-exposure potential for the different physical forms

1.B.13 Knowledge of the various types of solubility (highly soluble, soluble, slightly soluble, nonsoluble)

1.B.14 Knowledge of what pH is and how it measures acids and bases

2.0 | Hazard Communication (21%)

2.A Use GHS concepts to properly classify substances/mixtures and communicate their hazards.

2.A.1 Knowledge of the structure of the Purple Book

2.A.2 Knowledge of the scope, application, and limitations of the GHS

2.A.3 Ability to implement GHS classification principles for substances and mixtures (including the weight of evidence and reliability of studies)

2.A.4 Knowledge of GHS concepts, including the building block approach and application

2.A.5 Knowledge of which elements of the GHS are applicable to the different sectors (transport, workplace, consumer products)

2.A.6 Knowledge of GHS definitions (e.g., *hazard class, hazard category, weight of evidence*)

2.A.7 Skill in using cut-off values to determine the classification of a mixture

2.A.8 Knowledge of labeling concepts as applied to different sectors (transport, workplace, consumer products)

2.A.9 Knowledge of the general guidelines for overall SDS comprehension

2.A.10 Knowledge 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.11 Ability to identify data sources on the SDS (mixture testing vs. component data)

2.A.12 Knowledge of the term *article*

2.A.13 Ability to identify the harmonized GHS label elements

2.B Identify the standard format of an SDS and label to communicate hazards effectively.

2.B.1 Knowledge of identifying chemicals (IUPAC, common names, CAS, EC)

2.B.2 Ability to select label elements such as pictogram(s), signal word, hazard statement(s), and precautionary statement(s), based on a GHS classification

2.B.3 Ability to review an SDS for internal consistency

2.B.4 Knowledge of the elements of a GHS compliant label

2.B.5 Knowledge of the order of precedence for the label elements in the GHS

2.B.6 Knowledge of the process in which an SDS is developed (order of section development)

2.B.7 Knowledge of how a GHS label is developed using the tables in Annex 3 and Annex 7 of the GHS, including labeling of small packages, sets, and kits

2.B.8 Knowledge of the concepts found on an SDS and the applicable audience(s) for each section:

- Identification (product identifier/supplier information including emergency contact information/recommended use/restricted use)
- Hazards identification
- Composition
- First-aid measures
- Fire-fighting measures
- Accidental release measures

- Handling and storage
- Exposure controls/personal protection
- Physical and chemical properties
- Stability and reactivity
- Toxicological information
- Ecological information
- Disposal considerations
- Transport information
- Regulatory information
- GHS labeling requirements
- NFPA and HMIS ratings (alternative labeling systems)
- Other information

2.B.9 Knowledge of the sections, required format, and the content of a GHS SDS

3.0 | Physical Hazards (7%)

3.A Classify the physical hazards of a substance/mixture.

3.A.1 Knowledge of the GHS physical hazard classes

3.A.2 Knowledge of combustible dust

3.A.3 Knowledge of Hazards Not Otherwise Classified (HNOCs) and where they are implemented (OSHA HCS, WHMIS 2015)

3.A.4 Skill in classifying substances and mixtures according to the GHS physical hazard classes

3.A.5 Knowledge of the test methods used to determine physical hazards and how to interpret test data for the various classes

3.A.6 Skill in calculating the flammability of gas mixtures under the GHS

4.0 | Health Hazards (21%)

4.A Identify the general toxicology concepts for health hazard classification.

4.A.1 Skill in health hazard data conversion (e.g., 1 hour to 4 hours for acute inhalation toxicity data, ppm to mg/L for vapor toxicity)

4.A.2 Ability to distinguish between the different forms of matter in the determination of inhalation toxicity (gas, vapor, mist, dust)

4.A.3 Knowledge of 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, and Aspiration Hazard)

4.A.4 Skill in converting range data or acute toxicity category to an acute toxicity point estimate for mixture calculations

4.A.5 Knowledge of how to properly handle ingredients with unknown acute toxicity when calculating the acute toxicity estimate (ATE) of an untested mixture

4.A.6 Knowledge of the classification criteria of the 10 GHS health hazard endpoints and how to apply them to test data

4.A.7 Knowledge of the GHS tiered approach to classifying mixtures (e.g., tested mixtures, bridging principles, untested mixture calculations)

4.A.8 Knowledge of HNOCs and where they are implemented (OSHA HCS, WHMIS 2015)

4.A.9 Knowledge of simple asphyxiants

4.B Identify the general biology concepts for health hazard classification.

4.B.1 Knowledge of the structure and function of target organs (e.g., respiratory system, kidney, liver, nervous system), as well as what is generally observed when these organs are damaged due to chemical exposure

4.C Identify the concepts for health hazard classification.

4.C.1 Ability to distinguish between immediate (acute) vs. delayed (chronic) effects following chemical exposure

4.C.2 Ability to distinguish between local vs. systemic adverse health effects

4.C.3 Ability to distinguish between reversible vs. irreversible adverse health effects

4.C.4 Ability to find authoritative, reliable information for acute toxicity endpoints (LD_{50}, LC_{50})

4.C.5 Knowledge of acute toxicity endpoints (LD_{50}, LC_{50})

4.C.6 Knowledge of how chemicals move into and out of the body: absorption, distribution, metabolism, and excretion (ADME)

4.C.7 Knowledge of preferred species for various acute toxicity tests (e.g., oral LD_{50}, dermal LD_{50}, inhalation LC_{50}, dermal irritation, eye irritation, dermal sensitization)

4.C.8 Knowledge of the adverse health effect concept

4.C.9 Knowledge of the basis of toxicity tests, why they are done, and how to interpret the results

4.C.10 Knowledge of the dose-response relationship

4.C.11 Knowledge of the term toxicology

4.C.12 Knowledge of the threshold response concepts (NOEL, NOAEL, LOAEL)

4.C.13 Knowledge of weight of evidence and how it is used for health hazard classification purposes

4.C.14 Knowledge of when additivity is used and when it is not

4.C.15 Skill in classifying substances/mixtures according to the GHS health hazard classes

5.0 | Environmental Hazards (10%)

5.A Classify the environmental hazards of a substance/mixture using general ecotoxicology concepts.

5.A.1 Ability to apply criteria for classifying substances for acute and chronic aquatic toxicity potential, including the concept of different trophic levels (fish, aquatic inverts, aquatic plants)

5.A.2 Ability to apply the criteria for Ozone Depleting Potential under the GHS

5.A.3 Ability to identify the different methods and durations for acute aquatic toxicity testing and the organisms used

5.A.4 Ability to identify the different methods of classification for chronic aquatic toxicity testing and the organisms used

5.A.5 Knowledge of bioconcentration and bioaccumulation ($\log K_{ow}$/ P_{ow})

5.A.6 Knowledge of how to properly handle ingredients with unknown hazards to the aquatic environment

5.A.7 Knowledge of persistence testing (e.g., biodegradation, hydrolysis, photolysis)

5.A.8 Knowledge of the concept of M factor and application in mixture classification

5.A.9 Knowledge of the GHS tiered approach to classifying mixtures (e.g., tested mixtures, bridging principles, untested mixture calculations [i.e., summation and additivity])

5.A.10 Knowledge of the toxicity endpoints: LD_{50}, LC_{50}, EC_{50}, NOEC, and LOEC

5.A.11 Knowledge of the relevant ingredients concept for untested mixture classification

5.A.12 Skill in classifying substances/mixtures according to the GHS environmental hazard classes

6.0 | Industrial Hygiene and Safety (11%)

6.A Identify the industrial hygiene and safety concepts for SDS authoring.

6.A.1 Ability to apply appropriate first-aid measures based on the classification

6.A.2 Ability to determine which exposure limit(s) to include in the SDS based on the composition of the mixture

6.A.3 Ability to differentiate between suitable/unsuitable controls for fire types

6.A.4 Ability to identify the specific hazards arising from burning chemical fires

6.A.5 Ability to recommend personal precautions, protective equipment, and protective measures for spilled product(s)

6.A.6 Ability to select precautionary statements for safe handling based on classification and physical properties

6.A.7 Knowledge of chemical incompatibility

6.A.8 Knowledge of compatible and incompatible chemical placement

6.A.9 Knowledge of how stability and reactivity relate to an SDS

6.A.10 Knowledge of significant routes of exposure for various physical states

6.A.11 Knowledge of special needs that a physician should be made aware of when completing the first-aid section (Section 4) of the SDS

6.A.12 Knowledge of special treatments for exposure

6.A.13 Knowledge of the applicability of engineering controls (e.g., ventilation)

6.A.14 Knowledge of the PPE recommendations related to hazards, quantity, and conditions of use (e.g., type of respirator, eye protection based on applicable standards, glove permeation data, protective clothing)

6.A.15 Knowledge of the types of threshold limit values (e.g., TWA, STEL, ceiling limit, IFV, excursions, BEI, respirable fibers, dust limits—total, inhalable, thoracic fraction, and respirable)

7.0 | Risk Analysis (2%)

7.A Apply risk assessment principles pertinent to the classification of substances and mixtures.

7.A.1 Knowledge of how consumer product labeling can be based on the likelihood of injury (see GHS Annex 5) during normal conditions of use or foreseeable misuse of a product

7.A.2 Knowledge of how the term *biologically available* can be considered when performing hazard classification

7.A.3 Knowledge of the relationship between risk, hazard, and exposure

8.0 | International GHS Implementation, Associated Regulations and Consensus Standards (13%)

8.A Apply general knowledge of other regulatory information (standards, guidelines, etc.) related to SDS authoring.

8.A.1 Ability to apply general understanding of disposal regulations

8.A.2 Ability to identify and list OEL/BEI for different areas or countries (e.g., PEL, TLV, MAK, REL)

8.A.3 Knowledge of environmental regulations that would impact Section 15 of the SDS (e.g., CERCLA, SARA, TSCA)

8.A.4 Knowledge of EU regulations (e.g., CLP Annex VI, changes to Annex II of REACH, SVHCs, Annex XVII restrictions)

8.A.5 Knowledge of Inventory and chemical control laws (U.S. TSCA, Canadian DSL/NDSL, CEPA Toxic Substances List, etc.)

8.A.6 Knowledge of Right-to-Know Laws and other state-specific legislation, like California Proposition 65

8.A.7 Knowledge of SDS content required by EPCRA (SARA 313)

8.A.8 Knowledge of the comprehensibility concepts for SDSs and labels (e.g., ANSI Z129.1/Z400.1)

8.B Apply knowledge of global GHS implementations related to SDS authoring.

8.B.1 Knowledge of OSHA's Hazard Communication Standard requirements

8.B.2 Knowledge of which ingredients or impurities must be disclosed in an OSHA HCS SDS

8.B.3 Knowledge of what information may be claimed as a trade secret under OSHA HCS and how this differs from the treatment of CBI under WHMIS 2015

8.B.4 Knowledge of the differences in implementation of the GHS from the United States and Canada vs. the Purple Book (e.g., combustible dust, HNOC, PHNOC, HHNOC)

8.C Identify and apply dangerous goods transportation concepts required for SDS authoring

8.C.1 Knowledge of the classification of hazard classes/divisions, including the similarities to the physical, health, and environmental hazards presented in the GHS and the following key differences:

- classification of corrosive mixtures
- classification of toxic by inhalation substances/mixtures

8.C.2 Knowledge of the selection of a proper UN/NA/ID number and proper shipping name based on the order of precedence described in the regulation (listed below in order of preference):

- Single entries for well-defined substances or articles, including solution/mixture variations (e.g., Acetone, Isopropanol)
- Generic entries for well-defined groups of substances or articles with a specific listed use (e.g., Adhesives, Paint related material)
- Specific not otherwise specified (n.o.s) entries covering a group of substances or articles of a particular chemical or technical nature (e.g., Ketones, Alcohols)
- General n.o.s. entries covering a group of substances or articles meeting the criteria of one or more hazard classes/divisions (e.g., Corrosive liquid, Toxic solid)

8.C.3 Knowledge of the selection of technical names when applicable

WE ARE AIHA

This is what we do.

Every single day, we work to empower those who apply scientific knowledge to protect all workers from occupational hazards.

This is how we do it.

We are experts in what we do. We use our knowledge to better protect people and the environment.

We are supportive. We exist to serve Occupational Health and Safety professionals, and are constantly searching for new ways to do so.

We are inclusive. We know we are all stronger when knowledge is shared among people coming from diverse backgrounds and across our allied professions.

We are forward-looking. We are growing and evolving with the industry, always looking ahead.

This is why we do it.

Working together, we all share one goal:

A world where all workers are healthy and safe.

The AIHA brand is evolving. To learn more about the process and find FAQs and more, please visit us at **aiha.org**

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