UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

OCTOBER 2025 SEMESTER

COURSE CODE	:	HRB30403
COURSE TITLE	:	CHEMICAL SAFETY
PROGRAMME NAME	:	BACHELOR OF OCCUPATIONAL SAFETY & HEALTH (HONOURS)
DATE	:	30 JANUARY 2026
TIME	:	9:00AM - 12:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Answer ALL questions for Section A.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
9. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 21 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

1. A factory manager decides to protect workers from toxic fumes solely by purchasing high-quality respirators (PPE), arguing that it is the quickest solution. He rejects a proposal to install a Local Exhaust Ventilation (LEV) system due to cost. Critique this decision using the Hierarchy of Controls.

   A. The decision is flawed because Isolation must always be attempted before Engineering controls.

   B. The decision is flawed because Engineering Controls are higher in the hierarchy and more effective than PPE, which is a last resort.

   C. The decision is sound because "Safe Work Systems" prioritize individual protection over environmental changes.

   D. The decision is sound because PPE is the most effective control for fumes.

2. In the Identification of Chemicals process, who must the Chemical Register be made accessible to?

   A. Only the Safety and Health Officer.

   B. Only the DOSH Inspector.

   C. All employees.

   D. Only the management team.

3. Under the NADOPOD Regulations 2004, which of the following conditions is listed as a Serious Bodily Injury in the First Schedule?

   A. Sprained ankle.

   B. Temporary rash.

   C. Emasculation.

   D. Minor laceration requiring stitches.

4. Based on the Prohibition of Use of Substance Order 1999, Crocidolite is prohibited for all purposes EXCEPT:

   A. For cleaning and degreasing.

   B. For research or analytical purposes.

   C. For agricultural use.

   D. For the manufacture of matches.

5. Under the Chemical Management guidelines, for how long must records regarding the design and construction of engineering control equipment be retained?

   A. 30 years.

   B. For the lifetime of usage.

   C. 5 years from the date of construction.

   D. 10 years.

6. A chemical plant operates a large industrial activity. The quantity of hazardous substance (QHS) on-site is exactly **8%** of the Threshold Quantity (TQ) listed in Schedule 2. How is this activity categorized under CIMAH?

   A. Non-Major Hazard Installation (NMHI).

   B. Major Hazard Installation (MHI).

   C. Prohibited Installation.

   D. Excluded Industrial Activity.

7. According to the NADOPOD Regulations 2004, which specific form must a registered medical practitioner use to report a case of occupational poisoning or disease to the Director General?

   A. JKKP 6

   B. JKKP 9

   C. JKKP 7

   D. JKKP 8

8. An internal audit at a chemical plant reveals that Personal Exposure Monitoring reports from 15 years ago have been discarded. The records manager argues that keeping them for 10 years was sufficient. Assess this situation against the Record Keeping requirements

   A. The manager is correct; exposure monitoring reports only need to be kept for 5 years.

   B. The manager is incorrect; all safety records must be kept indefinitely for the lifetime of the company.

   C. The manager is correct; only Medical Surveillance records need to be kept for 30 years.

   D. The manager is incorrect; Personal Exposure Monitoring reports must be retained for at least 30 years.

9. An employer conducted a Chemical Health Risk Assessment (CHRA) in January 2020. In June 2023, the factory installed a new high-pressure heating system that significantly altered the chemical reaction process. The management decides to stick to the original schedule and reassess the CHRA in January 2025. Evaluate the compliance of this decision.

   A. Compliant, as the regulations strictly mandate reassessment only every 5 years.

   B. Non-compliant, as reassessment is required immediately when there is a significant change in the work process.

   C. Compliant, provided the original control measures are still functioning.

   D. Non-compliant, as CHRA reassessment must be conducted annually for high-pressure systems.

10. Which of the following industrial activities is EXCLUDED from the CIMAH Regulations 1996?

    A. A chemical manufacturing plant.

    B. An agrochemical production site

    C. A nuclear installation C.

    D. A petrochemical storage facility

11. The manufacturer owns two installations located 400 meters apart. Installation A holds 60% of the Threshold Quantity (TQ) of a specific hazardous substance, and Installation B holds 50% of the TQ. Based on the aggregation rule in Schedule 2 of the CIMAH Regulations 1996, how should the management classify and manage these installations?

    A. As a single Non-Major Hazard Installation, because the average quantity is 55%, which is less than the TQ.

    B. As two separate Non-Major Hazard Installations (NMHI) requiring only safe operation demonstration.

    C. As exempt installations since neither individually exceeds the TQ.

    D. As a single Major Hazard Installation because the total quantity exceeds the TQ and distance is less than 500m.

12. An employer provides high-quality Personal Protective Equipment (PPE) to workers but fails to provide training on how to wear it correctly. A worker is subsequently injured due to improper PPE usage. Under Section 15 of OSHA 1994, how would this situation be judged?

    A. The employer is not liable because the PPE was provided.

    B. The supplier of the PPE is liable for not training the workers directly.

    C. The employee is solely liable for not figuring out how to use the equipment.

    D. The employer is liable because the duty to ensure safety includes the provision of necessary information, instruction, training, and supervision.

13. According to the Occupational Safety and Health Act (OSHA) 1994, which of the following sectors is specifically excluded from the Act's coverage?

    A. Statutory Bodies.

    B. Work on board ships governed by the Merchant Shipping Ordinance.

    C. The Construction Industry.

    D. The Public Service (Government).

14. The main objective of the CIMAH Regulations 1996 is to:

A. Promote waste recycling.

B. Reduce water contamination.

C. Prevent major industrial accidents.

D. Monitor personal hygiene.

15. A container shows the flame pictogram and "Flash point = 25 °C." What NFPA flammability rating applies?

A. 0

B. 2

C. 4

D. 3

16. A worker complains of dizziness after repeated use of a solvent. The SDS includes toxicological information but does not specify routes of entry. Which analysis best identifies what is missing and why it matters?

A. Nothing is missing which symptoms confirm toxicity.

B. Missing ecological data is the primary issue.

C. Missing transport hazards explains dizziness.

D. Missing routes of entry impair linking exposure pathways to controls and medical response interpretation.

17. A workplace uses a chemical that is classified as a 'respiratory sensitization category 1' under the CLASS Regulations. According to the assessment strategies outlined, what is the most significant implication for the CHRA process?

    A. A Simple Assessment (SiRAC) is the recommended approach.

    B. A Generic CHRA must be performed instead of a Site Specific CHRA.

    C. The assessment can be waived if workers use respirators.

    D. A Full Assessment is mandatory, and a Simple Assessment cannot be used.

18. An assessor is evaluating two different work units. In Work Unit A, workers handle a highly hazardous chemical for 5 minutes once a week. In Work Unit B, workers handle a moderately hazardous chemical for 6 hours every day. This analysis, which considers duration and frequency, is a central part of which CHRA step?

    A. Risk Determination

    B. Determine Degree of Hazard

    C. Gather Information

    D. Assess Exposure

19. According to the CHRA manual's core concept, what is the relationship between Hazard, Exposure, and Risk?

    A. Divide the workplace into distinct work units.

    B. Risk is the product of Hazard and Exposure.

    C. Determine the overall risk level for the entire plant.

    D. Recommend appropriate control measures for the solvent.

20. A process changes from using granular pellets to using a fine powder of the same toxic chemical. How does this change affect the Magnitude Rating (MR) in the assessment?

    A. The MR decreases because powder is lighter than pellets.

    B. The MR remains the same because the chemical toxicity (HR) has not changed.

    C. The MR becomes zero because powder settles faster.

    D. The MR increases because fine powder has a higher potential for becoming airborne (higher degree of release).

21. Quantitative air monitoring was conducted **5 years ago**, showing levels well below the Permissible Exposure Limit (PEL). Today, workers report strong chemical odors and visible vapors near the process. Which information source should be used to determine the current Exposure Rating (ER)?

    A. An average of the old data and new observations.

    B. The current qualitative observations (odor/vapor), as they reflect the actual present conditions.

    C. The generic industry standard for that chemical.

    D. The 5-year-old quantitative report, as it is scientific data.

22. A Safety Data Sheet (SDS) lists two H-codes for a solvent: **H312 (Harmful in contact with skin)** and **H336 (May cause drowsiness or dizziness)**. When completing the **Inhalation Exposure Assessment**, which H-code determines the Hazard Rating (HR)?

    A. H312, because skin absorption is more dangerous than dizziness.

    B. H336, because it specifically addresses the inhalation route.

    C. H312, because it has a lower number.

    D. Both H312 and H336 should be averaged.

23. A mixture contains **0.5% Benzene** (Carcinogenic, Category 1A). The default cut-off value for classifying a mixture as a carcinogen is **0.1%**. How should this mixture be classified in Form B?

    A. As "Hazardous" (HR 5) because the concentration exceeds the specific cut-off value for carcinogens.

    B. As "Hazardous" (HR 3) because the low concentration reduces the severity of the hazard.

    C. As "Non-Hazardous" because Benzene is only dangerous in its pure form.

    D. As "Non-Hazardous" because the concentration is below 1%.

24. A worker asks: "What could happen to my body if I inhale this chemical repeatedly?" Which SDS section should you direct them?

    A. Ecological information

    B. Additional information

    C. Toxicological information

    D. Physical and chemical characteristics

25. Two chemicals have additive effects. TWA_1 = 40 ppm with PEL_1 = 100 ppm; TWA_2 = 30 ppm with PEL_2 = 50 ppm. Using the CEI formula shown, CEI equals:

    A. 1.20

    B. 0.40

    C. 1.00

    D. 0.60

26. If inhalation is identified as a possible route but hazard info does not indicate inhalation hazard classification/health effects, HR should be:

    A. 2

    B. 4

    C. 1

    D. 5

27. Why is ingestion/oral exposure considered a minor route in many workplaces ?

    A. Only gases can be ingested

    B. Ingestion is always more toxic than inhalation

    C. Chemicals cannot enter the body by ingestion

    D. Few chemicals enter via ingestion; exposure duration is usually shorter; oral toxicity often lower; eating/drinking prohibited

28. Airborne dust has a dominant particle size of 12 µm. Where is deposition most likely?

    A. Bronchioles

    B. Alveoli

    C. Nose

    D. Exhaled

29. Workers rotate between welding and pipeline inspection **every two weeks**. How should the work unit be classified for assessment?

    A. No work unit. The rotation invalidates CHRA.

    B. Two separate work units.

    C. Classify by job title only, not tasks.

    D. One work unit covering all rotated jobs.

30. A CHRA report states: "We measured exposure levels and compared them to PELs, then recommended controls." It does **not** discuss whether worker training/retraining is required. Based on the USECHH-required content, what is the *best analysis* of this report?

    A. Acceptable. Training is part of the employer's policy, not the assessment.

    B. Acceptable. Training is optional if monitoring was done.

    C. Incomplete. Training/retraining requirement is part of required assessment content.

    D. Incomplete. CHRA must only include engineering controls.

31. Two chemicals are used in the same open vat process:
Chemical X: Boiling point 40°C, operating temp 35°C.
Chemical Y: Boiling point 150°C, operating temp 35°C. Which chemical has a higher Degree of Release (Volatility)?

A. Both are equal because the operating temperature is the same.

B. Chemical X, because it is operating close to its boiling point.

C. Chemical Y, because it has a higher boiling point.

D. Chemical Y, because it is more stable.

32. An assessor calculates a Risk Rating (RR) of 10 for a specific work unit. The breakdown is HR=5 (Carcinogen) and ER=2 (Low Exposure). Why might this specific combination require stricter control than a different chemical with the same RR of 10 (derived from HR=2, ER=5)?

A. The calculation 5 x 2 is mathematically greater than 2 x 5.

B. ER 2 implies the ventilation is broken.

C. HR 5 indicates a severe, irreversible health effect (cancer), making any exposure potentially unacceptable despite the low rating.

D. HR 5 chemicals are always banned.

33. During an audit of a chemical storage area, you observe that the storage drums are chemically resistant, but the ventilation system is broken, and there is no separation between incompatible chemicals. If an accident occurs, which component of the Storage Area requirements was the *most critical* neglected factor in preventing the buildup of toxic releases?

A. Ventilation.

B. Access and Exit routes.

C. Integrity of the container (Air/Chemical resistant).

D. Drainage and sewerage

34. You are reviewing the packaging protocols for three different chemical products.
Product X: Causes death if swallowed in small amounts (Highly Toxic).
Product Y: Presents a low danger to health (Low Toxicity).
Product Z: Is toxic but not lethal in small doses (Toxic).
Based on the **UN Classifications** for packing groups, how should these products be categorized?

    A. Product X: Group 1, Product Y: Group 2, Product Z: Group 3.

    B. Product X: Group 1, Product Y: Group 3, Product Z: Group 2.

    C. Product X: Group 2, Product Y: Group 3, Product Z: Group 1.

    D. Product X: Group 3, Product Y: Group 1, Product Z: Group 2.

35. A director wants to cancel drills because "they reduce productivity." Which evaluation is most consistent with the introduction slide?

    A. Correct: drills always reduce productivity overall.

    B. Correct: morale improves when drills stop.

    C. Incorrect: effective safety and health programs are linked to increased productivity, reduced absenteeism/illness, and improved morale.

    D. Correct: workers' compensation is unrelated.

36. A plant has extinguishers and sprinklers but lacks evacuation routes, emergency recovery plan, and chemical identification for fire risk. Which evaluation is most defensible?

    A. Adequate: suppression is the only critical control.

    B. Adequate if extinguishers are inspected.

    C. Inadequate: preparedness also requires identifying chemicals/materials that could lead to fire, routes, contacts, and recovery planning.

    D. Inadequate only if an incident has already occurred.

37. A QRA identifies "chemical splash to eyes" as a credible hazard, but management refuses to install eyewash units, saying "PPE is enough." Which evaluation is best aligned with the preparedness principle?

    A. Weak: risk control should include engineered controls like eyewash facilities when credible exposure exists

    B. Acceptable: PPE is always sufficient

    C. Unacceptable only if the chemical is corrosive

    D. Acceptable if splash goggles are mandatory

38. A solvent drum tips over, releasing vapors that trigger an evacuation for 20 minutes. No one is injured, but production stops, and a nearby drain is threatened. Which evaluation best fits the slide definition of an emergency?

    A. An emergency only if external authorities are contacted

    B. Not an emergency because there were no injuries

    C. Not an emergency because the event ended within an hour

    D. An emergency because it is an unplanned event that can disrupt operations and cause environmental damage

39. An employer has completed a training program for employees handling hazardous chemicals. When is the employer required to review this training program?

    A. Only when an accident occurs.

    B. Every 5 years alongside the CHRA.

    C. Every 6 months.

    D. At least once in 2 years.

40. A logistics company transports large quantities of hazardous chemicals (exceeding Threshold Quantities) via public roads to a manufacturing plant. The local authority demands the company submit a safety report under CIMAH Regulations 1996. Evaluate the validity of this demand.

A. Invalid, because the regulations explicitly exclude vehicles transporting hazardous substances to or from the site.

B. Invalid, unless the vehicle is parked within the manufacturing plant for more than 24 hours.

C. Valid, because transportation is considered an "industrial activity" under the regulations.

D. Valid, because the quantity of hazardous substance exceeds the Threshold Quantity (TQ).

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

A chemical processing facility experiences an accidental spill of a corrosive chemical during routine operations, resulting in worker exposure, release of toxic vapours, and a potential fire hazard that disrupts normal operations.

Determine how emergency preparedness and emergency response management influence the control of injuries, environmental damage, legal liability, and continuity of operations in this incident, with reference to emergency planning, response actions, and availability of emergency facilities.

(20 marks)

Question 2

You are the newly appointed Safety & Health Officer (SHO) at Zenith MetalWorks. During your first week, you observe the cleaning department where workers use various solvents to degrease metal parts before plating.

You notice workers using a solvent labeled "Solution C-Tetra" (which contains Carbon Tetrachloride) to clean oil off the machinery surfaces and metal parts. They are using rags and scrubbing by hand without local exhaust ventilation.

Three days later, an accident occurs. A worker, Mr. Ali, collapses after inhaling high concentrations of the solvent vapor in a confined cleaning room. He is rushed to the hospital, diagnosed with acute respiratory distress, and is given medical leave (MC) for 6 days.

Upon checking the department's documentation to investigate, you find:

i. There is no list or inventory of the chemicals currently used in the factory.

ii. No risk assessment has ever been conducted for the cleaning activities.

iii. Mr. Ali and his colleagues have never attended any chemical safety training.

(a) Based on the *Occupational Safety and Health (Prohibition of Use of Substance) Order 1999*, determine if this activity is compliant. *(Your answer require a specific reference to the prohibited applications).*

(4 marks)

(b) i. Analyze the incident involving Mr. Ali with regards to the *NADOPOD Regulations 2004 :*
Classify the type of injury/incident based on the duration of his medical leave.

(2 marks)

ii. Outline the TWO (2) specific actions the employer must take to comply with the reporting requirements to DOSH, including the specific form required and the timeline for submission.

(4 marks)

iii. iii. Identify the specific regulation schedule that classifies "Serious Bodily Injury".

(2 marks)

(c) Identify FOUR (4) missing components of a Chemical Safety Management system based on the "Observation" details provided in the case study. For each component, briefly explain its function as required by the strategy on chemical safety.

(8 marks)

Question 3

You are the Safety Officer at ChemPro Logistics. During a routine audit of the liquid blending warehouse, you discover a 200-liter drum of a newly formulated cleaning mixture, "Mix-Clean 200", which has been left unlabelled near the pedestrian pathway.
Upon checking the production records, you find the formulation for "Mix-Clean 200" is as follows:
Ingredient A (10%): Oral LD50 = 75 mg/kg
Ingredient B (30%): Oral LD50 = 1,500 mg/kg
Ingredient C (60%): Water (Non-toxic)
While you are inspecting the drum, a forklift accidentally grazes it, causing a minor leak. The warehouse supervisor wants to know the hazards immediately to handle the spill safely.

(a) i. Calculate the Acute Toxicity Estimate (ATE) for the "Mix-Clean 200" mixture.

(6 marks)

ii. Based on your calculation, determine the Hazard Category for Acute Oral Toxicity according to the criteria.

CLASS Regulations		
Acute Toxicity Hazard Category	**LD_{50} (mg/kg body weight)**	
	Oral	Dermal
Category 1	≤ 5	≤ 50
Category 2	$5 < LD_{50} \leq 50$	$50 < LD_{50} \leq 200$
Category 3	$50 < LD_{50} \leq 300$	$200 < LD_{50} \leq 1000$
Category 4	$300 < LD_{50} \leq 2000$	$1000 < LD_{50} \leq 2000$
Not Classified (GHS Cat. 5)	> 2000	> 2000

(2 marks)

(b) Based on your classification in (a), identify the appropriate hazard communication elements for the "Mix-Clean 200" label as required by CLASS Regulations.
Your answer must include:
i. The Signal Word.
ii. The Hazard Statement (H-Code and text).
iii. The description of the required Hazard Pictogram.

(6 marks)

(c) The audit also revealed that this chemical was stored directly on the floor near a pedestrian pathway and adjacent to a rack containing strong acids. Analyze the storage conditions observed during the audit and answer the following:

i. The drum containing "Mix-Clean 200" was found without a label.

ii. The drum was stored directly on the floor near a pedestrian pathway, leading to the forklift accident.

iii. The mixture was stored adjacent to a rack containing strong acids.

(6 marks)

Question 4

A laboratory technician is assigned to a solvent cleaning process in an analytical laboratory. The task involves daily use of a chemical mixture (Solvent X) containing toluene and xylene for cleaning glassware.
The following information is obtained:
i. Task duration: 2 hours per shift, performed daily
ii. Ventilation: General ventilation only, no local exhaust ventilation
iii. PPE: Gloves are used inconsistently; no respiratory protection
iv. Air monitoring results:
- Toluene (8-hr TWA): 60 ppm (PEL: 50 ppm)
- Xylene (8-hr TWA): 90 ppm (PEL: 100 ppm)
v. SDS information indicates:
- Both chemicals cause central nervous system depression
- Skin contact may cause irritation
- Vapours may cause dizziness and headache
vi. The chemicals are known to have additive effects on the body.

(a) Identify the routes of exposure associated with the solvent cleaning task.

(4 marks)

(b) Determine the Hazard Rating (HR) for Solvent X through inhalation.

(8 marks)

(c) Calculate the combined exposure to toluene and xylene using the additive exposure concept.

(4 marks)

(d) Analyse the level of risk associated with the solvent cleaning activity.

(4 marks)

END OF EXAMINATION PAPER