UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

OCTOBER 2025 SEMESTER

COURSE CODE	:	HRB20203
COURSE TITLE	:	OCCUPATIONAL EPIDEMIOLOGY
PROGRAMME NAME	:	BACHELOR OF OCCUPATIONAL SAFETY & HEALTH (HONOURS)
DATE	:	27 JANUARY 2026
TIME	:	2:00PM - 5:00PM
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 22 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

1. Epidemiology is defined as the _____.

   A. study of the distribution and determinants of health-related events in specified populations, and its application in controlling health problems

   B. statistical analysis of hospital admission records to determine the cost of healthcare services to employers

   C. study of toxic chemical in the workplace and their biological mechanisms of action within the human body

   D. study of how to effectively treat and cure individual workers suffering from chronic occupational diseases

2. John Snow is famously known as the "Father of Field Epidemiology" for his investigation of the 1854 cholera outbreak in London. How did he successfully identify the source of the outbreak?

   A. He collected water samples and used a microscope to identify the *Vibrio cholerae* bacteria.

   B. He proved that the disease was spread through "bad air" (miasma) by measuring air quality in the sewers.

   C. He conducted a randomized controlled trial to test the effectiveness of a new cholera vaccine.

   D. He mapped the geographic locations of deaths and identified a cluster of cases surrounding the contaminated water pump.

3. An OSH manager compares amputation rates before and after installing new machine guards. The data shows a statistically significant drop in injuries. The OSH manager is using epidemiology to _____.

   A. evaluate the effectiveness of a preventive intervention

   B. establish the natural history of disease

   C. identify a new hazard

   D. conduct passive surveillance

4. A study is investigating whether shift work increases the risk of hypertension among assembly line workers. In this study, "shift work" is the _____.

   A. effect

   B. confounder

   C. exposure

   D. outcome

5. You are calculating the incidence of needle-stick injuries in a hospital. Which group most accurately represents the population at risk?

   A. The patients receiving injections.

   B. Only the staff who reported a needle-stick injury last year.

   C. Only the clinical staff who actively handle sharp instruments.

   D. All staff of the hospital.

6. An OSH officer conducts a cross-sectional survey on 1 January 2026, and finds that 50 out of 500 workers have noise-induced hearing loss. What value did the officer calculate?

   A. Point prevalence.

   B. Incidence.

   C. Case fatality rate.

   D. Incidence rate.

7. Which of the following scenarios best illustrates the concept of incidence rate?

   A. Measuring the proportion of workers who died from a disease over 5 years.

   B. Tracking 100 workers for exactly 1 year and counting new cases.

   C. Counting the total number of sick workers on a specific day.

   D. Calculating the number of injuries per 1,000,000 person-hours worked.

8. The incidence of occupational asthma in a factory remains constant (5 new cases per year). However, due to better medical treatment, affected workers can now remain employed for longer instead of resigning. How will this affect the prevalence of asthma in the workforce records?

   A. Prevalence will increase.

   B. Prevalence will remain exactly the same.

   C. Prevalence will decrease.

   D. Prevalence will become zero.

9. A factory employs 500 workers. Medical records show that 20 workers already had chronic dermatitis at the start of 2025. By the end of the year, 24 new cases were diagnosed among the remaining workforce. What is incidence of dermatitis in this factory in 2025?

   A. 8.8%

   B. 5.0%

   C. 4.8%

   D. 12.0%

10. The Standardized Mortality Ratio (SMR) for lung cancer among a group of welders is calculated as 2.0. What is the interpretation of this finding?

    A. There were exactly 2 deaths in the welding department.

    B. The welders have a death rate that is double the expected rate.

    C. The welders have a death rate that is half of the expected rate.

    D. The welders have the same death rate as the general population.

11. In a construction company with high staff turnover, why is incidence rate considered the most appropriate measure for assessing disease outcomes?

    A. It accounts for the fact that workers were at risk for different lengths of time.

    B. It allows you to calculate prevalence instead of risk.

    C. It does not require you to know the number of new cases.

    D. It is much easier to calculate mathematically.

12. The health status chart below tracks 5 workers in the painting workshop over a period of 6 months. Calculate the point prevalence of the disease in March.
    Refer Below - Table1 : Health Status of Workers .

Table 1: Health Status of Workers

Worker	Jan	Feb	Mar	Apr	May	Jun
A	-	-	X	X	-	-
B	-	-	-	-	-	-
C	X	-	-	-	-	-
D	-	-	X	X	X	X
E	-	-	-	-	-	-

Key:
X = Active disease
- = Healthy

    A. 20%

    B. 40%

    C. 60%

    D. 80%

13. Which of the following describes the "Healthy Worker Effect"?

    A. Older workers having more chronic illness than new hires.

    B. Female workers having higher injury rates than male staff.

    C. Workers having lower death rates than the general public.

    D. Office staff reporting more stress than manual laborers.

14. An OSH officer notices that "Heat Stroke" cases in the foundry always spike between 11:00 AM and 2:00 PM. This observation classifies the disease pattern according to _____.

    A. agent

    B. place

    C. time

    D. person

15. The primary goal of descriptive epidemiology is to _____.

    A. calculate the precise risk ratio (RR) of an exposure

    B. test specific hypotheses about causal links using control groups

    C. conduct randomized clinical trials for new control measures

    D. generate hypotheses by characterizing the distribution of disease

16. What type of outbreak source is suggested by the epidemic curve shown in the figure below?

Refer Below - Figure1 : Epidemic Curve .

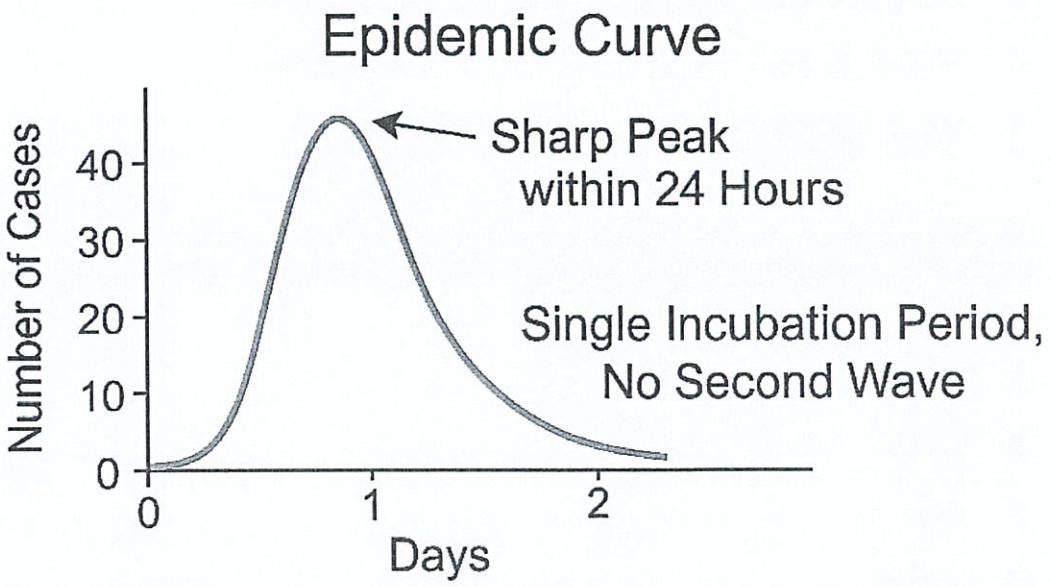

Figure 1: Epidemic Curve

A. Propagated Source

B. Intermittent Source

C. Point Source

D. Continuous Common Source

17. What does the spot map shown below suggest about the determinant of the disease?
Refer Below - Figure2 : Spot Map .

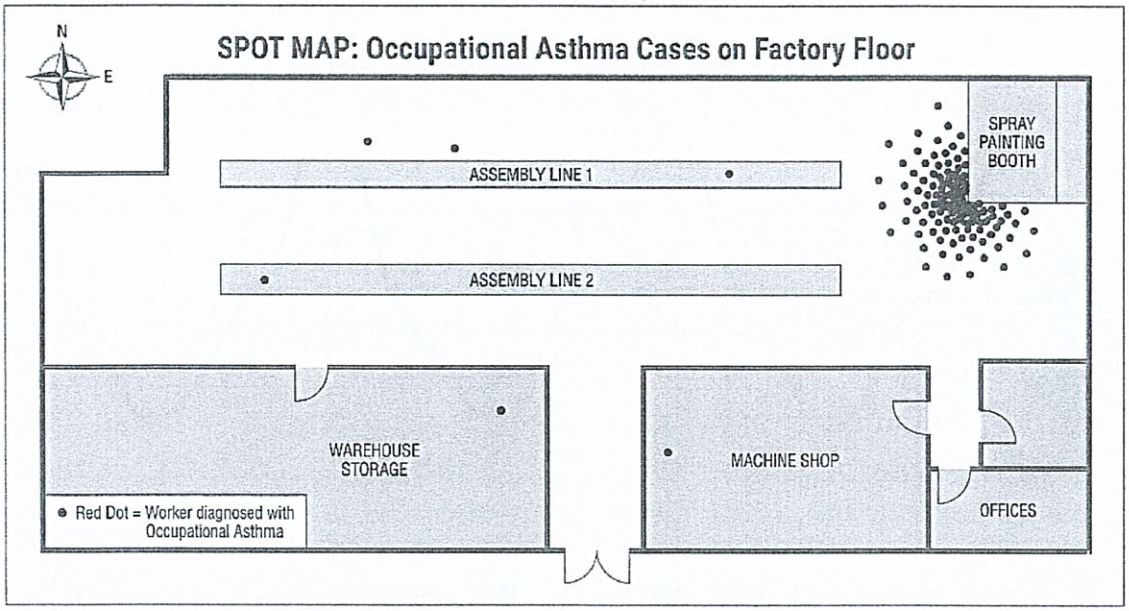

Figure 2: Spot Map

A. The disease is likely infectious and spreading randomly among staff.

B. The disease is strongly associated with local exposure to the spray painting operation.

C. The ventilation system in the southwest corner is defective.

D. The disease is likely caused by a genetic factor common to all workers.

18. What is the most logical interpretation of the information displayed in the graph below?

Refer Below - Figure3 : Slip and Fall Injuries .

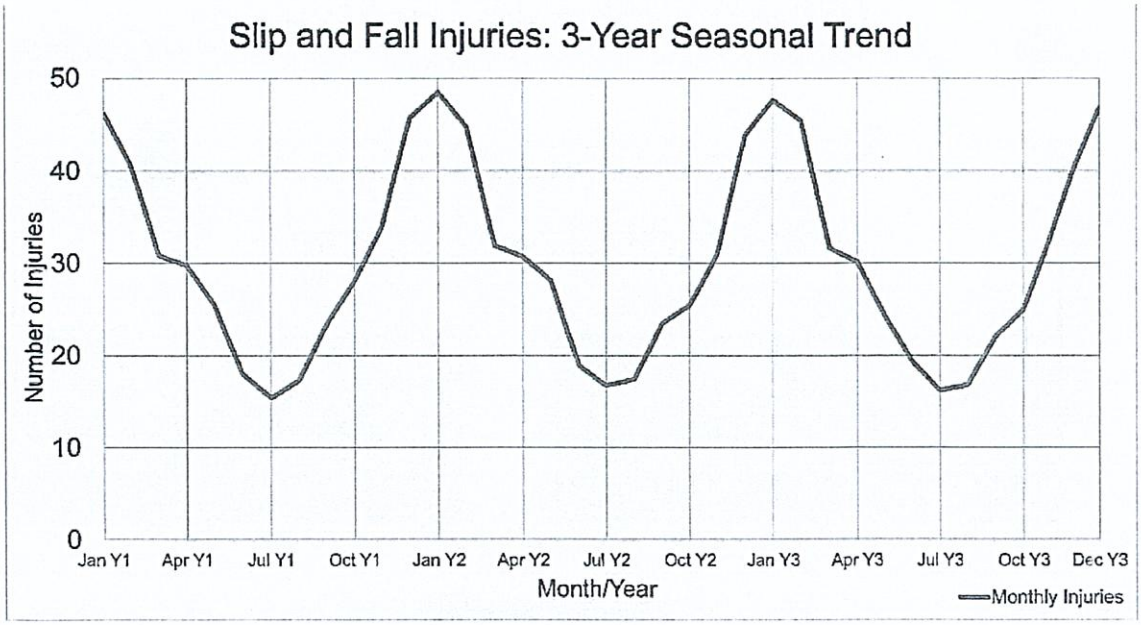

Figure 3: Slip and Fall Injuries

A. The injuries are random and have no pattern.

B. The safety officer is only reporting accidents in December.

C. The injuries are likely related to weather (rainy season) or end-of-year fatigue.

D. The workforce size doubles every December.

19. The table below shows the distribution of cases of occupational asthma in a factory of 85 workers. Calculate the prevalence of occupational asthma in the painting department.
Refer Below - Table2 : Distribution of Asthma Cases .

Table 2: Distribution of Asthma Cases

Department	Number of Cases
Warehouse	5
Painting	10
Assembly	20
Welding	6

A. 5.9%

B. 11.8%

C. 7.1%

D. 23.5%

20. An outbreak of food poisoning occurred after a company annual dinner. A total of 50 workers ate the spicy chicken dish. Within 4 hours, 20 of those workers became ill with vomiting. Calculate the incidence of the food poisoning.

A. 50.0%

B. 40.0%

C. 2.5%

D. 20.0%

21. A study finds a Risk Ratio (RR) of 1.0 for the association between computer use and Carpal Tunnel Syndrome. What is the correct interpretation of this finding?

A. Computer use is a risk factor that increases the likelihood of the disease.

B. Computer use is a protective factor that reduces the likelihood of the disease.

C. The incidence of the disease is identical in both the computer users and the non-users.

D. The exposure accounts for 100% of the disease cases.

22. You calculate an Odds Ratio (OR) of 4.5 in a case-control study on solvent exposure and kidney disease. How do you explain this number to management?

    A. Eliminating the use of solvents in the factory will immediately reduce the total kidney disease cases by 4.5%

    B. Workers who are not exposed to solvents are 4.5 times more likely to remain healthy than those who are exposed.

    C. The incidence rate of kidney disease among the solvent workers is 4.5 cases per 1,000 person-years worked.

    D. Workers exposed to solvents have 4.5 times the odds of developing kidney disease compared to unexposed workers.

23. Which measure of association is calculated using the formula below:
Incidence(Exposed) - Incidence(Unexposed)

    A. Attributable Risk

    B. Population Attributable Risk

    C. Risk Ratio

    D. Odds Ratio

24. In a study of noise exposure, the incidence of hearing loss in the high-noise group is 50 per 1,000 workers. The incidence in the low-noise group is 10 per 1,000 workers. Calculate the Attributable Risk Percent (AR%) due to noise.

    A. 80%

    B. 60%

    C. 5%

    D. 40%

25. Why is Population Attributable Risk (PAR) a useful metric for senior management?

A. It provides a mathematical ratio that is easier for non-experts to calculate compared to other methods of association.

B. It allows management to predict exactly which specific individuals in the company are going to develop the occupational disease.

C. It estimates the total reduction in disease cases for the whole company if the risk factor were completely eliminated.

D. It indicates which control measure recommendation is not effective for eliminating the hazard.

26. Calculate the Incidence Rate Ratio (IRR) comparing the High-Risk Area to the Low-Risk Area based on the following data:

The High-Risk Area recorded 45 injuries over 1,500 person-years.
The Low-Risk Area recorded 10 injuries over 2,000 person-years.

A. 6.0

B. 30.0

C. 4.5

D. 15.0

27. An Odds Ratio (OR) of 1.3 implies that the exposure is _____.

A. a weak risk factor

B. a strong risk factor

C. confounding

D. protective

28. Which of the following best defines a cohort study design?

A. A study that selects participants based on their disease status and looks backward at their exposure history.

B. A study that measures exposure and disease at a single point in time to determine prevalence.

C. A study that randomly assigns participants to an intervention or control group to test the effectiveness of a control measure.

D. A study that selects participants based on their exposure status and follows them over time to observe disease incidence.

29. Which study design is the most efficient and appropriate for investigating very rare occupational diseases?

A. Case-Control Study

B. Randomized Controlled Trial

C. Cross-Sectional Study

D. Prospective Cohort Study

30. _____ studies provides a "snapshot" of both exposure and disease status at a single point in time.

A. Cohort

B. Case-Control

C. Ecological

D. Cross-Sectional

31. What is the primary difference between a Prospective Cohort Study and a Retrospective Cohort Study?

    A. In a Prospective study, the exposure is manipulated by the researcher for the experiment; in a Retrospective study, the exposure occurs naturally in the workplace.

    B. In a Prospective study, the investigator selects participants based on their disease status; in a Retrospective study, the investigator selects participants based on their exposure status.

    C. In a Prospective study, the investigator follows the group forward in time to observe new outcomes; in a Retrospective study, the investigator looks back at historical records to identify past outcomes.

    D. In a Prospective study, the data collection process is generally fast and inexpensive; in a Retrospective study, the data collection process is generally slow and expensive.

32. Which study design is the best for establishing causation because it minimizes bias through randomization, even though it is often unethical to use for occupational hazards?

    A. Case-Control Study

    B. Prospective Cohort Study

    C. Randomized Controlled Trial

    D. Cross-Sectional Survey

33. You are reading a research paper that reports an Odds Ratio (OR) as the measure of association. Which study design was most likely used?

    A. Ecological Study

    B. Randomized Controlled Trial

    C. Case-Control Study

    D. Cohort Study

34. A researcher wants to study the prevalence of "Burnout Syndrome" in the healthcare sector. She sends a questionnaire to all hospital staff on October 1st asking about their current stress levels and current health status. This is an example of a _____.

A. Case-Control Study

B. Cross-Sectional Study

C. Clinical Trial

D. Cohort Study

35. _____ are typically the most expensive and time-consuming to conduct.

A. Randomized Controlled Trials

B. Prospective Cohort Studies

C. Case-Control Studies

D. Cross-Sectional Studies

36. Which of the Bradford Hill criteria is considered the only absolutely essential condition for establishing a causal relationship?

A. Strength of Association

B. Specificity

C. Temporality

D. Biological Gradient

37. A study finds a strong association between wearing a safety helmet and hearing loss among construction workers. However, further analysis reveals that workers who wear helmets are also more likely to work near loud machinery, which is the true cause of the hearing loss. In this scenario, working near loud machinery is a (an) _____.

A. random error

B. confounding variable

C. effect modifier

D. selection bias

38. In a case–control study, mothers of children with birth defects (cases) are more likely to remember or report past chemical exposures in greater detail than mothers of healthy children (controls). This differential accuracy in recalling past exposures leads to _____ bias.

A. recall

B. observer

C. lead-time

D. selection

39. A researcher studies the health of factory workers but inadvertently excludes those who have recently quit due to illness, resulting in an artificially healthy study population. This is a example of _____.

A. confounding

B. recall bias

C. selection bias

D. interviewer bias

40. The risk of occupational hearing loss increases progressively as the noise level and the duration of exposure increase. Which causal criterion does this observation support?

A. Consistency.

B. Dose-response.

C. Analogy.

D. Coherence.

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

You are the Group OSH Manager for "Geo-Resources," a mining company with two major operational sites: Site A (Deep Underground Mine in Sungai Lembing, Pahang) and Site B (Open Pit Mine in Papan, Perak).

Management is concerned about the burden of silicosis (a lung disease caused by silica dust) and the fatality rate at Site A. They have provided you with the following data for the reporting year 2024.

Refer Below - Figure4 : Health Data for Year 2024 .

Location	Average Population (2024)	Existing Cases (Jan 1)	New Cases Diagnosed (2024)	Observed Deaths (All Causes)
Site A	800	50	24	6
Site B	1,500	20	15	8

Figure 4: Health Data for Year 2024

(a) Compare the risk at both locations by calculating the incidence rate (IR) of silicosis per 1,000 workers for Site A and Site B.

(4 marks)

(b) Analyze the total disease burden by calculating the 2024 period prevalence (%) of silicosis for Site A.

(3 marks)

(c) The National Mortality Rate for the general population (adjusted for age/sex) is 4 deaths per 1,000 people per year.
Analyze the mortality impact at Site A by calculating the Standardized Mortality Ratio (SMR) based on the expected deaths.

(4 marks)

(d) Illustrate the disparity in risk by constructing a labeled bar chart comparing the incidence rates of Site A and Site B.

(5 marks)

(e) Analyze the results to contrast the safety performance of the two sites, interpret the SMR value, and formulate a descriptive hypothesis.

(4 marks)

Question 2

You are leading a 5-year prospective cohort study at "Chem-Tech Industries" to investigate the safety of a new cleaning agent called "Green-Solv."

The study recruited 700 healthy workers at the start of 2019.
215 workers were assigned to the "Special Projects" department where they were directly exposed to Green-Solv daily.
485 workers were assigned to the "General Assembly" department where they used standard water-based cleaners.

By the end of the 5-year study (2024), medical records confirmed that 38 of the workers exposed to Green-Solv had developed severe occupational dermatitis. In the unexposed group, 14 workers had developed the same condition.

(a) Organize the study data into a labeled 2x2 contingency table to categorize the population by exposure and disease status.

(4 marks)

(b) Compare the probability of disease development in the two groups by calculating the 5-Year cumulative incidence (risk) for both the exposed and unexposed workers.

(6 marks)

(c) Analyze the strength of the association by calculating the risk ratio.

(4 marks)

(d) Interpret the calculated risk ratio to distinguish the risk associated with Green-Solv exposure.

(3 marks)

(e) Examine the potential impact of eliminating the hazard by calculating and interpreting the attributable risk percent (AR%) among the exposed workers.

(3 marks)

Question 3

You are investigating a cluster of a rare respiratory cancer, sinonasal adenocarcinoma, among workers in the furniture manufacturing industry. Because the disease is rare and has a long latency period, you conduct a case-control study at "Timber-Works Ltd" to investigate the link between the cancer and exposure to hardwood dust.

You recruit 42 workers who have been diagnosed with the cancer (cases). You recruit a comparison group of 85 healthy workers from the same factory (controls).

Through detailed interviews regarding their work history:
Among the 42 cases, you find that 32 reported a history of high exposure to hardwood dust.
Among the 85 controls, you find that 25 reported a history of high exposure to hardwood dust.

(a) Organize the interview data into a labeled 2x2 contingency table to categorize the participants by exposure history and disease status.

(4 marks)

(b) Analyze the strength of the association by calculating the odds ratio (OR).

(6 marks)

(c) Interpret the calculated odds ratio to explain the relationship between hardwood dust exposure and the cancer.

(3 marks)

(d) Differentiate this study design from a cohort study by explaining why the risk ratio cannot be calculated directly from this data.

(3 marks)

(e) Examine the likelihood of a causal link by applying the Bradford Hill criterion of "strength of association" to your finding.

(4 marks)

Question 4

You are the OSH Manager for "Logi-Trans," a large national logistics company with 5,000 employees. The Workers' Union has raised a serious concern: they claim that long-term exposure to diesel engine exhaust is causing an increase in lung cancer among the truck drivers.

Management has authorized an epidemiological investigation but has emphasized two constraints: the budget is limited, and they require preliminary answers within 6 months.

(a) Differentiate between a retrospective cohort study and a case-control study by analyzing the criteria in which participants are recruited.

(4 marks)

(b) Select the most appropriate study design for this investigation and provide two justifications for your choice.

(6 marks)

(c) Identify the study population for your selected design by defining the eligibility criteria for the two groups you would recruit.

(6 marks)

(d) Analyze the validity of the investigation by identifying the most critical confounding variable and explaining how it could distort the relationship between diesel exhaust and lung cancer.

(4 marks)

END OF EXAMINATION PAPER