

NATIONAL EXAMS

December 2005

98-Ind-B10, Industrial Safety and Health

3 hours duration

NOTES:

1. If a doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. Any non-communicating calculator is permitted. This is an OPEN BOOK exam. Write the name and model designation of the calculator, on the first inside left hand sheet of the exam book.
3. Any four (4) questions constitute an exam paper. Only the first four questions as they appear in your answer book will be marked.
4. All questions are of equal value.
5. Where a question requires an answer in essay format, clarity and organization of the answer are important.

Question (1) – 25 points

- a. What is the difference between the Time-Weighted Average Exposure Value (TWAEV) and the Short-Term Exposure Value (STEV) in Ontario Regulation 833? What does the “Skin” designation in Ontario Regulation 833 mean? **(5 points)**
- b. Suppose a flask of acetonitrile is left open overnight in a laboratory room that has dimensions: 3m x 4m x 4m. Assume that the rate of emission of acetonitrile from the flask is 29 g/hour. The ventilation in the laboratory is shut off a night, allowing the concentration of acetonitrile to reach 1500 mg/m³ before the system automatically starts at 9:00 AM in the morning. Calculate the time when a technician can safely enter the room for 15 minutes, without a respirator, to cover the flask. Hint: use a mass balance on acetonitrile in the room assuming that the air in the room is completely mixed and that the make-up air entering the room contains no contaminants. For acetonitrile, use: TWAEV = 40 ppm, STEV = 60 ppm, MW = 39 g/mole **(15 points)**
- c. Calculate the steady state concentration of acetonitrile in the room, assuming the ventilation stays on and the flask remains uncovered. Is this an acceptable concentration for the technician to be exposed for a full 8-hour workday? **(5 points)**

Question (2) – 25 points

- a. What sound pressure level (in dB) is the threshold of pain for the human ear? What is the absolute sound pressure level (in Pa) at the threshold of human hearing (0 dB)? What is the frequency range of hearing for most humans? At what frequency does noise induced hearing loss usually occur? **(10 points)**
- b. A worker is exposed to 97 dB for 1.5 hours, 102 dB for 30 minutes, 90 dB for 4 hours and 80 dB for the rest of her 8-hour workday. Is this exposure permissible? Show your calculations. **(10 points)**
- c. Can employees be disciplined for not wearing protective safety equipment when required? Explain. **(5 points)**

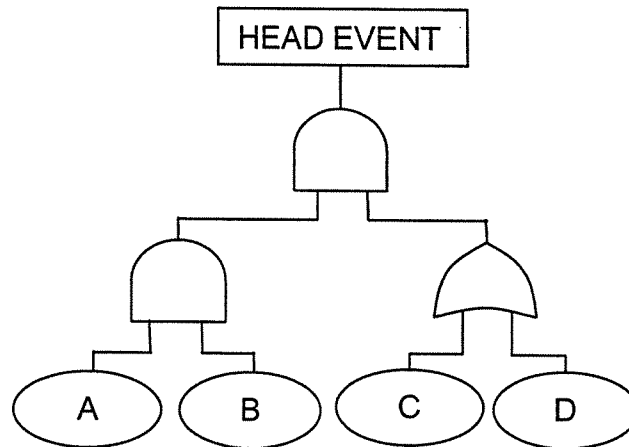
Question (3) – 25 points

a. Create a fault-tree for the top (or head) undesired event “Eye Injury From Flying Metal”. This injury occurred in a woodcutting facility where a worker was on his way to lunch when he was asked by his supervisor to do a “rush job”. Since the worker was on his way out, he had removed his safety glasses. The job consisted of cutting wood 4x4s in half length-wise to form 2x4s. The table saw that the worker used had a rotating blade shielded by a spring-loaded guard. In order to cut thick wood (like 4x4s), the safety guard had to be removed from the saw blade. After the accident, it was found that the 4x4s were recycled wood and a few of them contained nails. While cutting, the saw blade probably hit a nail and broke off a tooth, which flew into the worker’s eye. Another, equally likely, possibility is that a piece of a nail was thrown at the workers eye by the rotating saw blade. Suggested causal events for this analysis are:

- not wearing safety glasses
- supervisor not checking for safety glasses
- nail in wood
- saw in operation
- flying metal goes in direction of worker’s eye
- cutting thick wood
- using saw too small for thick wood
- worker stressed or angry due to rush job

(18 points)

b. Calculate the probability of occurrence of the top event in the fault tree diagram below.



Probability of:

Event A = 0.1

Event B = 0.4

Event C = 0.05

Event D = 0.9

(7 points)

Question (4) – 25 points

Read the following report of an incident.

TORONTO, March 24 /CNW/ - Lakeshore Village Development Corporation, a property holdings company in Toronto, was fined \$70,000 and a supervisor was fined \$3,500 today for one violation each of the Occupational Health and Safety Act that resulted in serious injuries to a worker's hand and foot.

On Aug. 6, 2003, a worker was installing a guardrail at the top of a metal, tubular-frame scaffolding at a townhouse construction site owned by Lakeshore Village Development Corporation when a 2.29-metre (7 1/2-foot) piece of rail came in contact with an overhead, 16,000-volt, energized electrical conductor. The worker suffered electrical burns to the foot and hand. At the time of the incident electrical lines ran near and through the scaffolding and the electrical conductor was about 1.2 to 1.8 metres (four to six feet) over the worker's head. The scaffolding had been erected by a subcontractor a few days before the incident in preparation for installation of exterior brick work. The injured worker was employed by the subcontractor.

A Ministry of Labour investigation determined a site supervisor did not check the scaffolding and power lines while at the site. The incident occurred at 9th Street and Lakeshore Boulevard West in Etobicoke in Toronto's west end.

Brainstorm possible methods that could have prevented this incident. Describe what you consider to be the best four of these, including their advantages and disadvantages. Full marks will be given for considering all possible levels of hazard control.

Question (5) – 25 points

- a. Under what conditions may a worker refuse to work? Who should the worker inform in such a case? If the worker is not satisfied by the corrective action taken by the supervisor, can other workers be sent to do the job that was initially refused? If yes, what must the supervisor do (provide details)? When must the Ministry of Labour be informed (provide details)? **(7 points)**
- b. What is a critical injury? **(5 points)**
- c. List five duties of a Joint Health and Safety Committee. **(5 points)**
- d. What worker has the right to stop the work of another worker? What should the worker who is stopping the work do? If the supervisor does not agree that dangerous circumstances exist, what happens next (elaborate) **(5 points)**
- e. Who, specifically, must inspect the physical condition of the workplace at least once per month? **(3 points)**

Question (6) – 25 points

Read the following accident report:

1333076 ONTARIO LIMITED FINED \$50,000 FOR HEALTH AND SAFETY VIOLATION

BRAMPTON, Ont.--1333076 Ontario Limited, a small Brampton company carrying on business as R.R. Nadon Fleet Services, which repairs tractor-trailers, was fined \$50,000 on May 18, 2001 for a violation of the Occupational Health and Safety Act that resulted in the death of an employee.

On the morning of Feb. 14, 2000, a worker was using a handheld disc grinder to grind smooth the raised metal edges of siderails inside a trailer. The grinder was running on a gasoline-powered generator inside the trailer. In the afternoon, the worker was found in a collapsed state in the trailer with the doors closed. He was taken to hospital and died later in the day from carbon monoxide poisoning. A Ministry of Labour investigation revealed the worker was not using any protective devices to limit his exposure to carbon monoxide fumes.

List possible methods that could have prevented this incident. Describe what you consider to be the best four of these, including their advantages and disadvantages. Full marks will be given for considering all possible levels of hazard control.