

## C37 INDUSTRIAL AND PROCESS HAZARDS

### IMPORTANT

The time allowed for this exam is 3 hours.

Total marks: 200

**You must hand in this paper** and any paper used for rough work to the supervisor when you leave the examination room. Failure to do so may result in disqualification.

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### Section A: Multiple-Choice Questions

Question 1. For the following multiple-choice questions, fill in the circle of the letter that identifies the most correct answer.

Example: (A) (B) ● (D)

**DO NOT MARK THE ANSWERS ON THESE PAGES.**

**USE THE FIRST PAGE OF YOUR ANSWER BOOK.**

1. With respect to boilers, a pre-purge of four air changes is recommended
- (A) after final shutdown.
  - (B) during firing.
  - (C) for initial light-off.
  - (D) in none of the above.

2. A low-water-level cut-out switch interlocked to the combustion system is required for
  - (A) gas-fired boilers only.
  - (B) oil-fired boilers only.
  - (C) both of the above.
  - (D) neither of the above.
  
3. Ovens and furnaces operating at approximately atmospheric pressure, wherein there may be flammable volatiles or combustible materials being processed or heated, are termed
  - (A) Class A ovens or furnaces.
  - (B) Class B ovens or furnaces.
  - (C) Class C ovens or furnaces.
  - (D) Class D ovens or furnaces.
  
4. A Class C furnace is
  - (A) a vacuum furnace that operates at temperatures above ambient to over 5000° F and at pressures below atmospheric.
  - (B) one in which there is a potential hazard due to a flammable or other special atmosphere being used for treatment of material in process.
  - (C) one operating at approximately atmospheric pressure, wherein there are flammable volatiles or combustible materials being processed or heated.
  - (D) one operating at approximately atmospheric pressure, wherein there are no flammable volatiles or combustible materials being processed or heated.
  
5. With respect to ovens, which of the following is true of explosion relief vents?
  - (A) They are required for ovens where fuel or vapour hazards are present.
  - (B) They maximize damage to the oven and surrounding structures should an explosion occur inside the oven.
  - (C) They should not be placed on the sides of the oven.
  - (D) They should not be placed on top of the oven.
  
6. With respect to ovens, **indirect firing** refers to a method of heating in which
  - (A) the products of combustion come in contact with the work in process.
  - (B) the products of combustion do not enter the work chamber.
  - (C) the products of combustion enter the work chamber.
  - (D) none of the above.
  
7. Which of the following is NOT a true statement? With respect to ovens, controls ensure
  - (A) management of fuel combustion.
  - (B) protection against excessive pressure.
  - (C) sufficient pre-ventilation.
  - (D) sufficient ventilation during operation.

8. An **interrupted pilot flame** is one that
- (A) is lighted automatically whenever there is a call for heat but burns during the entire period that the main burner is firing.
  - (B) is lighted automatically whenever there is a call for heat but in which the pilot fuel is cut off automatically at the end of the pilot flame-establishing period.
  - (C) burns throughout the entire period that the heating equipment is in service, but only if the main burner is firing.
  - (D) burns throughout the entire period that the heating equipment is in service, whether or not the main burner is firing.
9. A pilot flame that is lighted automatically whenever there is a call for heat but burns during the entire period that the main burner is firing is called a(n)
- (A) continuous pilot.
  - (B) expanding pilot.
  - (C) intermittent pilot.
  - (D) proved pilot.
10. Which of the following refrigerants is highly flammable but only slightly toxic?
- (A) Ammonia
  - (B) Carbon dioxide
  - (C) Ethyl chloride
  - (D) Propane
11. The condenser in a refrigeration system
- (A) causes the absorption of heat by the refrigerant, thereby cooling the desired location or material.
  - (B) decreases the pressure in the evaporator.
  - (C) increases the pressure of the vapourized refrigerant.
  - (D) removes heat from the refrigerant.
12. Operating the evaporator in a refrigeration system
- (A) decreases the pressure in the expansion valve.
  - (B) increases the pressure of the vapourized refrigerant.
  - (C) removes heat from the refrigerant and causes it to condense.
  - (D) results in the absorption of heat by the refrigerant, thereby cooling the desired location or material.
13. The component of a refrigeration system that decreases the pressure in the evaporator is called the
- (A) compressor.
  - (B) condenser.
  - (C) evaporator valve.
  - (D) expansion valve.

14. Which of the following is true of air conditioning systems?
- (A) A building that is air conditioned is less susceptible to damage than one that is not.
  - (B) A central air conditioning system does not present the problem of spreading fire from floor to floor.
  - (C) Life safety and evacuation are sometimes critical factors when considering the installation of a central air conditioning system.
  - (D) The "unit type" air conditioner is usually located either in the basement or on the roof of the building.
15. Which of the following is true of fire dampers?
- (A) Most are for vertical installation.
  - (B) They should not be used in air conditioning systems.
  - (C) They are available in ratings of not more than 90 minutes.
  - (D) They should not be installed in openings that penetrate a fire-rated barrier.
16. Which of the following is true regarding static electricity?
- (A) Bonding is done to maximize potential differences between conductive objects.
  - (B) Grounding is done to maximize potential differences between objects and the ground.
  - (C) Such liquids as gasoline and kerosene are electrically conductive.
  - (D) Such materials as glass and rubber are electrically non-conductive.
17. Which of the following is true of lightning?
- (A) An accumulation of negative charges generally occurs in the upper part of the thundercloud.
  - (B) The major part of the discharge current is carried in the stroke from the cloud downward to the ground.
  - (C) It is not necessary that lightning actually strike a building to damage it.
  - (D) There is no causal relationship between lightning and thunder.
18. Which of the following is true of electrical transformers?
- (A) A step-up transformer can sometimes be used to increase the voltage.
  - (B) A transformer consists essentially of two iron cores around which are wound the same number of turns of wire in the form of coils.
  - (C) A transformer generally increases incoming low voltage to a more desirable high voltage.
  - (D) A transformer is only used on direct current.
19. Which of the following is FALSE of lightning?
- (A) A building in a valley is usually subject to greater lightning hazard than one built upon high ground.
  - (B) An intense flash of lightning heats the air, which subsequently expands very rapidly.
  - (C) It is not necessary that lightning actually strike a building to damage it.
  - (D) Trees are sometimes provided with lightning protection where they are especially valuable or of historical significance.

20. When a business has electronic data processing equipment, it should have an emergency plan for the continued operation of a computer system, including a program to protect records, an analysis of the workload and its effect on continuing operations, and a written set of requirements for the back-up site. This plan is known as a(n)
- (A) Emergency Fire Plan
  - (B) Damage Control plan
  - (C) Recovery Procedures Plan
  - (D) EDP Operational Plan
21. An ionization-type detector
- (A) activates when carbon dioxide exceeds a specified density.
  - (B) detects both visible and invisible products of combustion.
  - (C) initiates a contact closure when the air temperature reaches the detector's fixed temperature rating.
  - (D) initiates a contact closure when the air temperature rises more than a predetermined number of degrees per minute.
22. A photoelectric-type detector
- (A) activates when smoke exceeds a specified density.
  - (B) detects both visible and invisible products of combustion.
  - (C) initiates a contact closure when the air temperature reaches the detector's fixed temperature rating.
  - (D) initiates a contact closure when the air temperature rises more than a predetermined number of degrees per minute.
23. Liquefied petroleum gases (LPGs)
- (A) are commonly obtained by refining crude oil to produce a variety of arrangements of carbon and oxygen atoms.
  - (B) are shock- and light-sensitive.
  - (C) are heavier than air.
  - (D) usually exist in a liquid form at normal temperatures and pressures.
24. Explosion vents used in buildings and containers
- (A) will prevent an explosion from occurring.
  - (B) are best if they are the closed type because they offer an unobstructed escape of the explosion pressure.
  - (C) are kept open in dusty areas to increase the spread of the dust after an explosion has occurred.
  - (D) open to relieve internal pressure at the lowest tolerable level that is practical.

25. Which of the following is FALSE concerning laminating?
- (A) Laminating is used to manufacture large beams used as structural supports in buildings.
  - (B) Laminating is used to manufacture various types of plywood.
  - (C) Most glues used in laminating are flammable.
  - (D) The main hazard in laminating is in the wood itself rather than the application of the glues.
26. With respect to grain elevators, the area where the grain is accumulated immediately before transfer into the scale bins is called the
- (A) belt conveyor tunnel.
  - (B) boot area.
  - (C) garner.
  - (D) storage bins.
27. Which of the following is a FALSE statement? With respect to grain elevators, eliminating layered dust
- (A) removes the psychological incentive of a clean-looking plant.
  - (B) removes the insulating blanket on hot surfaces such as bearings.
  - (C) removes the fuel for a fire or primary explosion.
  - (D) removes the fuel for a potential secondary explosion.
28. Paint dipping should ideally be conducted in a
- (A) detached non-combustible building.
  - (B) room above the first floor of a building.
  - (C) location over a basement of the building.
  - (D) room with a separation of fire resistance rating zero.
29. In paint dipping, the degree of hazard does NOT depend upon
- (A) the quantities of the flammable liquids.
  - (B) the characteristics of the flammable liquids.
  - (C) whether or not extinguishing systems are provided.
  - (D) the number of articles in the dip tank.
30. Perhaps the most common severe hazard in industry, often neglected as an obvious hazard because of its prevalence, is
- (A) spray finishing.
  - (B) dry cleaning.
  - (C) paint dipping.
  - (D) woodworking.

31. Which of the following is NOT a common method of dry cleaning?
- (A) Applying a fine stream of very fine droplets which fall on the object creating a coat of uniform thickness
  - (B) Immersion and agitation with the solvent in closed machines
  - (C) Brushing or scouring with cleaning solvents
  - (D) Dual-phase processing following a laundering operation
32. Which type of dry cleaning system uses nonflammable solvents with cleaning equipment not operated by the general public?
- (A) Type I
  - (B) Type II
  - (C) Type IV
  - (D) Type V
33. Which type of peroxide, used in the production of plastics, is not shock sensitive, difficult to ignite, and does not burn as vigorously as others in this category?
- (A) Inorganic
  - (B) Methyl ethyl ketone
  - (C) Lauroyl
  - (D) Benzoyl
34. Which of the following is a FALSE statement with respect to fibreglass reinforced plastics?
- (A) Epoxy resins are normally used only in special applications, such as the manufacturing of molds.
  - (B) Polyester resins are non-conductive and non-resistant to corrosion.
  - (C) Polyester resins are used most often partly because of their low cost.
  - (D) Resins can be hardened through exposure to direct sunlight.
35. The flammability of petroleum-based solvents such as a Stoddard solvent is a principal hazard in a
- (A) dry cleaning operation.
  - (B) trucking garage.
  - (C) grain handling facility.
  - (D) paint dipping operation.
36. One substance that is not used as a reinforcing material in the manufacture of fibreglass reinforced plastics is
- (A) Kevlar.
  - (B) rubber.
  - (C) cotton fabric.
  - (D) carbon fibre.

37. The most commonly used process for manufacturing fibreglass products simply uses paint brushes, squeegees, mixing containers, and scissors and is known as
- (A) polymerization.
  - (B) curing.
  - (C) the spray-up method.
  - (D) the hand lay-up method.
38. The smallest part of an element that retains the chemical properties of that element is called a(n)
- (A) atom.
  - (B) electron.
  - (C) molecule.
  - (D) proton.
39. **Beta particles**
- (A) are emitted from a nucleus during radioactive decay with a single electrical charge.
  - (B) are identical to positrons if negatively charged.
  - (C) are the least penetrating of the three common types of radiation.
  - (D) can easily be stopped by a sheet paper.
40. Which of the following would NOT be considered a principal hazard causing losses to industrial lift trucks?
- (A) Fuel hazards from leaking or spilled fuel
  - (B) Sources of ignition such as sparks from electrical components and exhaust systems
  - (C) Ignition of highly pressurized atomized hydraulic oil escaping from hydraulic systems
  - (D) Overturn due to a shift in the weight of the load

(2 marks each = 80 marks)

## Section B: Narrative Questions

- Question 2. (a) Describe the FOUR (4) classes of industrial ovens and furnaces. (14 marks)
- (b) Identify and briefly describe the TWO (2) general methods of heating the contents of an oven. (6 marks)
- Question 3. Identify and briefly discuss FOUR (4) ionization methods used to dissipate static electricity. In what industry could each be used? (20 marks)

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- Question 4. Discuss in detail the following points in connection with constructing and equipping a room to accommodate a major computer installation.
- (a) Location and segregation of the equipment (4 marks)
  - (b) Construction of the computer room (4 marks)
  - (c) Wiring and installation (4 marks)
  - (d) Air conditioning (4 marks)
  - (e) Fire protection (4 marks)
- Question 5. Briefly describe each of the following particularly hazardous areas of a grain elevator, and make recommendations to control their hazards:
- (a) Boot area (5 marks)
  - (b) Garner (5 marks)
  - (c) Grain driers (5 marks)
  - (d) Track shed and truck dump (5 marks)
- Question 6. (a) Name TWO (2) types of organic peroxide, and briefly describe their characteristics. (6 marks)
- (b) Name and briefly describe THREE (3) methods for disposal of organic peroxides. (14 marks)

### Section C: Application Question

- Question 7. (a) One of ABC Insurance Company's industrial insureds has recently incurred two minor losses, both caused by the rupture of the refrigeration system due to over-pressure. You are the loss prevention representative sent by ABC to inspect the insured's premises. What safeguards would you recommend to minimize the possibility of similar losses in the future? (10 marks)
- (b) You are the foreman responsible for the paint dipping equipment in a small factory. You realize that your staff should be fully acquainted with the hazards involved in this process and with the routine maintenance practices. Your staff should give special attention to what maintenance factors? (10 marks)

