

M505: CONTROL OF HAZARDOUS SUBSTANCES

MOCK EXAMINATION

PART A – MULTIPLE CHOICE QUESTIONS

1. Controls can be introduced to protect the health or comfort of workers. Other objectives can include:
 - a) Reduction in environmental pollution
 - b) Reduction in economic loss
 - c) Improved employee safety
 - d) All of the above

2. When developing a strategy for the control of hazardous substances, it is essential to identify:
 - a) All persons on site
 - b) Exactly what is causing the exposure
 - c) Which control strategy is the most cost effective
 - d) Potential barriers to the implementation of the chosen control measure

3. What is the commonest challenge to implementing any type of exposure control?
 - a) Employee acceptance
 - b) Engineering design
 - c) Cost
 - d) Regulatory approval

4. Which of the following are “worker based” controls?
 - a) Automation
 - b) Containment
 - c) Administrative measures
 - d) General ventilation

5. The key to implementing an effective control strategy is:
 - a) To ensure all workers are trained in the operation of the control measure
 - b) Ensuring that a detailed risk assessment has been undertaken of the situation
 - c) Supervision is in place to ensure the control operates correctly
 - d) None of the above

6. A “significant risk” is normally considered present when:
- a) The work is likely to adversely affect the health of workers
 - b) The workplace is subject to an inspection by the regulatory authority
 - c) The health of workers is the subject of industrial action
 - d) All of the above
7. “Adequate control” of a contaminant applies when:
- a) A point when it is considered that the process is under control
 - b) An exposure threshold cannot be established for the contaminant
 - c) A threshold can be established and the exposure level of the contaminant is below that threshold
 - d) The time weighted average (TWA) exposure standard is achieved but the short term exposure limit (STEL) is sometimes exceeded
8. Pitot tubes are generally not considered reliable with velocities less than:
- a) 10 ms^{-1}
 - b) 7 ms^{-1}
 - c) 5 ms^{-1}
 - d) 3 ms^{-1}
9. When should an occupational hygienist be involved in specifying controls for a new process?
- a) During the design stage
 - b) During commissioning
 - c) Immediately after commissioning
 - d) After a few weeks of use so that any problems have become evident
10. In the control of carbon monoxide from a LPG powered forklift truck, which is the most appropriate from an occupational hygiene perspective?
- a) Regular maintenance
 - b) Fit all trucks with a catalytic converter
 - c) Replace with electric powered forklift trucks
 - d) Install a LEV system
11. Generation of dust in the workplace should preferably be minimised by:
- a) Regular sweeping
 - b) Regular vacuuming
 - c) Water sprays
 - d) Good process design

12. The “best” option of controlling exposure to dust emissions from addition of a powder to a mixture is:
- a) Issue respiratory protective equipment
 - b) Improve the local exhaust ventilation
 - c) Add the substance as pellet form rather than as a fine powder
 - d) Improve supply of fresh air to the area
13. In the design of plant handling human carcinogens, which of the following is not appropriate?
- a) High reliability, high containment valves
 - b) High pressure transfer of materials between plant vessels
 - c) Integral decontamination of lines and plant
 - d) Automated process control with in-line sampling
14. Which of the following is the most appropriate for the control of carcinogens?
- a) Total enclosure
 - b) Substitution with alternative
 - c) Monitor to ensure exposure is below the OEL
 - d) Minimise number of people involved
15. Which of the following measures will increase the risk of airborne dust exposure during a powder handling process?
- a) Process enclosure
 - b) Increasing particle size
 - c) Decreasing particle size
 - d) Local exhaust ventilation
16. Which of the following is least effective at minimising the risk of skin absorption during solvent cleaning operations?
- a) Automating the process
 - b) Barrier creams
 - c) Use of water based substitute cleaner
 - d) Impervious gloves
17. Which of the following paint application processes presents the greatest potential health risk?
- a) Dipping
 - b) Brush application
 - c) Powder painting
 - d) Spraying

18. The most important control feature of a **hot** vapour degreasing bath is:
- a) Lip extraction
 - b) Vapour condensing coils
 - c) Canopy extraction
 - d) Automated removal of components
19. In a plastics mixing process, fine powder is fed into a reaction vessel by pouring. A lot of fine dust is produced in the process. To improve control the powder is introduced in pelletised form. This form of control is an example of:
- a) Elimination
 - b) Substitution
 - c) Modification of the process
 - d) Administrative control
20. Control of exposure to a solvent from a vapour-degreasing tank is best achieved by:
- a) LEV for components removed from tank
 - b) Ventilation of workshop
 - c) Lip extraction
 - d) Respiratory protective equipment
21. A maintenance worker must enter an empty reactor vessel for cleaning, inspection and lining repair. In the absence of continuous ventilation and testing of the air in the vessel, what should an occupational hygienist recommend?
- a) An organic vapour respiratory for the worker and a helper with a life line within earshot
 - b) Performance of the work at night with prior notice to the Emergency Response Unit
 - c) Flushing the tank with a suitable organic solvent before the worker enters
 - d) A SCBA and fixed life line for the worker and a helper directly outside the tank
22. Which of the following is the preferred technique for assessing the performance of an extract hood once capture performance has been established?
- a) Measurement of face velocity
 - b) Measurement of velocity pressure inside the hood
 - c) Measurement of static pressure immediately downstream of the hood
 - d) Measurement of capture velocity at the source of contaminant
23. Which of the following instruments would be most appropriate for assessing the face velocity of a fume cupboard?
- a) A velometer
 - b) A 100 mm diameter vane anemometer
 - c) A vertical manometer
 - d) A pitot tube

24. The most effective way of viewing the generation of a dust cloud in a work process is:
- a) By using a smoke tube
 - b) By using a light scattering particle counter
 - c) By using beta absorption direct reading instrument
 - d) By using the Tyndall effect
25. The static pressure measured upstream from a fan is -600 Pa and the total pressure is 1000 Pa. What is the velocity pressure?
- a) 400 Pa
 - b) 600 Pa
 - c) 1000 Pa
 - d) 1600 Pa
26. A fan is operating at a speed of 860 rpm and a volume flow of $4.5 \text{ m}^3\text{s}^{-1}$. If the fan speed is reduced to 780 rpm the new volume flow is:
- a) $4.95 \text{ m}^3\text{s}^{-1}$
 - b) $4.08 \text{ m}^3\text{s}^{-1}$
 - c) $4.26 \text{ m}^3\text{s}^{-1}$
 - d) $4.00 \text{ m}^3\text{s}^{-1}$
27. What type of fan is good at moving moderate volumes of air against a high resistance?
- a) Forward curved centrifugal
 - b) Radial bladed centrifugal
 - c) Backward curved centrifugal
 - d) None of these
28. At entry to an exhaust fan, the total pressure equals 400 Pa and the static pressure equals -800 Pa. What is the velocity pressure?
- a) -400 Pa
 - b) 400 Pa
 - c) -1200 Pa
 - d) 1200 Pa
29. Slots are hoods where the width-length aspect ratio is:
- a) Less than 1
 - b) Less than 0.5
 - c) Less than 0.2
 - d) None of the above

30. The best means of having an instant check that an extract system is operating correctly at the extract point is by:
- a) Measuring the face velocity at the extract hood
 - b) Checking the duct velocity downstream of the extract point
 - c) Using a smoke tube
 - d) Observing the reading on a fixed manometer attached to the ductwork just after the extract point
31. The typical capture velocity required for solvents evaporating from degreasing tanks, paint dipping or drying is:
- a) $0.3 - 0.5 \text{ ms}^{-1}$
 - b) $0.5 - 1.0 \text{ ms}^{-1}$
 - c) $1.0 - 2.5 \text{ ms}^{-1}$
 - d) $2.5 - 10 \text{ ms}^{-1}$
32. A ventilation system is used to control exposure to a toxic substance in the workplace. Visual inspection of the system to ensure it is working correctly should take place every:
- a) Week
 - b) Month
 - c) Quarter
 - d) Year
33. Which of the following fans is most suitable for a high velocity, high resistance local extract system?
- a) Backward curved centrifugal
 - b) Forward curved centrifugal
 - c) Axial flow
 - d) Propeller fan
34. The transport velocity for a heavy metal dust is typically:
- a) 5 ms^{-1}
 - b) 12 ms^{-1}
 - c) 25 ms^{-1}
 - d) 50 ms^{-1}
35. Which of the following is general dilution ventilation suitable to control?
- a) Toxic substances at source
 - b) Low toxicity substances from diffuse sources
 - c) Contaminants released in the workers breathing zone
 - d) Solvent vapours from degreasing tanks

36. A recommendation is required for a fan to operate in a ventilation system that deals with heavy fume loading and where the gas cleaning system is sometimes unreliable. The chosen fan is:
- a) An axial flow fan with propeller blades
 - b) A centrifugal fan with backward curved blades
 - c) A centrifugal fan with radial blades
 - d) A centrifugal fan with forward curved blades
37. Velocity of air is 30 ms^{-1} in ductwork. What is the velocity pressure? (Assume normal temperature and pressure conditions)
- a) 180 Pa
 - b) 540 Pa
 - c) 1080 Pa
 - d) 2600 Pa
38. The minimum face velocity for a fume cupboard should be:
- a) 0.3 ms^{-1}
 - b) 0.5 ms^{-1}
 - c) 0.7 ms^{-1}
 - d) 1.0 ms^{-1}
39. The velocity pressure measured in a duct was 225 Pascals. The velocity was:
- a) 15.0 ms^{-1}
 - b) 19.4 ms^{-1}
 - c) 22.5 ms^{-1}
 - d) 31.7 ms^{-1}
40. A spray booth has face dimensions of 2 metres by 2.5 metres. The face velocity is 0.6 metres per second. The volume flow through the booth is:
- a) $2.8 \text{ m}^3\text{s}^{-1}$
 - b) $3.0 \text{ m}^3\text{s}^{-1}$
 - c) $3.6 \text{ m}^3\text{s}^{-1}$
 - d) $4.0 \text{ m}^3\text{s}^{-1}$
41. Which type of fan is commonly used in small systems to move gases or vapours?
- a) Axial fan
 - b) Backward bladed centrifugal
 - c) Forward bladed centrifugal
 - d) Radial bladed centrifugal

42. The advantage of a balanced extraction system without dampers is that it:
- a) Prevents blockages
 - b) Additional branches can be added
 - c) The operator can readily adjust flow
 - d) The operator cannot easily interfere with the flow
43. Push-pull systems are often used on which of the following operations?
- a) Welding
 - b) Grinding
 - c) Large open surface tanks
 - d) Spraying isocyanate based paints
44. If the direction of rotation of a centrifugal fan goes backwards, what happens to the flow?
- a) The direction of flow is reversed
 - b) The flow rate is unaffected
 - c) The flow efficiency remains the same
 - d) The flow continues in the same direction but the flow rate is reduced
45. Air is passing through a duct of cross-sectional area 0.04 m^2 at a rate of $1 \text{ m}^3 \text{ s}^{-1}$. If the static pressure is - 300 Pascals, what is the total pressure in the duct?
- a) - 375 Pascals
 - b) 75 Pascals
 - c) 375 Pascals
 - d) 675 Pascals
46. What does the dust lamp qualitatively assess?
- a) Respirable dust
 - b) Thoracic respirable dust
 - c) Inhalable dust
 - d) Dusts and vapours
47. During a thorough examination and test it is found that the static pressure upstream of a particular point has fallen significantly from the initial examination and test. The static pressure downstream of that same point has gone up significantly. This signifies there is a:
- a) Leak in the system between the two test points
 - b) Blockage upstream of both test points
 - c) Blockage between the two test points
 - d) Blockage downstream of both test points

48. The method by which a cyclone separates dust from an air stream is:
- a) Wetting of particles
 - b) Trapping on a filter
 - c) Impaction on the side wall and dropping down to collector
 - d) Electrical charge given to particles
49. Branches of ductwork should join the main duct at an angle of:
- a) 90 degrees
 - b) 120 – 150 degrees
 - c) 10 – 15 degrees
 - d) 30 – 45 degrees
50. Air is passing through a duct of 0.2 m diameter pipe. The flow rate is $1.5 \text{ m}^3 \text{ s}^{-1}$ and the static pressure is -165 Pascals. What is the total pressure to the nearest 5 Pa?
- a) 800 Pascals
 - b) 1000 Pascals
 - c) 1200 Pascals
 - d) 3000 Pascals
51. For any LEV system, which of the following statements is always true?
- a) Velocity pressure is positive upstream from the fan
 - b) Static pressure is negative downstream from the fan
 - c) Velocity pressure is negative downstream from the fan
 - d) None of the above
52. Which of the following describes LVHV systems?
- a) Low volume high vacuum
 - b) Low volume high velocity
 - c) Low velocity high volume
 - d) Low velocity high vacuum
53. For a particular process, the quantity of air required to control a substance by a small hood requires a face velocity of 5 ms^{-1} per second. If a larger hood was to be installed will the required hood face velocity necessary to achieve the same air quantity be:
- a) More than 5 ms^{-1}
 - b) Less than 5 ms^{-1}
 - c) The same
 - d) None of the above

54. Air is being transported through an extraction system at high temperature. Which would be the most suitable filter media?
- a) Nylon
 - b) Glass fibre
 - c) Cotton
 - d) Cotton/nylon
55. Which one of the answers to the following question is incorrect?
Respiratory protective devices (respirators) are designed to provide protection against one or more of the following hazards:
- a) Deficiencies in oxygen
 - b) Particulate contaminants
 - c) Gaseous and vapour contaminants
 - d) Permeation of solvents
56. Pre filters are usually added to combination particulate and gas/vapour filters to:
- a) Remove small particles
 - b) Extend the life of the main particulate filter
 - c) Remove contaminants that may affect the gas/vapour filter
 - d) None of the above
57. Air quality for supplied air respirators should have a moisture/water content of less than 50 mg m^{-3} to:
- a) Maintain the moisture level in the inhaled air
 - b) Prevent ice formation in the pressure let-down valve
 - c) Reduce the respiration rate
 - d) Prevent corrosion
58. What is the required minimum protection factor for a contaminant where the airborne concentration is 1.5 mg m^{-3} and the OEL is 0.1 mg m^{-3} ?
- a) 1.5
 - b) 15
 - c) 150
 - d) 1500
59. Which of the following is an example of an administrative control?
- a) Swipe or access card system
 - b) Respiratory protection
 - c) Natural ventilation
 - d) Air conditioning

60. To be able to use administrative controls effectively, workers need to know:
- a) Why the control is needed
 - b) How the control is to be achieved
 - c) The limitations of the procedures
 - d) All the above

PART B – SHORT ANSWER QUESTIONS
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1. Describe the main types of air cleaning devices used in LEV systems. In your answer indicate the advantages and limitations of each.
2. You are an Occupational Hygienist who has arrived at a new site and has been asked by the Manager to develop a site-wide PPE programme. What are the elements you would consider when developing this programme?
3. List the three basic categories of hoods used in LEV systems and indicate their application, advantages and limitations.
4. List and discuss the five (5) steps to achieving effective control of worker exposures in a process.
5. What is “control banding”? In your answer indicate the steps involved in establishing an appropriate control strategy.