

CSP Questions and Answers- Part- I

Question #: 1- Maintenance grounds-keepers often use self-propelled machines to assist them with their work. The most protective type of guard used for this equipment is the:

- 1) Self-adjusting 2) Adjustable **3) Interlocked** 4) Fixed

Answer:3- Self-propelled lawn mowers and snow blowers are interlocked with the source of power so that the machine cannot be operated without all guards in place. The interlocking guard prevents operation of the control that sets the machine in motion until the guard is moved into position, so that the operator cannot reach the point of operation or the point of danger.

Question #: 2-The most common guard for an automatic guillotine paper cutter is:

- 1) Barrier **2) Remote controls** 3) Sensing 4) Mechanical

Answer: 2- Remote controls are the most common guards on these devices.

Question #: 3- 5 workers are exposed to airborne lead at 8-hr TWA's of 27 mg/m³, 42 mg/m³, 54 mg/m³, 24 mg/m³, and 60 mg/m³. What is the mean exposure?

- 1) 41 mg/m³** 2) 42 mg/m³ 3) 46 mg/m³ 4) 40 mg/m³

Answer: 1- In order to get the mean average exposure for the five workers, sum the exposures for all workers first.

$$(27 + 42 + 54 + 24 + 60) \text{ mg/m}^3 = 207 \text{ mg/m}^3$$

Then calculate the mean exposure by dividing the sum by the total number of workers.

$$207 \text{ mg/m}^3 / 5 \text{ workers} = 41.4 \text{ m/m}^3 \text{ per worker}$$

Question #: 4- Six workers are exposed to Methylene chloride at the following levels (based on an 8-hr TWA): 27 ppm, 31 ppm, 12 ppm, 86 ppm, 27 ppm, and 40 ppm. What is the statistical mode of their exposures?

- 1) 37 ppm 2) 31 ppm **3) 27 ppm** 4) 29 ppm

Answer: 3 - The statistical mode is the number in a set of numbers that appears most frequently. 27 ppm is correct because it appears most frequently in this set of numbers.

Question #: 5- TLV-C refers to an airborne exposure concentration:

- 1) That should never be exceeded** 2) Permitted for a 30 minute exposure
3) That is below the TLV-TWA 4) That is an emergency exposure level

Answer: 1- The TLV-C (threshold limit value-ceiling) should never be exceeded.

Question #: 6- Some common causes of eye injury involve exposure to:

- 1) High energy arcs, compressed air, dilute boric acid
- 2) High energy arcs, methanol, compressed air**
- 3) Compressed air, metal filings, de-ionized water
- 4) De-ionized water, dilute boric acid, compressed air

Answer: 2- High energy arcs, methanol, and compressed air have all been causes of eye injuries. Dilute boric acid is used to treat eye inflammation; de-ionized water is ultrapure water.

Question #: 7- Acetylene can be described as a:

- 1) Colorless gas with a slight garlic-like odor**
- 2) Pungent, irritating greenish-yellow gas
- 3) Faint yellow liquid
- 4) White powder with a chlorine-like odor

Answer: 1- Acetylene is a colorless gas with a slight garlic-like odor.

Question #: 8- When designing a safety program, it is essential that psychological factors like individual differences, motivation, emotion, attitudes, and _____ be considered.

- 1) Reward
- 2) Punishment
- 3) Learning**
- 4) Negativism

Answer: 3- Learning underlies much of what makes for differences and similarities among people. Through learning, people have developed certain kinds of psychological needs, habitual patterns of behavior, ways of reacting to emotion, and the attitudes which brought them into the workplace. It is essential to consider learning because training is a major consideration in safety programming.

Question #: 9- Under what conditions is Level A protection preferred over Level B protection?

- 1) Where heat stress is a factor
- 2) Where the highest level of skin protection available is needed**
- 3) Where the highest level of respiratory protection available is needed
- 4) Where there is a high potential for fire/explosion

Answer: 2- Level A protection provides a higher level of skin protection than Level B protection.

Question #: 10- Which of the following is NOT an example of protective footwear?

- 1) Steel-toed boots
- 2) Fitted orthotics**
- 3) Molders (foundry) shoes
- 4) Conductive footwear

Answer: 2- Fitted orthotics is not a type of safety protective footwear.

Safety shoes have impact-resistant toes and heat-resistant soles that protect the feet against hot work surfaces common in roofing, paving and hot metal industries. The metal insoles of some safety shoes protect against puncture wounds. Safety shoes may also be designed to be electrically conductive to prevent the buildup of static electricity in areas with the potential for explosive atmospheres or nonconductive to protect workers from workplace electrical hazards.

Electrically conductive shoes provide protection against the buildup of static electricity. Employees working in explosive and hazardous locations such as explosives manufacturing facilities or grain elevators must wear conductive shoes to reduce the risk of static electricity buildup on the body that could produce a spark and cause an explosion or fire. Foot powder should not be used in conjunction with protective conductive footwear because it provides insulation, reducing the conductive ability of the shoes. Silk, wool and nylon socks can produce static electricity and should not be worn with conductive footwear. Conductive shoes must be removed when the task requiring their use is completed. Note: Employees exposed to electrical hazards must never wear conductive shoes.

Electrical hazard, safety-toe shoes are nonconductive and will prevent the wearers' feet from completing an electrical circuit to the ground. These shoes can protect against open circuits of up to 600 volts in dry conditions and should be used in conjunction with other insulating equipment and additional precautions to reduce the risk of a worker becoming a path for hazardous electrical energy. The insulating protection of electrical hazard, safety-toe shoes may be compromised if the shoes become wet, the soles are worn through, metal particles become embedded in the sole or heel, or workers touch conductive, grounded items. Note: Nonconductive footwear must not be used in explosive or hazardous locations.

Foundry Shoes, in addition to insulating the feet from the extreme heat of molten metal, foundry shoes keep hot metal from lodging in shoe eyelets, tongues or other shoe parts. These snug-fitting leather or leather-substitute shoes have leather or rubber soles and rubber heels. All foundry shoes must have built-in safety toes.

Question #: 11- A simple definition for hazard, as it applies to system safety, is:

- 1) A source of danger
- 2) Risk, peril, or jeopardy
- 3) A potential to do harm**
- 4) A dangerous condition which can interfere with the orderly progress of an activity

Answer:3- A potential to do harm is the simple and abbreviated version of the definition of "hazard." More formally, a hazard is "a potential condition, or set of conditions, either internal and/or external to a system, which when activated by a stimulus (set of events or conditions that transforms a hazard from its potential state to one that causes harm to the system) or series of events which culminate in a loss (accident)."

Question #: 12- Which of the following is the LEAST likely property of activated carbon that makes it a good sample collecting medium?

- 1) Large surface area
- 2) Ease of stripping collected samples
- 3) High adsorbitivity for gases, vapors
- 4) High polarity**

Answer: 4- Activated carbon is extremely porous and has a non-polar surface. It adsorbs molecules to its surface readily. When bathed in a non-polar solvent such as carbon disulfide, the adsorbed molecules are easily removed and dissolved into the solvent.

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Question #: 13- Silicosis is a dust disease from exposure to:

- 1) Glass **2) Crystalline SiO₂** 3) Amorphous silica 4) Aluminum silicate

Answer: 2- All of the answers contain the element silicon. However, only crystalline silicon dioxide (SiO₂) causes the disease silicosis. Dust from glass, amorphous silica, and aluminum silicates are considered nuisance dusts and have minimal long term biological effects.

Question #: 14- Vibration exposure is monitored by measuring all of the following EXCEPT:

- 1) Acceleration **2) Decibels** 3) Frequency 4) Duration of exposure

Answer: 2- Decibels are units used for measuring noise exposure. Vibration is measured in acceleration, frequency, and duration.

Question #:15- The octave band center frequencies that most closely correlate with human speech are:

- 1) 750 Hz, 1,500 Hz, 3,000 Hz 2) 250 Hz, 500 Hz, 1,000 Hz
3) 1,000 Hz, 1,500 Hz, 2,000 Hz **4) 500 Hz, 1,000 Hz, 2,000 Hz**

Answer: 4- The center frequencies of the octave bands that most closely correlate with human speech are 500 Hz, 1,000 Hz, and 2,000 Hz.

Question #:16- Numerical values that are based on procedures to determine the amount of hazardous materials the human body has absorbed (by measuring the actual materials or their metabolic products in tissue, fluid, or exhaled air) is called a:

- 1) BCM 2) BLD **3) BEI** 4) BP

Answer: 3- BEI's (Biological Exposure Indexes) are numerical values based on procedures to determine the amount of a material the human body absorbs by measuring the actual materials or their metabolic products in tissue, fluid, or exhaled air.

Question #: 17- Of the following, which is the LEAST effective way for a manager to maximize his or her safety program?

- 1) Written safety policies 2) Supervisory safety training
3) Audit of safety program **4) Weekly staff meetings**

Answer: 4- Common elements to maximize a safety program include: written policies, supervisor training, auditing, investigation of all hazards and accidents, and formation of safety committees. Staff meetings can be on any schedule that allows you to reach your goals.

Question #: 18- What is the percentage of all occupational illnesses accounted for by cumulative trauma disorders and skin diseases/disorders?

- 1) 30% 2) 40% 3) 50% **4) 70%**

Answer: 4- CTD and skin diseases and disorders account for over 70% of all occupational illnesses.

Question #: 19- 3.7×10^{10} disintegrations per second equal's _____ disintegrations per minute.

- 1) 2.22×10^{12}** 2) 6.2×10^8 3) 1.0×10^7 4) 1.3×10^{14}

Answer:1- To calculate the number of disintegrations per minute, simply multiply the number of disintegrations per second by 60 sec/min. $60 \text{ sec/min} \times 3.7 \times 10^{10} \text{ dis/sec} = 2.22 \times 10^{12} \text{ dis/min}$

Question #: 20- The explosimeter, combustible gas indicator, and vaptester operate on what principle?

- 1) Adsorption 2) Absorption 3) Beilstein reaction **4) Heat of combustion**

Answer:4- All of the listed instruments cause an oxidation to take place and make a measurement based on the heat released.

Question #: 21- The principal of the Rotameter is similar to:

- 1) Venturi meter **2) Variable orifice meter** 3) Pitot tube 4) Anemometer

Answer: 2- As the float rises, the annular width varies in the rotameter. An analogous condition is present when the orifice size is changed in a variable orifice meter.

Question #: 22- The term self-accelerating decomposition temperature (SADT), is defined as:

- 1) The maximum temperature of a liquid at which it gives off vapor sufficient to form an ignitable mixture with air
- 2) The minimum temperature of a liquid at which it gives off vapor sufficient to form an ignitable mixture with air
- 3) The ambient temperature at which a self-sustaining chemical reaction of stored organic peroxides will occur**
- 4) The rate of decomposition of certain organic peroxides when stored at very high temperatures

Answer: 3- The SADT is determined for stored organic peroxides. It is the ambient temperature at which a run-away reaction will likely occur.

Question #: 23- Water principally extinguishes fires by:

- 1) Cooling the fuel surface** 2) Excluding oxygen 3) Pre-wetting the fuel 4) Dilution

Answer:1- All four answers legitimately describe how water extinguishes a fire. Of these, though, cooling the fuel surface has the most impact.

Question #: 24- Building fire safety is achieved by all of the following EXCEPT:

- 1) Separating igniters from ignitable materials
- 2) Managing the impact of a fire through building design
- 3) Taking measures to control products of combustion

4) Organizing a fire brigade

Answer: 4- Building fire safety may be achieved either by fire ignition prevention or, if a fire does occur, by managing its impact through building design. Ignition prevention is accomplished by separating igniters from ignitable materials. The products of combustion that must be considered by the building designer can be categorized as thermal (flame and heat) and non-thermal (smoke and gases).

Question #: 25- A combustible liquid is best defined by one of the following:

- 1) Any liquid having a flash point above 100°F and below 140°F
- 2) Any liquid having a flash point at or above 100°F**
- 3) Any liquids having a flash point above 140°F
- 4) Class II liquids having flash points at or above 100°F and below 140°F

Answer: 2- A combustible liquid is any liquid having a flash point at or above 100°F. Flammable and combustible liquids are subdivided into classes. Combustible liquids are:

- Class II - flash points at or above 100°F and below 140°F
- Class III- flash points at or above 140°F.

NFPA 30 - Flammable and Combustible Liquids Code

Question #: 26- A flammable liquid is best defined by one of the following:

- 1) Any liquid having a flash point below 73°F and a boiling point below 100°F
- 2) Any liquid having a flash point below 100°F and a vapor pressure not exceeding 40 psi (a) at 100°F.**
- 3) Any liquid having flash points at or above 100°F and below 140°F

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4) Any liquid having a flash point below 73°F and having a boiling point at or above 100°F

Answer: 2- A flammable liquid is any liquid having a flash point below 100°F and having a vapor pressure not exceeding 40 psi(a) at 100°F.

Flammable and combustible liquids are subdivided into classes with:

- Class I having a flash point below 100°F
- Class II having flash points at or above 100°F
- Class III having flash points above 140°F.

NFPA 30 - Flammable and Combustible Liquids Code

Question #: 27- "Flame Spread Rating" is a measure of a materials' surface burning characteristics. Which test is employed?

- | | |
|---------------------------|-------------------------------|
| 1) Time/Temperature Curve | 2) Steiner Tunnel Test |
| 3) ASTM E 32 | 4) FM Calorimetry Test |

Answer: 2- The 25 ft Steiner Tunnel Test, also known as ASTM E-84, NFPA 255, and UL 723 was developed at Underwriters Laboratories. Due to the need for some method for control of interior finishes, the Steiner Tunnel Test was recognized and adopted by ASTM & NFPA as an official standard in 1958.

Question #: 28- The chemistry of fire is depicted by a fire triangle. Which of the following does NOT apply?

- 1) Air, heat, and fuel comprise the three elements of the triangle
- 2) All three elements must be present to sustain combustion
- 3) The combustion process will cease when any one of the three elements is removed

4) The heating process will cease when the ignition source is removed

Answer: 4- An ordinary fire (extinguished using conventional methods) results from the combination of air (oxygen), fuel, and heat. Take one away and the combustion process will stop.

Question #: 29- The minimum concentration of gasoline in air that can be ignited is 7.6%. This minimum concentration is called the:

- 1) Lower explosive limit** 2) Upper flammability limit 3) Lower ignitable limit 4) Both 1 and 3

Answer: 1- The minimum concentration of a material in air that can be ignited is commonly called the LEL, or lower explosive limit. The maximum concentration of a material in air that can be ignited is called the upper explosive limit or UEL. The terms lower explosive limit and lower flammability limit (LFL) are used interchangeably as are upper explosive limit and upper flammability limit (UFL).

Question #: 36- In an automated man-machine system, man acts as a:

- 1) Power source and controller 2) Controller
- 3) Power source **4) Monitor**

Answer: 4- Since the man-machine system is automated, the man acts as a monitor.

Question #: 37- Non-regulatory consequences of failure to adequately clean-up chemical releases include all EXCEPT:

- 1) Decreased property values
- 2) Difficulties in selling the affected property
- 3) Reduced collateral value of the property in borrowing situations
- 4) Reduced charges to waste disposal budget**

Answer: 4- Answers 1, 2, and 3 are possible. Answer 4 is not (most likely, costs will increase). Chemical contamination can cause a property to have a negative economic value because the costs of remediation exceed the market value of the property, once remediated. There are legal/regulatory consequences as well.

Question #: 38- The fall season has arrived at a New England office facility and with it, a rash of HVAC complaints that were not recorded during the summer. Which troubleshooting step should be first?

- 1) Determine if the dampers are operating properly
- 2) Check the inside/outside temperature controls
- 3) Determine if the air distribution is balanced to specifications
- 4) Check the make-up air system, or damper**

Answer: 4- During the warm months of the year, large volumes of air of relatively high velocities are welcomed by the workers. During the fall or winter months, care must be taken to make sure that air blowing over the occupants is kept within acceptable values (comfort conditions) suitable for the work situation.

Question #: 39- Compared to local exhaust ventilation, dilution ventilation:

- 1) Is more suitable for highly toxic substances
- 2) Is not adequate for ventilating hazardous point source emissions**
- 3) Must be used as make-up air
- 4) Uses less air than local exhaust ventilation

Answer: 2- General dilution ventilation is not appropriate for point source emissions or for use with highly toxic materials. In these situations local exhaust ventilation should be used. Because of these limitations, short circuiting of exhaust is less critical than in local exhaust ventilation. The air from general ventilation may or may not be used for local exhaust ventilation make-up air, depending upon the type of local exhaust ventilation device.

Question #: 40- Dilution ventilation is:

- 1) Used to control a contaminant at its source
- 2) Used for controlling vapors with low toxicity**
- 3) More economical than local exhaust ventilation
- 4) Is the first consideration for hazard control

Answer: 2- Dilution ventilation lowers the concentration of a contaminant by adding air to the general work area. Since the air is added to the general work area it will not effectively control exposure to a toxic substance used in a specific location (point source).

Question #: 41- The Brief and Scala Model refers to:

- 1) Biologically-derived airborne contaminants
- 2) Unusual work schedules**
- 3) TLV's for mixtures
- 4) Skin notation

Answer: 2- The Brief and Scala Model refers to unusual work schedules. The model reduces the TLV proportionately for increased exposure time and reduced non-exposure time. It is generally intended to apply to work schedules longer than 8 hours/day or 40 hours/week.

Question #: 42- Immediate corrective measures should be taken when the atmospheric concentration of:

- 1) Carbon dioxide is less than 2.0%
- 2) Carbon dioxide is greater than 3.0%**
- 3) Carbon monoxide is less than 0.1%
- 4) Oxygen is greater than 18% but less than 20%

Answer: 2- Immediate corrective measures should be taken when the atmospheric concentration of carbon dioxide is greater than 3.0%.

Question #: 43- One of the key elements of a good fire prevention program in industry is:

- 1) A no smoking policy
- 2) A good housekeeping program**

3) A sprinkler system

4) Correct storage of flammables

Answer:2 -While all contribute to an effective program, a good housekeeping program can prevent many fires in the workplace. These practices maintain control over many common exposures that can lead to or contribute to the spread of fires.

Question #: 44- Overloading an electrical circuit is a known fire hazard. This hazard exists due to the heat produced by the overload situation that can be a source of ignition. Overloading a circuit is a greater hazard because:

1) The heat breaks down the electrical insulation which can lead to short circuits

2) The device connected to the circuit can fail due to a brown-out condition

3) The circuit breaker can fail

4) The heat from the circuit can ignite the insulation of the wire

Answer:1- Overloaded circuits, over time, will cause the insulation to fail, which can lead to short circuits and arcing. Arcing then becomes a significant ignition source.

Question #: 45- You are a safety professional in a large corporation with a high-rise corporate office building. The building is occupied totally by employees of your company except for a few service contractors and first floor space leased by store tenants. Life safety is one of your principle concerns. Strategies for evacuation that you may consider include all the following EXCEPT:

1) Relocating occupants

2) Constructing a vertical exit

3) Constructing a horizontal exit

4) Staging, or phasing, the evacuation

Answer:2- Relocation means to move people away from the fire floor, generally two floors up or down from the fire. A horizontal exit on the same floor is possible when fire walls, ceilings, and floors exist that allow people to evacuate through a fully protected enclosure before arriving at a stairwell. Staged evacuation can take several forms but essentially means to evacuate people in stages and to perhaps use a series of safe areas in the staging. There is no such term as a vertical exit.

Question #: 46- A command post established for managing a hazardous chemical spill should contain, at a minimum, all of the following EXCEPT:

1) Two radios

2) Spill clean-up equipment

3) Phone

4) Facility MSDS's

Answer:2- A command post is set up away from the spill area, therefore the spill cleanup equipment needs to be at the spill scene, not at the command post.

Question #: 47- How often should instruments used for emergency response be calibrated?

1) Quarterly

2) Annually

3) Monthly

4) Before and after each use

Answer:4- Emergency response instrumentation should be calibrated before and after each use.

Question #: 48- For a chemical to be required to be listed on an MSDS by the manufacturer, the chemical must meet all of the following criteria EXCEPT:

1) Be present in a concentration greater than 1%

2) Be listed as a hazardous material on selected lists

3) If a carcinogen, be present in a concentration greater than 0.1%

4) Have an LEL greater than 10%

Answer:4- There are a variety of criteria for determining if a material must be listed on the ingredient list of an MSDS. It must be listed on one of the identified lists as a hazardous material and must be present in some minimum quantity. The LEL is not one of the criteria.

Question #: 49- A survey was conducted to determine the causes of occupational dermatitis. Exposure to which of the following materials is the MOST probable cause of the occupational illness?

1) Petroleum products and greases

2) Solvents

3) Metals and metal plating

4) Rubber and its compounds

Answer:1- Petroleum products and greases (19%) was more than double that of solvents (8%), triple that of metals and metal plating (6%), and more than 5 times that of rubber and its compounds (3%).

Question #: 50- Workers in certain jobs are subjected to a greater risk of contacting occupational dermatitis. Which industry accounts for the highest percentage of cases?

1) Oil refining

2) Synthetic resin manufacturing

3) Automotive manufacture

4) Tanneries

Answer:2- The yearly prevalence of occupational dermatitis for the synthetic resin manufacturing industry (8%) was double its closest runner ups, tanneries (4%) and oil refining (3%). Of the 12 industries surveyed, the automobile manufacturing industry had the least number of cases (0.4%).

Question #: 51- The occupation most likely to encounter metal fume fever is:

1) Electroplater

2) Welder

3) Firefighter

4) Miner

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Answer:2- Metal fume fever is an acute condition of short duration caused by a brief high exposure to the freshly generated fumes of metals, such as zinc and magnesium or their oxides. Symptoms appear from four to twelve hours following exposure and consist of fever and shaking chills.

Question #: 52- Cumulative trauma disorders (CTD's) are rapidly becoming a major source of workers' compensation losses. The most prevalent form of CTD is:

- 1) Bursitis **2) Carpal tunnel syndrome** 3) Kaolinositis 4) Tendonitis

Answer:2- Carpal tunnel syndrome is a common disease of workers performing repeated exertions or movements of the fingers/hand and wrist which compress the median nerve in the carpal tunnel. It is often associated with tingling, pain or numbness in the thumb and first three fingers, frequently resulting in lost time and workers' compensation costs.

Question #: 53- Disorders that result from repeated exertions or movements of the body are most often described by which of the following terms?

- 1) Regional musculoskeletal disorders **2) Cumulative trauma disorders**
3) Occupational cervicobrachial disorders 4) Occasional trauma disorder

Answer:2- Disorders that are caused, precipitated, or aggravated by repeated exertion or movements of the body are most frequently called cumulative trauma disorders (CTD's). Other terms less commonly used include: repetitive trauma disorders, repetitive strain injuries, overuse syndromes, and regional musculoskeletal disorders.

Question #: 54- In conducting a safety and health audit at a plant owned by your company, you discover that an extremely hazardous solvent is being used which has a high probability of injury. What is your first course of action?

- 1) Stop the operation 2) Recommend that the solvent be substituted
3) Take air samples for analysis 4) Initiate actions to construct engineering controls

Answer:3- The first course of action is to take air samples for analysis. Then, you can determine whether further action is warranted.

Question #: 55- Which of the following is LEAST likely to involve problems with occupational dermatitis?

- 1) Leather tanning 2) Lumbering **3) Asbestos processing** 4) Farm labor

Answer:3- The incidence rates reported by OSHA indicate that occupational dermatitis occurs more frequently in leather tanning > farm labor > forest services > asbestos processing.

Question #: 56- What is the most **effective component** in a fire prevention program for welding or cutting?

- 1) Inspection of the welding apparatus 2) Upright storage of acetylene cylinders
3) Board-certified welders **4) Cutting and welding hot-work permit system**

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Answer:4- A permit system which allows safety professionals to preview all cutting and welding work is very successful in eliminating fires.

Question #: 57- "Design for building fire safety" represents a systematic approach to the six principal types of fire safety strategies. Three of these are prevention, slowing of initial growth and spread, and detection. Of the following, which is NOT one of the other three strategies?

- 1) Alarming 2) Suppression 3) Compartmentalization 4) Evacuation

Answer:1- Alarming is not a specific major strategy as defined by the National Fire Protection Association.

Question #: 58- In fire safe designs, the acceptable levels of risk and the focus of fire safety analysis and design process is concentrated in three areas. The three areas are in the list below. Which is NOT one of the three principle areas of study, analysis, and design?

- 1) Life safety 2) Contents protection 3) Property protection 4) Continuity of building operations

Answer:2- All but contents protection are major areas of concern and study in fire safety design.

Question #: 59- All of the following practices can affect the success of fire prevention EXCEPT:

- 1) Housekeeping 2) Security 3) Education of occupants 4) Exposure

Answer:4- Exposure is a factor affecting bringing heat and ignitable material together.

Question #: 60- If the concentration of flammable gases in a work environment is high enough to be a fire hazard, which of the following hazards also probably exists?

- 1) A product liability exposure 2) An environmental hazard
3) A health hazard 4) A chemical contamination hazard

Answer:3- Generally, if a fire or explosion hazard is created by a concentration of gas, that concentration exceeds the safe levels of human exposure as well.

Question #: 61- Anticipating and controlling hazards are best accomplished:

- 1) Twenty-four hours following a workplace inspection
2) Any time before a pilot process is closed to production
3) During all design stages of an activity
4) After an accident has occurred

Answer:3- Anticipating and controlling hazards at the design stages of an activity is the cornerstone of a safety program. The ultimate goal for any safety program is to design environments, equipment, and job procedures so that employee exposures to injuries will be either eliminated or controlled as completely as possible.

Question #: 62- Arrange the following hazard control steps into the proper sequence:

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A. guard the hazard B. engineer the hazard out if possible C. educate personnel

1) B, A, C 2) C, A, B 3) A, B, C 4) C, B, A

Answer:1- The proper sequence in hazard control is to engineer out, guard, and educate (B, A, C).

Question #: 63- In general, personal protective equipment tends to _____ worker efficiency and _____ personal injury.

1) Increase, Increase **2) Decrease, Decrease**
3) Increase, Decrease 4) Decrease, Increase

Answer:2- Personal protective equipment will decrease the injuries/illnesses incurred by the workers but their efficiencies will probably also decrease due to sensory impairment and restricted motion.

Question #: 64- Which of these circumstances would you expect to have the HIGHEST likelihood of producing a severe injury?

1) Routine, planned work 2) Production work
3) Low energy sources **4) Non-routine work**

Answer:4- Most accidents resulting in severe injuries occur in non-routine work, non-production work, high energy work, or construction.

Question #: 65- The total value estimated to be at risk as a result of a particular hazard being evaluated is called:

1) Loss exposure **2) Total risk exposure** 3) Risk unit 4) Loss expected

Answer:2- Total risk exposure is the total number of dollars estimated to be at risk as a result of a particular hazard being evaluated.

Question #: 66- Hot working of metals refers to:

1) Power presses **2) Foundries** 3) Shears 4) Punches

Answer:2-The term "hot working" refers to foundry operations where metals are heated to their melting points and are then poured.

Question #: 67- The most common accident in an office setting is:

- 1) **Falling** 2) VDT over-exposure 3) Paper cuts 4) Alcoholism

Answer:1- Falling is the primary accident type in office settings.

Question #: 68- Experience has indicated that the most effective way to reduce accidents is:

- 1) Training employees to be more safety conscious
- 2) Behavior modification
- 3) **Designing safety features into systems**
- 4) Job rotation

Answer:3- Hazards can be more effectively reduced or eliminated through system design, whereas hazard reduction through changing human behavior is limited and requires continuous reinforcement.

Question #: 69- In assessing risk, one of the analytical techniques used by systems safety is called hazard risk. It is:

- 1) A means used to identify and measure the hazard
- 2) A way to measure potential hazard conditions in the operational phase
- 3) A method for calculating the effect of a hazard if allowed to become an accident
- 4) **The product of hazard severity and hazard possibility of occurrence**

Answer:4- Risk assessment techniques use mainly system-oriented inductive and deductive analyses. The system safety analytical technique called hazard risk is the product of hazard severity and hazard possibility of occurrence (frequency).

Question #: 70- A procedure to make a job safer by identifying hazards in each step of the job and developing measures to counteract those hazards is a:

- 1) Time and motion analysis
- 2) Fault tree analysis
- 3) **Job safety analysis**
- 4) Probabilistic risk assessment

Answer:3- A job safety analysis examines job hazards during each step of the job.

Question #: 71- What is a JSA?

- 1) **A procedure of reviewing methods, hazards, and safety**
- 2) A type of job description
- 3) A private company well-recognized by safety practitioners
- 4) Joint safety authority

Answer:1- A job safety analysis is a written procedure for reviewing job methods, uncovering hazards, and recommending safe procedures.

Question #: 72- Which of these is an essential step in performing a JSA?

- 1) Break the job down into discreet steps
- 2) Formally identify the hazards in each discreet step
- 3) Compare the job to others
- 4) Both 1 and 2

Answer:4- The actual steps in a JSA are to identify the job, break the job down into steps, identify hazards, and determine how to control the hazards.

Question #: 73- You have conducted a JSA in the patient-accessible areas of a major hospital. Which of the following occupational hazards was a major concern?

- 1) Welding machine
- 2) Hot slag
- 3) Radionuclides
- 4) Inert environments

Answer:3- Knowing that the JSA was at a hospital, the most commonly found hazard from this list was probably radionuclides used for radiation therapy and research.

Question #: 74- The concentration of flammable vapors in a confined space should be less than _____ upon entry.

- 1) 0.1% of LEL
- 2) 1% of LEL
- 3) 10% of LEL
- 4) 100% of LEL

Answer:3- The acceptable entry concentration of flammable vapor should be less than 10% of the Lower Explosive Limit (LEL).

Question #: 75- Hazardous locations are areas where flammable liquids, gases, vapors, combustible dusts, or other easily ignitable materials exist in sufficient quantities to produce an explosion or fire. Hazardous locations are classified as Class I, Class II, or Class III. Which one of the following statements is NOT true?

- 1) Class I locations are those in which flammable vapors and gases may be present
- 2) Class II locations are those in which combustible liquids may be found
- 3) Class III locations are those in which there are ignitable fibers or flyings
- 4) Class I and Class II locations are subdivided into groups of gases, vapors, and dusts having similar properties

Answer:2- Class II locations are those in which combustible dust may be found.

Question #: 76- In 1981, President Reagan issued a broad directive that required all new governmental regulations to include:

- 1) Cost benefit analyses
- 2) Environmental impact statements
- 3) Assurances that increased taxes will not be required
- 4) Spending cuts comparable to the implementation costs

Answer:1- The Reagan administration mandated cost benefit analyses for all new regulations. Executive Order 12291 has resulted in agencies of the federal government conducting

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quantitative risk assessments to determine the benefits (lives saved). This is then compared to costs for various control strategies and the resulting levels of protection.

Question #: 77- Which of the following is an example of a program sponsored by an Employee Assistance Program?

- 1) Smoking cessation
- 2) Occupational counseling
- 3) Substance abuse counseling
- 4) All of the above**

Answer:4- Employee Assistance Programs (EAPs) have gained popularity as a management system to retain good employees by assisting them with their personal problems that cause occupational problems. For example, in many cases an employee with an alcohol or other substance abuse problem can enroll in the appropriate EAP program for treatment without the risk of termination provided that the employee meets all of the requirements of the program.

Question #: 78- As the facility safety professional, you have become acquainted with two line employees that want to learn more about occupational safety in their own work environments beyond what is typically provided to them in their standard training courses. Which of the following is the best way to encourage their continued interest in safety?

- 1) Work with the employees and their supervisors to develop mutually agreeable written individual development plans outlining new training goals and safety-related responsibilities.**
- 2) Work with their supervisors to send them to advanced occupational safety training.
- 3) Work with the employees and their supervisors to permit them to accompany you for a week.
- 4) Work with their supervisors to assign these employees as safety coordinators in their respective operations.

Answer:1- Individual development plans (IDPs) are agreements between employees and their managers to help increase the employees' satisfaction with their jobs. IDPs should include measurable performance goals for attending training, demonstrating new skills, and achieving more diverse job responsibilities.

Question #: 79- A worker's muscles act on an angle of 45° with respect to the direction of motion. The horizontal force necessary to start moving the item is 256 N and is measured standing in front of the item to be moved. What is the actual muscle force needed to start moving the item?

- 1) 181 N
- 2) 256 N
- 3) 362 N**
- 4) 551 N

Answer:3- Using the cosine trigonometric identity and vector mechanics:

Cosine of Angle = Adjacent Component / Hypotenuse Resultant

$\cos 45^\circ = 256 \text{ N} / \text{Hypotenuse Resultant}$

Hypotenuse Resultant = $256 \text{ N} / \cos 45^\circ$

= $256 \text{ N} / 0.7071 = 362 \text{ N}$

CSP Questions and Answers- Part- I

Question #: 80- A 12 ft long beam is supported at each end. If a 3,000 lb load is placed in the middle of the beam, what is the reaction experienced by each support (neglect the weight of the beam)?

- 1) 750 lb **2) 1,500 lb** 3) 3,000 lb 4) 6,000 lb

Answer:2- Use $R_L = R_R = P/2$, where R_L and R_R are the reactions on the left and right, respectively. This formula is for a uniformly distributed load.
 $3,000 \text{ lb} / 2 = 1,500 \text{ lb}$

Question #: 81- A 10 ft beam is supported at both ends. If a 200 lb load is placed 2 ft from one end, what reaction is experienced at the more distant support (neglect the weight of the beam)?

- 1) 40 lb** 2) 100 lb 3) 160 lb 4) 200 lb

Answer:1- Use the formula for a concentrated load at any point along a beam:
 $R_L = P_b / L$, where R_L = the reaction left, P = the force in pounds, b = the distance in feet from the reaction point and L is the length of the beam. **$R_R = (200 \text{ lb} * 2 \text{ ft}) / 10 \text{ ft} = 40 \text{ lb}$**

Question #: 82- An 18 ft beam is supported at both ends, and due to heavy winds, is subject to a continuous, uniform 200 lb/ft load. Neglecting gravity (i.e., the weight of the beam), what are the reactions experienced by each support?

- 1) 200 lb 2) 400 lb **3) 1,800 lb** 4) 3,600 lb

Answer:3
Use the formula for uniform load reactions: $R_L = R_R = (w * l)/2$
 $R_L = R_R = (200 \text{ lb/ft} * 18 \text{ ft}) / 2 = 1,800 \text{ lb at each support}$

Question #: 83- A 10 ft beam is supported at both ends. If a 200 lb concentrated load is placed 2 ft from one end, what force is supported at the closer support (neglect the weight of the beam)?

- 1) 40 lb 2) 100 lb **3) 160 lb** 4) 200 lb

Answer:3- Use the formula for concentrated loads at any point on a beam: $R_L = P_b/l$
 $R_R = (200 \text{ lb} * 8 \text{ ft}) / 10 \text{ ft} = 160 \text{ lb}$

Question #: 84- A 10 ft beam is supported at each end. If a 3,000 lb load is placed in the middle of the beam, what is the bending moment at each support?

- 1) 1,500 ft-lb 2) 3,000 ft-lb **3) 7,500 ft-lb** 4) 30,000 ft-lb

Answer:3- Use the formula for maximum bending moment for a concentrated load at the center of a beam:
 $M = (P * l) / 4$ $M = (3,000 \text{ lb} * 10 \text{ ft}) / 4 = 7,500 \text{ ft-lb}$

Question #: 85- A 12 ft beam is supported at both ends. If a 400 lb load is placed 3 ft from one end, what is the bending moment around each of the supports (neglecting the weight of the beam)?

CSP Questions and Answers- Part- I

- 1) 33.3 ft-lb 2) 400 ft-lb **3) 900 ft-lb** 4) 4,800 ft-lb

Answer:3- Use the formula for calculating the maximum bending moment for a concentrated load at any point along a beam:

$$M = (P * a * b) / l \qquad M = (400 \text{ lb} * 3 \text{ ft} * 9 \text{ ft}) / 12 \text{ ft} = 900 \text{ ft-lb}$$

Question #: 86- An 18 ft beam is supported at both ends and due to heavy winds is subject to a continuous, uniform 200 lb/ft load. What is the bending moment at each support (neglecting the weight of the beam)?

- 1) 200 ft-lb 2) 1,800 ft-lb **3) 8,100 ft-lb** 4) 16,200 ft-lb

Answer:3- Use the formula for calculation the maximum bending moment for a simple beam supporting a uniform load:

$$M = (w * l^2) / 8 \qquad M = [200 \text{ lb/ft} (18 \text{ ft})^2] / 8 \qquad M = 8,100 \text{ ft-lb}$$

Question #: 87- What is the moment of inertia with respect to its base, of a rectangular beam section 6 in. wide and 8 in. high?

- 1) 0.049 ft4** 2) 0.148 ft4 3) 21.33 ft4 4) 256 ft4

Answer:1- Use the formula for calculating the moment of inertia for a rectangular beam section:

$$I = (bh^3) / 3 \qquad I = [6 \text{ in}(8 \text{ in})^3] / 3 = 1024 \text{ in}^4 \qquad I = 1024 \text{ in}^4 / (12 \text{ in/ft})^4 \\ I = 1024 \text{ in}^4 / (20,736 \text{ in}^4/\text{ft}^4) \qquad I = 0.049 \text{ ft}^4$$

Question #: 88- What is the moment of inertia of a circular section with a radius of 3 in.?

- 1) 12.1 in4 2) 28.4 in4 **3) 63.6 in4** 4) 78.8 in4

Answer:3- Use the formula for calculating the moment of inertia for a cylindrical beam section: diameter = radius * 2 = 6 in.

$$I = p d^4 / 64 \\ I = [p(6 \text{ in})^4] / 64 = 63.6 \text{ in}^4$$

Question #: 89- What is the moment of inertia of a hollow circular section with an outside diameter of 6 in. and an inside diameter of 3 in.?

- 1) 12.1 in4 2) 37.7 in4 3) 42.8 in4 **4) 59.6 in4**

Answer:4- Use the formula for calculating the moment of inertia for a hollow cylindrical beam section:

$$I = p (d_o^4 - d_i^4) / 64 \\ I = p [(6 \text{ in})^4 - (3 \text{ in})^4] / 64 = 59.6 \text{ in}^4$$

Question #: 90- If an 8 ft beam is supported in the middle on a fulcrum and a 50 lb load is applied at one end. Neglecting the weight of the beam, what magnitude of load must be placed 2 ft from the fulcrum on the opposite side to balance the load?

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- 1) 25 lb 2) 50 lb **3) 100 lb** 4) 150 lb

Answer:3- Use the mechanics formula for calculating forces and distances of fulcrums:

$$F_1D_1 = F_2D_2 \quad 50 \text{ lb} * 4 \text{ ft} = F_2 * 2 \text{ ft} \quad F_2 = 100 \text{ lb}$$

Question #: 91- If a fulcrum is placed 3 ft from one end of 10 ft beam and a 100 lb load is applied to the shorter end, what size force must be applied to the opposite end to start to raise the load (neglect the weight of the beam)?

- 1) 5 lb **2) 43 lb** 3) 50 lb 4) 234 lb

Answer:2- Use the mechanics formula for calculating forces and distances of fulcrums.

$$F_1D_1 = F_2D_2 \quad 100 \text{ lb} * 3 \text{ ft} = F_2 * 7 \text{ ft} \quad F_2 = 43 \text{ lb}$$

Question #: 92- A 3/4in manila rope has a safety factor of 5 and a tensile strength of 1,000 lb. What is the maximum safe working load?

- 1) 100 lb 2) 200 lb 3) 750 lb 4) 1,000 lb

Answer:2- To determine safe working load, divide the tensile strength by the safety factor.
 $1,000 \text{ lb} / 5 = 200 \text{ lb}$

Question #: 93- What device is used to measure traction on walking surfaces?

- 1) Friction-meter **2) Slip-meter** 3) Drag-meter 4) Shoe-sole meter

Answer:2- A slip-meter is used to make these measurements.

Question #: 94- What does a "bird cage" in a wire rope usually signify?

- 1) Repeated bending over sheaves
2) Jumping a sheave
3) Fatigue
4) Sudden release of tension and rebound

Answer:4- A "bird cage" signifies that the wire rope was subjected to a sudden release of tension.

Question #: 95- The definition of the tensile strength of an object or of a material is:

- 1) The compressive force that distorts it from its original shape
2) The breaking strength when exposed to a stretching force

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- 3) 1/4 of the sheer strength
- 4) The sheer strength cubed

Answer:2- The tensile strength is the same as the breaking strength of a material when exposed to a stretching force.

Question #: 96- A man is standing on an elevated scaffold measuring 18 ft from the top of the scaffold to the floor. The wheels of the scaffold are locked. The scaffold is 6 ft wide at the base. The height from the ceiling of the building to the floor is 24 ft. The man weighs 200 lbs. The scaffold weighs 400 lbs. The man is pushing on a bar joist at the roof to move the scaffold. What force did the man exert to upset the scaffold?

- 1) 50 lbs.
- 2) 75 lbs.**
- 3) 100 lbs.
- 4) 150 lbs.

Answer:2- Sketch the problem.-- The scaffold will be upset at the point when the moment resulting from the man pushing on the joist is equal to the moment resulting from the weight of the scaffold plus the weight of the man. Assume the man is standing in the center of the scaffold platform. The total force that will be required to overturn the scaffold is equal to the 400 pounds of the scaffold plus the 200 pounds of the man multiplied by the 3 foot distance that the combined load center is from the edge of the bottom of the scaffold. (Moment = Force * Distance)

The man is pushing against the bar joist a total distance of 24 feet from the point of contact between the scaffold and the floor. Therefore, the force that the man must exert to upset the scaffold is equivalent to the Moment divided by the Distance.

The resultant equation is $F1D1 = F2D2$.

F1 equals the force of the man pushing

D1 equals the distance to the floor

F2 equals the weight of the scaffold plus the weight of the man

D2 equals the distance from the center of the scaffold to the edge

$$(F1)(24) = (600)(3)$$

$$F1 = 1800/24$$

$$F1 = 75 \text{ lbs}$$

Question #: 97- How long is a single stay wire of a smoke stack if, at a distance of 80 ft from the base, the stay wire makes an angle of 65° with the ground? How high is the smoke stack?

- 1) 88 ft stay wire, 37 ft high smoke stack
- 2) 37 ft stay wire, 88 ft high smoke stack
- 3) 169 ft stay wire, 149 ft high smoke stack
- 4) 189 ft stay wire, 172 ft high smoke stack**

Answer:4- Length of stay wire - Using the cosine trigonometric identity:

Cosine of angle = Adjacent Side Leg / Hypotenuse Side Leg

$$\cos 65^\circ = 80 \text{ ft} / \text{Hypotenuse Side Leg}$$

$$0.4226 = 80 \text{ ft} / \text{Hypotenuse Side Leg}$$

$$\text{Hypotenuse Leg} = 189.3 \text{ ft} = \text{stay wire length}$$

Height of smokestack - Using the Pythagorean Theorem:

$$\text{Horizontal Side Leg} = a = 80 \text{ ft}$$

Vertical Side Leg = b = height of smoke stack

Hypotenuse Side Leg = c = 189.3 ft

$$a^2 + b^2 = c^2$$

$$(80 \text{ ft})^2 + b^2 = (189.3 \text{ ft})^2$$

b = 171.6 ft = height of smoke stack

Question #: 98- The boom indicator on a mobile crane:

- 1) Provides the angle of the boom
- 2) Shows the safe load with the boom at any angle
- 3) Indicates load capacity
- 4) Signals when the crane is out of balance

Answer:1- A boom indicator is a device that shows the angle of the boom. The boom angle is used in conjunction with the crane load chart to determine safe loads. Modern load measuring systems for cranes allow for real-time direct reading of actual crane load and can provide output warnings indicating that the rated capacity is approaching. Such devices can even be integrated with the crane controls to stop the crane operation.

Question #: 99- When using u-bolt drop forged steel wire rope clips to make an eye in a 1 in. improved plow steel wire rope, you should use:

TABLE H - 2. -- NUMBER AND SPACING OF

U-BOLT WIRE ROPE CLIPS

Improved plow steel, rope diameter (inches)	Number of clips		Minimum spacing (inches)
	Drop	Other	

[illegible]

4) The strength of the magnetic field

Answer:4- The electromagnetic force (emf) induced in a wire depends on three things:

- a) The length of wire cutting the magnetic field
- b) The strength of the magnetic field being cut
- c) The speed with which the field is being cut at right angles.

Question #: 102- Electronic circuits designed to produce high-frequency alternating currents are usually known as:

- 1) Rectifiers **2) Oscillators** 3) Amplifiers 4) Diodes

Answer:2- Oscillators capable of producing high-frequency alternating current may include crystals capable of producing particular frequencies or they may involve electronic components, like capacitors and inductors, capable of being tuned to varying frequencies.

Question #: 103- Heat energy is converted directly into electrical energy by which of the following:

- 1) A photoelectric cell **2) A thermocouple**
3) A piezoelectrical crystal 4) A calorimeter

Answer:2- Thermocouples usually consist of connections between wires of two dissimilar metals. They are frequently calibrated so that the amount of voltage produced can be directly related to the temperature and the capability of measuring it.

Question #: 104- The resistance of a length of copper wire $\frac{3}{32}$ in. in diameter is 1.5 W. What is the resistance of a copper wire of the same length with a diameter of $\frac{3}{16}$ in.?

- 1) **0.375 W** 2) 0.750 W 3) 3.000 W 4) 6.000 W

Answer:1- The applicable formula is: $r(\text{resistance}) = p(\text{resistivity}) [l(\text{length})/a(\text{area})]$

As the wire resistivity and the length are constant, they cancel out, along with the term $p/4$ from calculating for the area of a circle.

Resulting is the following relationship: $1.5 \text{ W } (\frac{3}{32} \text{ in.})^2 = R (\frac{3}{16} \text{ in.})^2$

$$R = 1.5W/4 = 0.375 \text{ W}$$

Question #: 105- What is the resistance of a single phase motor rated at 2.2 A and 115 V?

- 1) 253.0 W **2) 52.3 W** 3) 25.8 W 4) 0.02 W

Answer:2- By applying Ohm's law, we obtain $E = IR$ or $R = E/I$

$$R = 115 \text{ V}/2.2 \text{ A} \quad R = 52.3 \text{ W}$$

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Question #: 106- If the voltage in a DC circuit is 120 V and the resistance is 10 W, what is the current?

- 1) 0.01 A 2) 10 A **3) 12 A** 4) 1,200 A

Answer:3- Utilizing Ohm's Law ($V = IR$) and solving for I: $I = V/R$ $I = 120 \text{ V}/10 \text{ W}$ $I = 12 \text{ A}$

Question #: 107- The correct formula to determine the total resistance of a group of resistors in series is:

- 1) $R_T = R_1 + R_2 + \dots R_N$ 2) $1/R_T = 1/R_1 + 1/R_2 + \dots 1/R_N$
3) $R_T = R(N-1)/N$ 4) $R_T = R_1 R_2 \dots R_N$

Answer:1- The series formula involves simply a summation of all involved resistances in the circuit. Answer 2 is the formula for parallel resistors.

Question #: 108- What is the general formula for Ohm's Law?

- 1) $E = mc^2$ **2) $E = IR$** 3) $c = \text{wavelength} * \text{frequency}$ 4) $E = h * \text{frequency}$

Answer:2- Ohm's Law relates the current in an ohmic resistor to the voltage and resistance. In physics the abbreviation for voltage is V, amperes is A, and resistance is W. "E" represents a source of electromotive force (voltage), "I" represents current, and "R" represents resistance.

Question #: 109- A simple series circuit consists of five resistors: 5 W, 10 W, 15 W, 5 W and 25 W. What is the total circuit resistance?

- 1) 0.407 W 2) 2.46 W **3) 60 W** 4) 18,750 W

Answer:3-In a series circuit: $R = R_1 + R_2 + R_3 + \dots R_N$
 $R = 5 \text{ W} + 10 \text{ W} + 15 \text{ W} + 5 \text{ W} + 25 \text{ W}$ $R = 60 \text{ W}$

Question #: 110- What is the power rating of an electric motor which draws a current of 3 A at 40W?

- 1) 53.3 W 2) 120 W **3) 360 W** 4) 4,800 W

Answer:3- Use the formula: $P = I^2 R$, $P = (3 \text{ A})^2 40 \text{ W}$, $P = 360 \text{ W}$

Question #: 111- A charge of 30 coulombs is sent through a resistor with a 120 V potential. What is the power?

- 1) 40 W **2) 3,600 W** 3) 108,000 W 4) 432,000 W

Answer:2- 1 coulomb = 1 ampere, $P = E * I$, $P = 120 \text{ V} * 30 \text{ A}$, $P = 3,600 \text{ W}$

Question #: 112- Determine the power of a hoist motor that is required to lift a load of 200 lb to a height of 55 ft in 10 sec.

- 1) 2.75 W 2) 200 W 3) 1,100 W **4) 1,492 W**

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Answer:4- Power = (force * distance) / time, = (200 lb * 55 ft) / 10 sec, = 1,100 ft-lb/sec
1 hp = 550 ft-lb/sec , 1 hp = 746 W, 1,100 ft-lb/sec = 2 hp = 1,492 W

Question #: 113- A motor is rated at 1.5 A at 115 V. What is the resistance of the motor at its maximum duty?

- 1) 0.013 W 2) **77 W** 3) 173 W 4) 259 W

Answer:2- Use Ohm's Law: $E = I * R$, $115 \text{ V} = 1.5 \text{ A} * R$, $R = 76.7 \text{ W}$

Question #: 114- How much current is flowing through a 110 V electric circuit having a resistance of 40 W?

- 1) 0.367 A 2) **2.75 A** 3) 150 A 4) 4,400 A

Answer:2- $E = I * R$, $I = 110 \text{ V} / 40 \text{ W}$, $I = 2.75 \text{ A}$

Question #: 115- What is the resistance of a 10 m length of 0.5 mm diameter nickel wire? (resistivity of nickel = $6.93 \times 10^{-8} \text{ ohm-m}$)

- 1) 0.693 W 2) 0.875 W 3) **3.54 W** 4) 6.93 W

Answer:3- Use the formula for calculating total resistance: $R = rL/A$, where R = resistance, r = resistivity, L is length in meters, and A is the cross-sectional area of the conductor.

$$R = (6.93 \times 10^{-8} * 10 \text{ m}) / [\pi (2.5 \times 10^{-4} \text{ m})^2]$$

$$R = (6.93 \times 10^{-7}) / (19.6 \times 10^{-8})$$

$$R = 3.54 \text{ W}$$

Question #: 116- A 10 m copper wire with a diameter of 0.5 mm is connected across a 110 V power line. What current flows through the wire? Resistivity of copper = 1.58×10^{-8}

- 1) 3.2 A 2) 5.4 A 3) **136 A** 4) 408 A

Answer:3- First calculate the resistance of the conductor using the formula for calculating resistance:

$R = rL/A$, where R = total resistance, r = resistivity, L = length in meters, and A = the cross sectional area of the conductor.

$$R = (1.58 \times 10^{-8}) (10 \text{ m}) / [\pi (0.25 \times 10^{-4} \text{ m})^2] \quad R = 0.806 \text{ W}$$

Then use Ohm's law: $V = I / R$, $I = 110 \text{ V} / 0.806 \text{ W}$, $I = 136 \text{ A}$

Question #: 117- A 2 hp, 110 V electric motor draws how much current?

- 1) **13.6 A** 2) 55.0 A 3) 91.1 A 4) 103 A

Answer:1- Convert hp to W:, $2 \text{ hp} = 1,492 \text{ W}$, $P = E / I$, $I = 1,492 \text{ W} / 110 \text{ V} = 13.6 \text{ A}$

Question #: 118- A 5 hp, 220 V electric motor draws how much current?

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- 1) 4.24 A 2) 8.78 A 3) 11.5 A **4) 17.0 A**

Answer:4- Convert 5 hp to W. $5 \text{ hp} = 746 \text{ W/hp} \times 5 \text{ hp} = 3,730 \text{ W}$
 $P = E / I$ $I = 3,730 \text{ W} / 220 \text{ V} = 16.95 \text{ A}$

Question #: 119- What is the WBGT given a wet bulb temperature of 75°F and a globe temperature of 89°F (no solar load)?

- 1) 85°F 2) 92°F 3) 78.5°F **4) 79.2°F**

Answer:4- $WBGT = 0.7 \text{ WB} + 0.3 \text{ GT} = (0.7 \times 75^\circ\text{F}) + (0.3 \times 89^\circ\text{F}) = 79.2^\circ\text{F}$
where WB = natural wet bulb temperature obtained with wetted sensor exposed to natural air movement. GT is the globe temperature taken from the center of a 6 in. diameter hollow copper sphere painted on the outside with black matte finish (called a globe thermometer).

Question #: 120- Six workers are exposed to methylene chloride at the following levels (based on an 8-hr TWA): 27 ppm, 31 ppm, 12 ppm, 86 ppm, 27 ppm and 40 ppm. What is their statistical median exposure?

- 1) 37 ppm 2) 31 ppm 3) 27 ppm **4) 29 ppm**

Answer:4- Placing in order: 86 40 **31 27** 27 12
The median number in a set is the middle number, if the number (n) in the set is an odd number. When there are an even number of values in a sequence, the median is found by taking the average of the 2 "middle" numbers, in this case: $(31 \text{ ppm} + 27 \text{ ppm}) / 2 = 29 \text{ ppm}$

Question #: 121- An employee's exposure to a mixture of solvents is found to be 20 ppm to solvent A, 10 ppm to solvent B, and 14 ppm to solvent C. If the toxic effects of these solvents are additive, and their TLV's are 100 ppm, 50 ppm, and 100 ppm respectively, what is the employee's exposure as a percent of the TLV?

- 1) 44% **2) 54%** 3) 64% 4) 74%

Answer:2- To get the total exposure determine the percentage of the TLV of each substance the employee is exposed to and add them together or:

$\text{Exposure} = (20 \text{ ppm}/100 \text{ ppm}) + (10 \text{ ppm}/50 \text{ ppm}) + (14 \text{ ppm}/100 \text{ ppm}) = 20\% + 20\% + 14\% = 54\%$

Question #: 122- Calculate a worker's daily 8 hr TWA exposure to a solvent with a TLV of 100 ppm if she spends 1 hr at an operation where the concentration is 250 ppm, 4 hr at 200 ppm, and 3 hr at 100 ppm.

- 1) 69 ppm 2) 135 ppm **3) 169 ppm** 4) 1,350 ppm

Answer:3- $\text{TWA} = [(1 \text{ hr} \times 250 \text{ ppm}) + (4 \text{ hr} \times 200 \text{ ppm}) + (3 \text{ hr} \times 100 \text{ ppm})] / (1 \text{ hr} + 4 \text{ hr} + 3 \text{ hr})$

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= 169 ppm

Question #: 123- Compute the TWA concentration from the following data taken during the day shift of a worker.

- 6:00 am - 9:00 am ... 100 ppm
- 9:00 am - 11:00 am ...200 ppm
- 11:00 am - 12:00 pm 0 ppm
- 12:00 pm - 2:00 pm ...100 ppm

1) 105 ppm 2) 109 ppm 3) 111 ppm **4) 113 ppm**

Answer:4- $TWA = (C_1T_1 + C_2T_2 + C_3T_3 + C_4T_4)/(T_1+T_2+T_3+T_4)$
where C1=concentration during T1 , T1=Time at concentration C1
C2=Concentration during T2, T2=Time at concentration C2, etc...

$TWA = [(100 \text{ ppm} * 3 \text{ hr}) + (200 \text{ ppm} * 2 \text{ hr}) + (0 \text{ ppm} * 1 \text{ hr}) + (100 \text{ ppm} * 2 \text{ hr})] / (3 \text{ hr} + 2 \text{ hr} + 1 \text{ hr} + 2 \text{ hr}) = 112.5 \text{ ppm}$

Question #: 124- NIOSH has established accuracy requirements for detector tubes requiring that at one half of the exposure limit the tube will be +/- _____ % and +/- _____ % at one to five times the exposure limit.

1) 25, 35 **2) 35, 25** 3) 10, 25 4) 25, 25

Answer:2- The NIOSH criteria for detector tubes is that they be accurate to +/- 35% at one half the exposure limit and +/- 25% at one to five times the exposure limit.

Question #: 125- Some materials are not collected well on charcoal sorbent tubes. Polar molecules tend to be collected better on:

- 1) Coconut charcoal tubes 2) PVC
3) Silica gel tubes 4) Both 2 and 3

Answer:3- Silica gel tubes collect polar materials better than charcoal tubes. Materials such as methanol and most amines are collected much better on silica gel. One reminder, water is polar and can be collected in large quantities and may interfere.

Question #: 126- The TLV's for gases and vapors are estimated on what basis?

- 1) Weight to weight **2) Volume to volume**
3) Volume to weight 4) Weight to specific density

Answer:2- The unit "ppm" means parts of contaminant per million parts of air (for gases and vapors). This is a volume to volume measurement.

Question #: 127- The chemical component of the smoke tubes used in most ventilation studies is:

- | | |
|-----------------------|----------------------------------|
| 1) Vanadium pentoxide | 2) Titanium tetrachloride |
| 3) Ammonium chloride | 4) Dioctylphthalate |

Answer:2-Titanium tetrachloride decomposes in moist air to form titanium dioxide and hydrochloric acid. The titanium dioxide is white.

Question #: 128- The preferred method of sampling for benzene is:

- | | |
|------------------------------|---|
| 1) Fritted bubbler with NaOH | 2) Activated charcoal tube |
| 3) Portable LIRA | 4) Midget impinger with H ₂ O ₂ |

Answer:2- Other methods have been recommended but the OSHA method is activated charcoal.

Question #: 129- To determine an employee's exposure to noise, all noise from ____ dB to 130 dB is accumulated.

- | | | | |
|----------------|----------|----------|----------|
| 1)80 dB | 2) 85 dB | 3) 90 dB | 4) 95 dB |
|----------------|----------|----------|----------|

Answer:1- All continuous, intermittent, and impulse sound shall be integrated into the noise measurement beginning at 80 dB and continuing to 130 dB. 29 CFR 1910.95 (d)(2)(i)

Question #: 130- What agent is generally used to desorb a sample from an activated carbon tube?

- | | | | |
|---------------|----------------------------|------------|----------------------|
| 1) Chloroform | 2) Carbon disulfide | 3) Toluene | 4) Methyl chloroform |
|---------------|----------------------------|------------|----------------------|

Answer:2- The most common desorbent is carbon disulfide.

Question #: 131- What instrument would be used to check for a refrigerant?

- | | |
|-------------------------------|------------------------|
| 1) DU flame spectrophotometer | 2) Halide meter |
| 3) Combustible gas indicator | 4) Gas chromatograph |

Answer:2- Refrigerants are mainly halogenated hydrocarbons, therefore, the Halide meter is the best instrument.

Question #: 132- What is the OSHA method for sampling for trichloroethylene?

- | | |
|---|---------------------------|
| 1) 100 liters on silica gel | 2) 10 liters on hopcalite |
| 3) 10 liters on activated charcoal | 4) 10 liter mylar bag |

Answer:3- Trichloroethylene, as is true for many organic solvents, is collected on a charcoal tube with a recommended sample size of 10 liters.

Question #: 133- What is the best adsorbent for most organic vapors that have boiling points above 0°C?

- | | | | |
|--------------------|-------------|-----------|-----------|
| 1) Charcoal | 2) Impinger | 3) Filter | 4) Silica |
|--------------------|-------------|-----------|-----------|

CSP Questions and Answers- Part- I

Answer: 1- The non-polar characteristic of charcoal allows for the adsorbance of organic vapors in preference to atmospheric moisture.

Question #: 134- What is the first thing to do when a water sample comes into a lab?

- 1) Refrigerate the sample
- 2) Take the pH of the sample
- 3) **Log in and assure chain of custody of the sample**
- 4) Analyze the sample

Answer: 3- Log in the sample. Good laboratory procedures dictate that the sample be immediately logged in as soon as possible after arriving at the lab.

Question #: 135- What is the major factor in determining the required sample volume?

- 1) **Analytical sensitivity**
- 2) Flow rate
- 3) Type of contaminant
- 4) Type of air mover

Answer: 1- The analytical sensitivity is the determining factor when calculating the required sample volume.

Question #: 136- What is the primary OSHA method for sampling for carbon monoxide?

- 1) Hopcalite direct reading meter
- 2) Gas detection tube
- 3) **Ecolyzer**
- 4) Activated charcoal tube

Answer: 3- The Ecolyzer is the recommended method for sampling for carbon monoxide. It is also recommended that detector tubes be used throughout the day to sample from the worker's breathing zone.

Question #: 137- What is the secondary (NIOSH) method for field carbon monoxide determination?

- 1) Hopcalite catalytic combustion
- 2) **Detector tubes**
- 3) Gas chromatography
- 4) Infrared absorption spectrometry

Answer: 2- Detector tubes that meet the standards of quality in the detector tube certification program are the preferred secondary method of sampling for carbon monoxide in the field.

Question #: 138- When measuring for an oxygen deficient atmosphere one could use any of the following EXCEPT:

- 1) Galvanic sensing cell
- 2) Paramagnetic gas analyzer
- 3) Coulometric detector
- 4) **Detector tube**

Answer: 4- All the listed techniques are commonly available for measuring oxygen concentration. However, a detector tube has an accuracy of +/- 25% and would be inappropriate for measuring oxygen deficiency. The minimum acceptable concentration of oxygen is 19.5% for general industry.

Question #: 139- When using a compound such as Isoamyl acetate to test the fit of a respirator, one of the limitations is that the individual being fitted:

- 1) Is at an increased risk of cancer
3) **May not give an honest response**
2) **May have olfactory fatigue**
4) **Both 2 and 3**

Answer: 4- For fitting of the respirator to be effective, the person being fitted must detect the odor and tell the tester. This requires that the sense of smell not be fatigued and that the person give an honest answer.

Question #: 140- When using a passive monitor to measure employee exposure to organic solvents, monitoring begins:

- 1) When the employee begins the operation
2) **When the cover is removed from the badge**
3) When the pump is turned on
4) Before and after lunch break

Answer: 2- Monitoring begins when the cover is removed from the badge. Diffusion of the materials begins immediately upon removal of the cover. The time to record is the time the cover was removed.

Question #: 141- Which does a combustible gas indicator best measure?

- 1) Mercury vapors 2) Lead vapors 3) **Petroleum solvent vapors** 4) Beryllium oxide

Answer: 3- Combustible gas meters, as the name implies, only measure those substances which are flammable. Hence, the answer is petroleum solvent vapors.

Question #: 142- Which type of filters are used for asbestos counting?

- 1) Whatman Ashless 2) PVC 3) **Mixed cellulose ester** 4) Glass with PVC backing

Answer: 3- The mixed cellulose ester filter is used because its index of refraction is the same as the oil that is used in the oil immersion process for fiber counting. The oil and paper disappear, leaving the fibers to be counted.

Question #: 143- You determined that the concentration of a material is 100 mg/m³ by using a pump calibrated to 1.0 lpm. You later find out that the pump actually ran at 1.5 lpm. What is the corrected concentration?

- 1) **66.7 mg/m³** 2) 1.667 mg/m³ 3) 166.7 mg/m³ 4) 6.67 mg/m³

Answer: 1- We actually drew in more air than we thought. We drew in 1.5 * the air we thought. 1 / 1.5 is the ratio of the air sample sizes. So 1 / 1.5 = 0.667
0.667 * 100 mg/m³ = 66.7 mg/m³

Question #: 144- Conversion of TLV's in mg/m³ to ppm is found in the following formula:

$$1) = (\text{TLV in mg/m}^3) (22.45) / (\text{Gram Molecular Weight of Substance})$$

2) = (TLV in ppm) (24.45) / (Gram Molecular Weight of Substance)

3) = (TLV in mg/m³) (24.45) / (Gram Molecular Weight of Substance)

4) = (Gram Molecular Weight of Substance) / (TLV in mg/m³) (24.45)

Answer: 3- Since ppm is a volume/volume ratio, the mass must cancel out, leaving volume units. 24.45 is used for the molar volume since temperature is assumed to be 25°C.