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Scheme of Evaluation Internal Assessment Test II – December 2021

Sub:	Industrial Safety				Sub Code:	18ME753	Branch:	CIV/CSE/ECE/ EEE/ISE
Date:	20/12/2021	Duration:	90 min's	Max Marks: 50	Sem / Sec:	6^{th}		

	Answer any 5 question	Split up	Max. MARKS
1.	Explain fire tetrahedron. Discuss the fire extinguishing process for each of the elements of fire tetrahedron. **Diagram 2 marks** **Explaining each element 4 marks** **Mention and explaining process of extinguishing – 4 Marks**	**2M** **4M** **4M**	[10]
2	List the different classes of fires? Explain each with examples. **Listing types of fire – 4 Marks** **Explanation – 6 Mark**	**4M** **6M**	[10]
3	(a) Explain the steps to be taken after the occurrence of fire. **(b)** Explain with a neat sketch carbon dioxide fire extinguisher. **(a) Diagram 2 marks** **Writing steps- 3 Marks** **(b) Diagram 3 marks** **Explanation – 2 MArks**	**2M** **3M** **3M** **2M**	[10]
4	What are personal protective equipment? Explain PPEs meant to protect head, hand and respiratory tract **(a) Definition 1 mark** **(b) Explaining 3 PPE -Each carries 3 marks**	**1M** **9M**	[10]
5	Discuss safety measures to be followed while working with lathe machine tool. **Lathe machine-Stating 10 precaution, 01 marks each**	**10M**	[10]
6	Explain the procedure to be followed while disposing empty hydrocarbon containers. **Container-Stating 10 precaution, 01 marks each**	**5M** **5M**	[10]
7	Explain the factors which influence the effect of electric current on human body **Mentioning factors – 4 marks** **Explanation – 1.5 mark each**	**4M** **6M**	[10]

Solution

The fire triangle is a model for conveying the components of a fire. The fire triangle's three sides illustrate the three elements of fire, which are heat, fuel and oxidization.

The three elements must be combined in the right proportions for a fire to occur. If any of the three elements are removed, the fire is extinguished.

The first element in the fire triangle is heat, which is perhaps the most essential of fire elements. A fire cannot ignite unless it has a certain amount of heat, and it cannot grow without heat either.

One of the first things firefighters do to extinguish a fire is to apply a cooling agent — usually water. Another cooling agent is a chemical fire retardant, such as the ones used in fire extinguishers.

Another method of diffusing heat from a fire is to scrape the embers from the fire source, such as wood embers on a burning building. Firefighters will also turn off the electricity in a burning building to remove a source of heat.

The second element in the fire triangle is fuel. A fire needs a fuel source in order to burn. The fuel source can be anything that is flammable, such as wood, paper, fabric, or chemicals. Once the fuel element of the fire triangle is removed, the fire will go out.

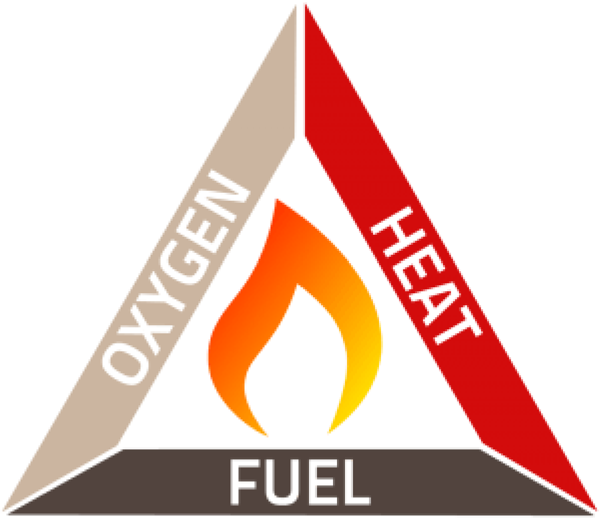
If a fire is allowed to burn without any attempt to extinguish it, as in the case of a controlled burn conducted by the Forest Service, it will extinguish on its own when it is consumed all of the fuel.

The final element of the fire triangle is oxygen, which is also an essential component of fire. A fire needs oxygen to start and continue. That is why one recommendation for extinguishing a small fire is to smother it with a non-flammable blanket, sand or dirt.

A decrease in the concentration of oxygen retards the combustion process. In large fires where firefighters are called in, decreasing the amount of oxygen is not usually an option because there os no effective way to make that happen in an extended area.

An alternative to the fire triangle model is the fire tetrahedron. The fire tetrahedron adds another element to the fire, which is chemical reaction. Fires involving metals such as titanium, lithium and magnesium have a chemical reaction that requires a different approach for firefighters.

This is called a class D fire and the application of water will exacerbate the combustion. Because of the chain reaction caused by the metals in class D fires, firefighters must use a different approach involving the introduction of inert agents like sand to smother it.



2. Fire is a rapid chemical reaction of oxidant with fuel accompanied by the release of energy, indicated by incandescence or flame

- Class A Fires involving solid combustible materials of organic nature such as wood, paper, rubber and plastics where the cooling effect of water is essential.
- Class B Fires involving flammable liquids or liquefiable solids or the like where a blanketing effect is essential.
- Class C Fires involving flammable gases under pressure including liquefied gases, where it is necessary to inhibit the burning gas at fast rate with an inert gas, powder or vaporising liquid.
- Class D Fires involving combustible metals like magnesium, aluminium, zinc, sodium, and potassium where the burning metals are reactive to water containing agents and in certain cases carbon dioxide, halogenated hydrocarbons and ordinary dry powders. These fires require special media and techniques to extinguish.
- Class E Fire risks involving electrical apparatus/equipment.
- Class F/K Fires involving cooking oils, trans-fats or fats in cooking appliances. These typically occur in restaurant and cafeteria kitchens

3. a

13.19. STEPS AFTER OCCURRENCE OF FIRE

1. Fire Occurs
2. Fire is Detected by Observer or Detection System
3. Alarm is Sounded
4. Electric Power Supply and Other Fuel Supplies are Switched Off
5. Immediate Use of Portable Fire Extinguishers and Water/Sand for Extinguishing Small Fires then and there
6. Automatic Fire Fighting System Gets Initiated
7. Call Fire Brigade.
8. Persons vacate the place.

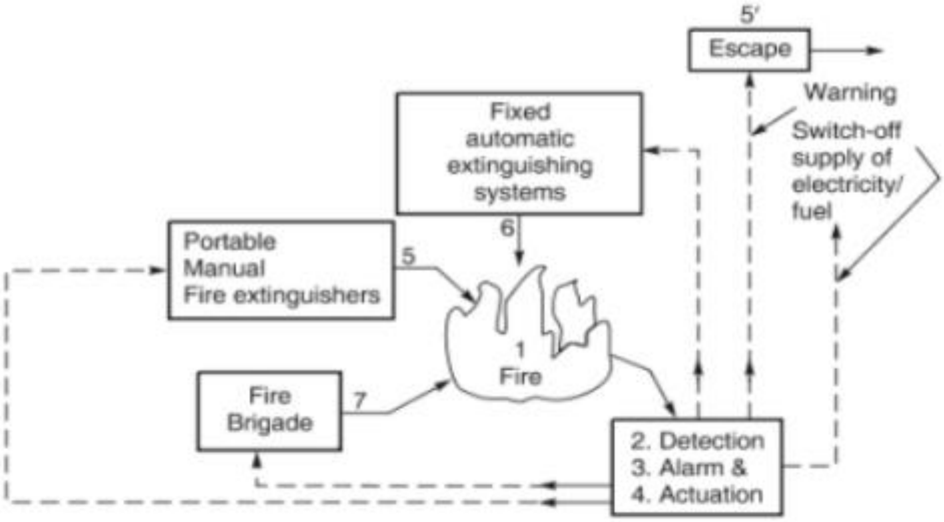


Fig. 13.3. Steps in fire fighting 1, 2, 3 ...... 7 sequence of steps. Some steps may be simultaneous. Time is the essence of success.

Carbon Dioxide (CO_2) is effective extinguishing agent primarily it reduces the oxygen content of air to a point where combustion cannot continue. CO_2 is non combustible and does not react with most substances. Being a gas it can penetrate and spread to all areas affected by fire.

Carbon Dioxide fire extinguishers are used for putting out fires in oils, petroleum products, gaseous substances under pressure, and also on electronic apparatus.

Carbon Dioxide extinguishers are **not** to be used in :

(*i*) Fires involving chemicals that contain their own oxygen supply (such as cellulose nitrate).

(*ii*) Fires involving reactive metals such as sodium, potassium and magnesium.

The common type of portable carbon dioxide extinguisher covered by IS : 2878-1976 is discussed here.

Construction. The principal parts of extinguishers are, as shown in Fig. 13.6 figure above. Carbon Dioxide is retained in the cylinder as liquid under pressure. The cylinder is filled with the charge to about two-thirds by weight of its total water capacity.

Method of Operation. Take extinguisher to the place of fire. Remove the safety pin operate the discharge device or unscrew the valve depending on the design. Carbon dioxide is delivered by means of discharge horn through a high pressure flexible hose.

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Project the hose to the base of the fire, starting at one edge and sweeping across the surface of the burning material. When used in open air, the operator should stand on the up-wind side of the fire. On fires in electrical equipment first switch off the current. Then direct the jet or horn straight at the fire.

The gas at the time of discharge makes considerable noise. The user should therefore be well conversant with its operation to prevent the jet from being misdirected during the first few vital seconds.

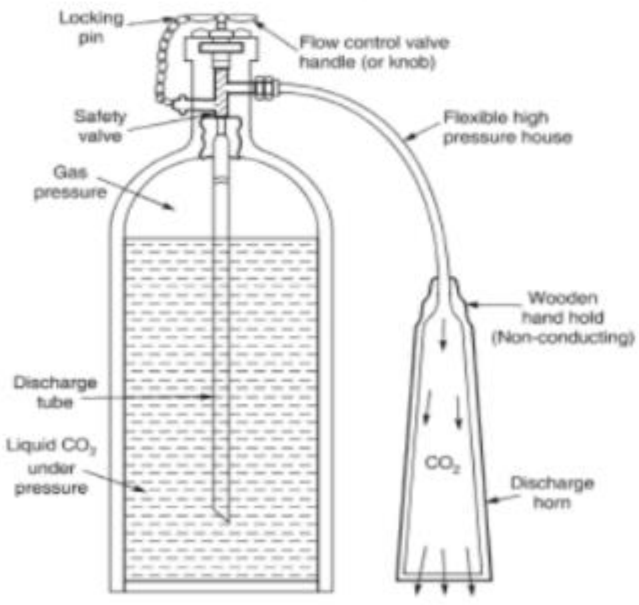

Fig. 13.7. Carbon dioxide extinguisher.

PRINCIPLE OF CARBON DIOXIDE EXTINGUISHER

When the extinguisher is actuated carbon dioxide from the cylinder comes out at a considerable velocity into the atmosphere and forms a layer of gas which is about one and a half times heavier than air. The vapour blanket puts out fire and reducing the oxygen supply needed to continue combustion.

4. Personal protective equipment (PPE) refers to protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.

PPE for the Head

Employees must wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts

Protective helmets into two different types and three different classes.

Type 1 helmets incorporate a full brim (brim fully encircles the dome of the hat) helmets offer protection from blows to the top of the head

Type 2 helmets have no encircling brim, but may include a short bill on the front. Helmets offer protection from blows to both the top and sides of the head

- Class A Helmets reduce the force of impact of falling objects and also reduce the danger of contact with exposed low-voltage electrical conductors. Helmet shells are proof-tested at 2,200 volts of electrical charge.
- Class B Helmets reduce the force of impact of falling objects and also reduce the danger of contact with exposed high-voltage electrical conductors. Helmet shells are proof-tested at 20,000 volts.
- Class C Helmets reduce the force of impact of falling objects, but offer no electrical protection

PPE for the Eyes & Face

Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion

5. Wear PPE
    a. Remove all flammable material, such as cotton, oil, gasoline, etc., from the vicinity of welding.
    b. Keep a suitable fire extinguisher nearby at all times
    c. Gain sufficient knowledge before using machine.
    d. Proper ventilation should be provided
    e. Obey the instructions given by the instructor
    f. Machine must be maintained and serviced regularly
    g. Proper safety guard must be provided

6.

a. Always handle containers of corrosives carefully. Damaged containers may leak
    a. Acid containers, such as drums and carboys, can cause particular problems if they are not handled and stored safely.
    b. Dispense from only one container at a time. Finish all the dispensing of one material before starting to dispense another
    c. Gain sufficient information about the material
    d. Proper ventilation should be provided
    e. Always store material at low temperature region

    a. Secure cylinders upright with a chain or strap in a proper cylinder cart.
    b. Store cylinders at least 20 feet from combustible materials in a dry, ventilated place.
    c. Keep oxygen cylinders at least 20 feet from fuel gas cylinders.
    d. Ensure valves are completely closed and any protection devices are secured.
    e. Avoid storing cylinders in lockers – a leak could result in a dangerous gas buildup.
    f. Use proper warning signs in areas where cylinders are stored.
    g. Keep cylinders in a location free from vehicle traffic, excessive heat and electrical circuits.
    h. Keep empty cylinders away from full ones.

7. The effects of electric shock on the human body depend on several factors. The major

factors are:
1. Current and Voltage
2. Resistance
3. Path through body
4. Duration of shock

The muscular structure of the body is also a factor in that people having less musculature and more fat typically show similar effects at lesser current values.

CURRENT AND VOLTAGE

Although high voltage often produces massive destruction of tissue at contact locations, it is generally believed that the detrimental effects of electric shock are due to the *current* actually flowing through the body. Even though Ohm's law (I=E/R) applies, it is often difficult to correlate voltage with damage to the body because of the large variations in contact resistance usually present in accidents. Any electrical device used on a house wiring circuit can, under certain conditions, transmit a fatal current. Although currents greater than 10 mA are capable of producing painful to severe shock, currents between 100 and 200 mA can be lethal. With increasing alternating current, the sensations of tingling give way to contractions of the muscles. The muscular contractions and accompanying sensations of heat increase as the current is increased. Sensations of pain develop, and voluntary control of the muscles that lie in the current pathway becomes increasingly difficult. As current approaches 15 mA, the victim cannot let go of the conductive surface being grasped. At this point, the individual is said to "freeze" to the circuit. This is frequently referred to as the "let-go" threshold. As current approaches 100 mA, ventricular fibrillation of the heart occurs. Ventricular fibrillation is defined as "very rapid uncoordinated contractions of the ventricles of the heart resulting in loss of synchronization between heartbeat and pulse beat." Once ventricular fibrillation occurs, it will continue and death will ensue within a few minutes. Use of a special device called a de-fibrillator is required to save the victim. Heavy current flow can result in severe burns and heart paralysis. If shock is of short duration, the heart stops during current passage and usually re-starts normally on current interruption, improving the victim's chances for survival.

RESISTANCE

Studies have shown that the electrical resistance of the human body varies with the amount of moisture on the skin, the pressure applied to the contact point, and the contact area. The outer layer of skin, the epidermis, has very high resistance when dry. Wet conditions, a cut or other break in the skin will drastically reduce resistance. Shock severity increases with an increase in pressure of contact. Also, the larger the contact area, the lower the resistance. Whatever protection is offered by skin resistance decreases rapidly with increase in voltage. Higher voltages have the capability of "breaking down" the outer layers of the skin, thereby reducing the resistance. If skin resistance is high, much energy may be dissipated at the surface as current passes through the skin, and large surface burns can result at the entry and exit points.

PATH THROUGH BODY The path the current takes through the body affects the degree of injury. A small current that passes from one extremity through the heart to the other extremity is capable of causing severe injury or electrocution. There have been many cases where an arm or leg was almost burned off when the extremity came in contact with electrical current and the current only flowed through a portion of the limb before it went out into the other conductor without going through the trunk of the body. Had the current gone through the trunk of the body, the person would almost surely have been electrocuted. A large number of serious electrical accidents in industry involve current flow from hands to feet. Since such a path involves both the heart and the lungs, results can be fatal.

DURATION OF SHOCK

The duration of the shock has a great bearing on the final outcome. If the shock is of short duration, it may only be a painful experience for the person. If the level of current flow reaches the approximate ventricular fibrillation threshold of 100 mA, a shock duration of a few seconds could be fatal. This is not much current when you consider that a small light duty portable electric drill draws about 30 times as much. At relatively high currents, death is inevitable if the shock is of appreciable duration; however, if the shock is of short duration, and if the heart has not been damaged, interruption of the current may be followed by a spontaneous resumption of its normal rhythmic contractions