SUMMER-18 EXAMINATION

Model Answer

Subject Title: Plant Safety & Maintenance

Subject code 17558

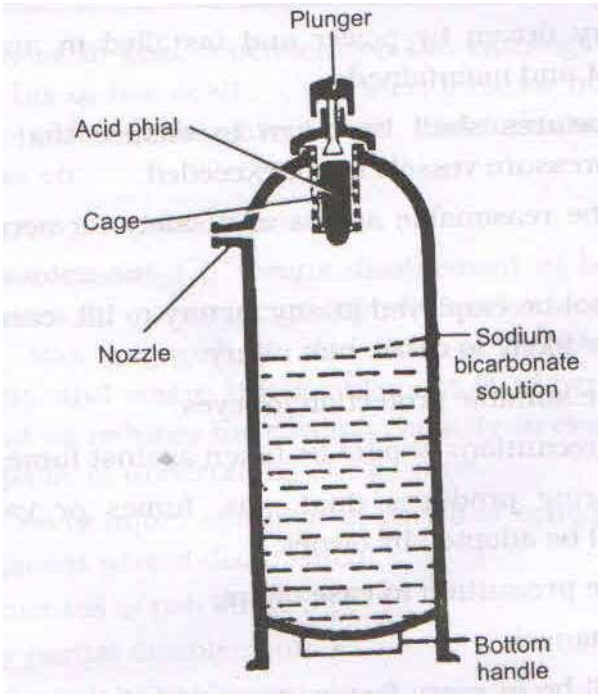
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

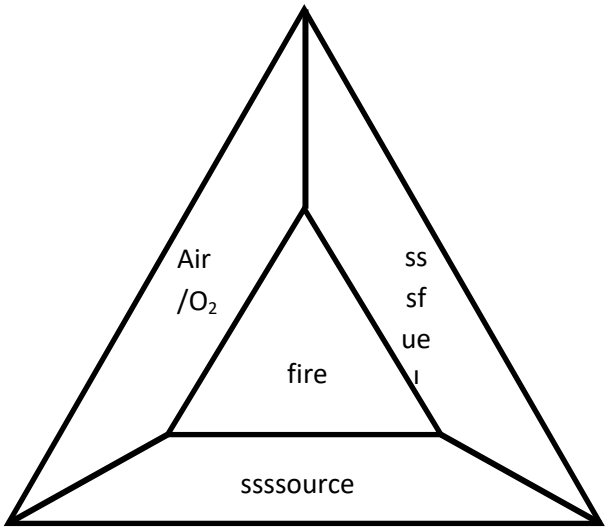
Q No.	Answer	marks
1-A	**Answer any 3**	**12**
1A-a	**Hazard:** A hazard in anything in the work place that has the potential to harm people. It includes objects in the workplace such as machinery or dangerous chemicals. **Types of hazards** : 1) Mechanical hazards 2) Electrical hazards 3) Noise hazards 4) Radiation hazards 5) Explosion hazards 6) Toxic hazards 7) Chemical hazards	2 2 1/2 mark each for any 4
1A-b	**Equipments used for breathing and respiratory protection are:** 1. Air Purifying Type a. Mechanical filter respirators: b. Canister gas masks: c. Chemical Cartridge Respirators: 2. Air Supplied Type: This includes- a. Air line respirators: b. Fresh air or Suction Hose Masks:	4 1mark each for any 4

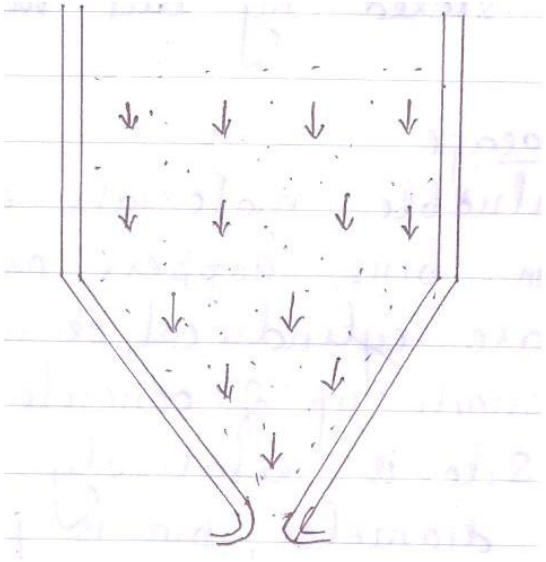
	3. Self Contained Breathing Apparatus: These are mainly of three types. a. With compressed air or oxygen cylinder b. Oxygen rebreathing or recirculating type c. Oxygen regenerating type	
1A-c	**Harmful effects of chlorine on human being:** 1. Inhalation: Chlorine is very toxic, it can cause death. It can cause severe irritation of the nose and throat and severe lung injury. It can cause life-threatening accumulation of fluid in the lungs. Long term damage may result from a severe short term exposure. A single exposure to a high concentration can cause a long lasting condition like asthma. 2. Skin contact: The gas irritates or burns the skin. Permanent scarring can result. Direct contact with the liquefied gas can chill or freeze the skin. The skin may become waxy white or yellow. Blistering, tissue death and infection may develop in severe cases. 3. Eye contact: The gas irritates or burns the eyes. Permanent damage including blindness can result. Direct contact with the liquefied gas can freeze the skin. Permanent eye damage or blindness can result.	4 2mark each for any 2 point
1A-d	**Importance of Plant Maintenance :** In modern industry, equipment and machinery are a very important part of the total productive effort. With the development of special purpose and sophisticated machines, equipment and machinery cause a lot more money and therefore their idle or downtime becomes much more expensive. For this	4

	reason, it is vitally important that the plant machinery should be properly maintained. The term plant maintenance includes all work relating to the economical preservation of facilities and equipment of plant, at a level satisfactory to perform their designed function. Maintenance division of the factory ensures the availability of the machines, buildings and services required by other section of the factory for the performance of their function.	
1-B	**Any one**	**6**
1B-a	**Construction and Working of Soda Acid type Fire Extinguisher :** **Construction:**:In soda acid fire extinguisher the material used are dry chemical, bicarbonate of soda designed to be dissolved in water and a liquid chemical sulphuric acid. Reaction of the acid & bicarbonate of soda produces pressure which expels the liquid from the extinguisher a horizontal distance of 30 to 40 feet at a rate of 2.5 gal. in one min. **Working:** When the plunger is struck, it breaks the acid bottle. The sulfuric acid and the sodium bicarbonate solution react together to release CO_2 gas. The gas generated creates pressure, which forces the water out of the extinguisher nozzle. Before using this extinguisher, it is advisable to check whether these extinguishers are upright type or turn over type. Dire the jet at the base of the fire and sweep it across the area of fire. Attack a vertically spreading fire at its lowest point and follow it up. Search out for hot spots and ensure that the fire is completely extinguished and that it is not smouldering.	2 2

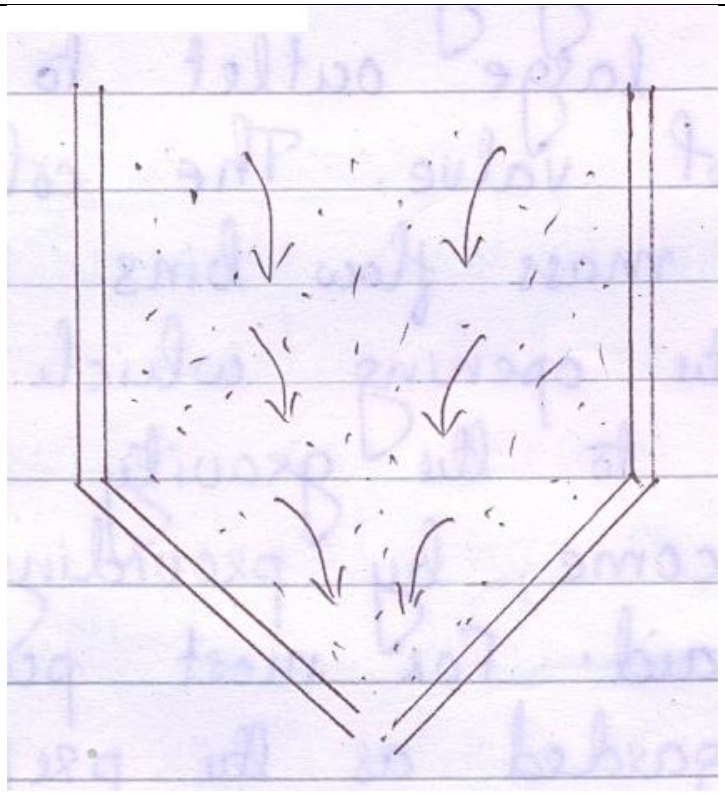
		2
1B-b	**High efficiency Dust respirator** : Dust respirators are designed for protection against the higher levels of toxic particulate material. The mass can be adapted for respirators or breathing apparatus. Their life expectancy is between one and five years and the filters are likely to last two months. **Blasting helmet** : Blasting helmets are used when operators are carrying out blast cleaning of structures, castings etc. A full protective suit made in rubberized canvas is donned by operator, and then an independent blasting helmet is applied over the	3 3

	head and fixed to be full suit. External clean air is supplied via a compressor with a filter, or from a compressed air supplied again with a suitable filter. Work inside a full blasting suit is very difficult work efficiency will be low, fatigue will be high and such suit should only be used when all other precautions cannot be reasonable applied.	
2	**Answer any 4**	**16**
2-a	**Safety audit** is a proactive process by which and organization is able to continually evaluate and monitor the progress of its safety and health programs. Audits are designed to rate an organization's total safety and health program, identify it's strength and weakness , show where improvement are needed , and obtain commitment and target dates for correcting problems. **Objectives are:** 1. Confirm that safety, health, fire and environmental program activities and controls are in place and functioning. 2. Verify that the facility is in compliance with internal benchmarks and government regulations. 3. Assess past and current practices to identify and correct safety impediments which may result in personal injuries, property damage or business interruption.	2mark each for any 2 points
2-b	**Fire Triangle:** A fire can be caused and sustained by a fuel, oxygen or oxidizer and source of heat (ignition source).These three forms three sides of a fire triangle. It requires all three should be present simultaneously to cause fire.	2

	 **Principle of fire extinguishing:** **Fire may be extinguished** by withdrawal of flammable contents, interrupting flammable flow, isolating fuel from air, heat removal to below reaction temperature. **Withdrawal of flammable contents** can be accomplished by 1).Blowing down the vessel and piping contents (2) Pump out or 3)draining Flammable flow may be interrupted by the shutdown of pumps, closing of valves. **Isolation of flammable flow** from the air is accomplished by blanketing with steam or water spray, foam, CO_2 etc.	1mark each for any 2 points
2-c	**Bin Storage:** Valuable materials are stored in bins, hoppers or silos which are cylindrical or rectangular vessels made up of concrete or metal. Silo is relatively tall and small in diameter, bin is fairly wide and short, hopper is a small bin with sloping bottom which is used to temporarily store the solid before feeding the	2 marks for diagram and 2 marks for

	solid to a process. Storage bins or hoppers are generally classified based upon the flow pattern of bulk material discharged- **core flow, mass flow** and **composite flow**. The actual pattern of flow within the container depends upon the nature of bulk solid concerned as well as on the shape of the hopper. **Mass flow bins** **Working:** These are characterized by shallow angle of converging section. In mass flow bin, every particle of the bulk material in the hopper begins to move when the outlet is opened. Hence mass flow bins has steep wall slopes of the converging sections. It has relatively large outlet to the feeder or flow control valve. The cohesive solids stored in mass flow bins form cohesive arch at the opening which acts as the obstruction to the gravity flow of material. It is overcome by providing some discharge aid.  **Advantages of Mass flow bins:** i) Absence of channeling, surging and flooding.	description of any one type

	ii) Uniform and steady flow which is independent of the head of material in the bin. iii) The pressure across any horizontal section of the bin are uniform. iv) There are no dead regions within the bin. v) There is minimum segregation of bulk solid stored. **OR** **Core flow bins** **Construction:** In core flow bins the discharge of the bulk solid is essentially irregular with the material flowing through a vertical channel called rat hole, which forms within the bin. The material around this central channel is stationary. The main characteristics of core flow bin are 1. First – in- last-out 2. The material gets spoil or degraded by caking in the non flow region. 3. The material which segregate on charging, there is no remixing in the hopper. 4. Non uniform flow is obtained.	

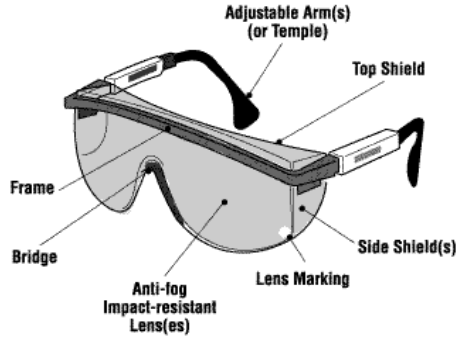
	 OR **Composite Flow:** This is a combination of both –core and mass flow pattern. The upper section is designed for mass flow. This increases the storage capacity while still maintaining mass flow that also results in a greater uniformity of feed, at the outlet.	
2-d	**Diagram of personal protective device(any 4)**	1 mark each for any 4

Helmet

hand gloves

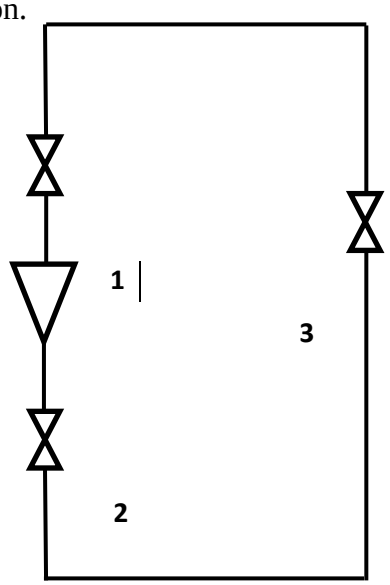
Ear plug

Apron(suit)

	 Goggle  Safety shoes	
2-e	**Types of plant maintenance:** 1. Corrective or breakdown maintenance 2. Scheduled maintenance 3. Preventive maintenance 4. Predictive maintenance **Scheduled maintenance:** Scheduled maintenance is a stich-in-time procedure which is aimed at avoiding breakdowns. Breakdowns can be dangerous to life and hence should be minimized. This method of maintenance incorporates inspection, lubrication, repair and overhaul of certain equipment which if neglected may result in breakdown. Scheduled maintenance practice is generally adopted for overhauling of machines, cleaning of water and other tanks, white washing of buildings etc.	2 2
2-f	**Protection used against noise:** Two types of hearing protections are available- ear plugs and ear muffs. **Ear Plug** :	2

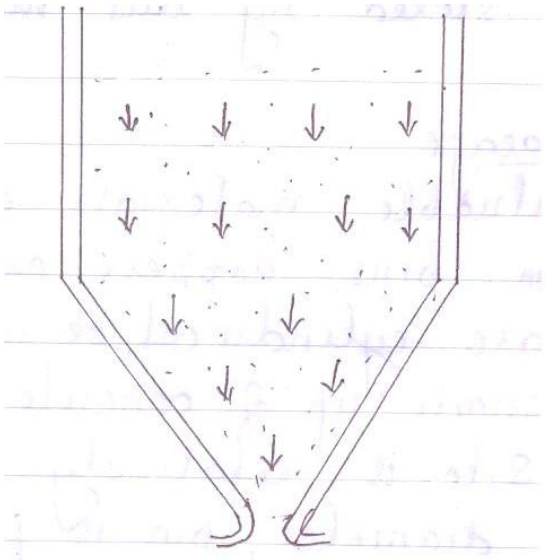
	It is personnel protective device for ear which is put inside the ear. They are worn in the ear canal, sealing the entrance to the ear. 2-12 dBA reduction can be achieved in noise levels by their use. Proper fitting of the plug is important. While a loose fit will give no reduction, a tight fit will make it uncomfortable. **Ear Muffs** : It is again a personnel protective device for ear which is placed on the ear thereby covering the ear completely. This can be worn over the head, behind the neck or under the chin. The cups may also be attached to some safety helmets by adjustable side arms. The cushions are liable to degrade from mechanical abuse or sweat from the wearer and therefore need regular inspection and replacement. Ear muffs are of two types, circumaural and super aural. The former, which enclose the ears, are common and more effective except where spectacles with normal side- arms are worn. The latter, which are lighter, seal against the ears themselves and are less affected by spectacle frames.	2
3	**Answer any 4**	**16**
3-a	**Physiological effects of electricity:** The primary effect of electric shock is due to current actually flowing through the body. Electrical burns occur when the body completes a circuit connecting the power source with the ground. Although the resistance of dry, unbroken skin to electric current is relatively high, the amount of current necessary to kill person is small. Therefore it is necessary to exceed lethal levels of current flow, especially if the skin is broken, wet or damp with sweat. Four different kinds of damage can result from the passage of of an electric	4

	current through the body. First is burning close to the contact point particularly at high voltages. Second effect is that breathing becomes increasingly difficult or suffocation. The third and fourth type directly concerns the heart and may rapidly become fatal.	
3-b	**Disadvantages of breakdown maintenance** : 1) Breakdown generally occurs at inopportunate time. This leads to poor, hurried maintenance and excessive delays in production. 2) Reduction of output. 3) Faster plant deterioration 4) Increased chances of accidents and less safety to both workers and machines. 5) More spoilt material. 6) Direct loss of profit. 7) Breakdown maintenance can not be employed for those plant items which are regulated by statutory provision eg. Cranes, lifts, and pressure vessels.	1 mark each for any 4
3-c	**Safety precautions in the transportation of inflammable liquids:** 1. Inflammable liquids shall be transported in rugged pressure resistant safety cans. 2. Original containers of inflammable liquids shall be placed in an outside container or acid carrying bucket. 3. Not more than five gallons of inflammable liquids in glass container shall be transported on the freight elevator unless the original shipping carton is used and the material is on an appropriate cart.	1mark each

	4. Before transportation details of the packing requirements should be obtained from the hazard data sheet. The packing group for which the chemical belongs will decide the amount which can be transported at any one time.	
3-d	**On line maintenance of Rotameter**: In a chemical plant, it is a normal practice to do on line maintenance work. This avoids total shutdown of the equipment or plant. This is possible, if proper pipe fittings are installed at the time of erection. e.g. Suppose there is a Rota meter in pipe line. If we desire to replace a broken glass pipe of Rota meter, we can close valve 1 & 2 and open 3 and divert the fluid through by pass line. After replacement of the glass pipe in the Rota meter close valve 3 and open 1 and 2. Thus it is possible to attend maintenance jobs in the line without stopping the production.  	3 1

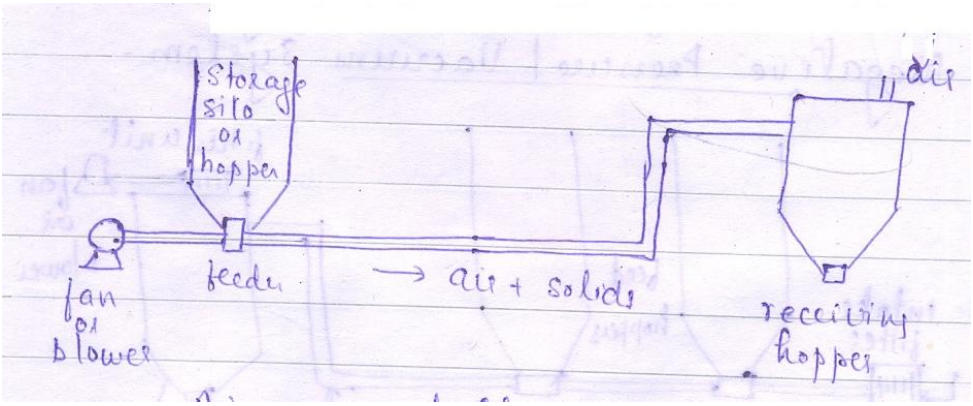
3-e	**Predictive maintenance**: Predictive maintenance makes use of human sense or other sensitive instruments such as audio gauges, vibration analyzer, amplitude meter, pressure, temperature and resistance strain gauges etc. to predict trouble before the equipment fails. Unusual sounds coming out of rotating equipment predict a trouble, an electric cable excessively hot at one point predict a trouble. Simple hand touch can point out many unusual conditions and thus predict a trouble. In predictive maintenance, equipment conditions are measure periodically or on a continuous basis and this enables maintenance men to take a timely action such as equipment adjustment, repair or overhaul. Predictive maintenance extends the service life of equipment without fear of failure. **senses adopted for predictive maintenance technique** (Human senses) : 1. Ear :eg. Unusual sound coming out of rotating equipment. 2. Eye :eg. Excessive vibration of equipment or dislocation of moving part. 3. Touch :eg. Excessive temperature of equipment. 4. Smell :eg. Unusual smoke coming out of equipment. **sensitive instruments adopted for predictive maintenance technique:** 1. Audio gauges :eg. Unusual sound coming out of rotating equipment. 2. Vibration analysor:eg. Excessive vibration of equipment 3. Amplitude meter:eg. Excessive temperature of equipment. 4. Pressure, temperature and resistance strain gauges: eg. Excessive temperature of equipment.	4
4-A	**Answer any 3**	**12**

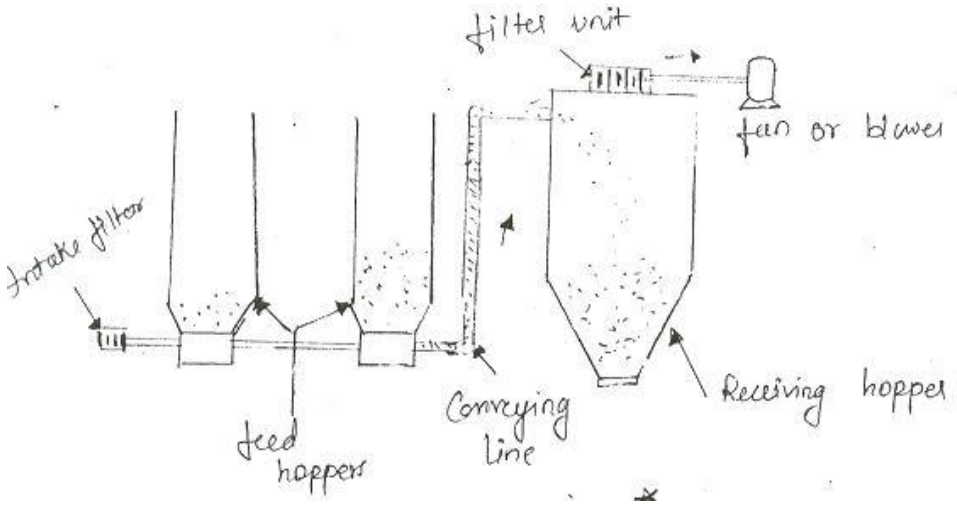
4A-a	**Fire hydrant System:** For immediate firefighting, the fire buckets are to be located in conspicuous are inside the shop. These should be kept filled with water or fine sand depending upon the fire hazard in the area. Fire hydrants with high pressure water available through opening of the hydrant valve are also located in conventional locations inside the plant. Fire hose boxes with spraying nozzle and hose which are provided with instantaneous coupler, attachments are also provided near the hydrant points, which are to be used as necessary. Similarly the fire hydrant points, hoses and nozzles should also not be used for any other purpose without taking approval from appropriate authority. The canvas hose after use should be laid on the ground to dry up before being rolled back to the place into the hose boxes. The nozzle should also be put back inside the fire hose box immediately after use.	4
4A-b	**Mass flow bins** **Working:** These are characterized by shallow angle of converging section. In mass flow bin, every particle of the bulk material in the hopper begins to move when the outlet is opened. Hence mass flow bins has steep wall slopes of the converging sections. It has relatively large outlet to the feeder or flow control valve. The cohesive solids stored in mass flow bins form cohesive arch at the opening which acts as the obstruction to the gravity flow of material. It is overcome by providing some discharge aid. **Advantages:** 1. Uniform and steady flow which is independent of head o material in the bin.	2 2

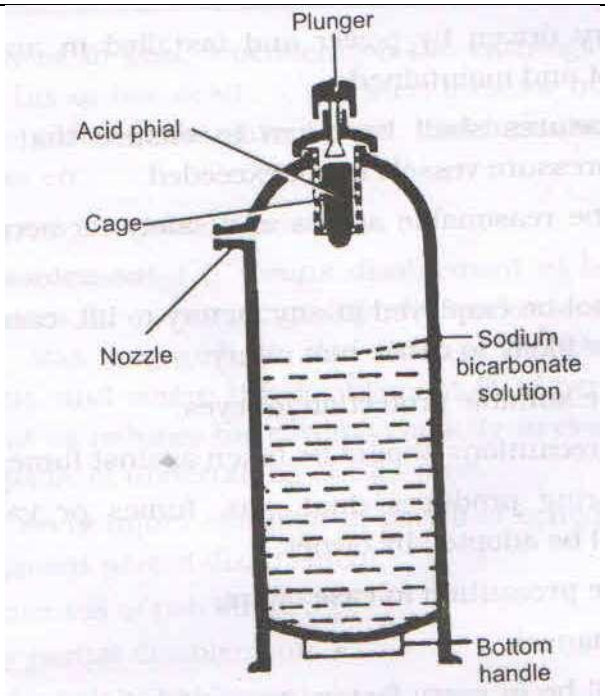
	2. Bulk density of the down solid is constant and practically independent of the head of material in the bin. 3. Pressure across any horizontal section of the bin is uniform. 4. There are no dead regions within the bin. 5. Material already present in the bin gets discharged first. 6. There is minimum segregation of bulk solid stored. 	
4A-c	**Causes of Breakdown Maintenance:** 1) Failure to replace worn out parts. 2) Lack of Lubrication 3) Neglecting cooling system 4) Indifferent towards minor faults. 5) External forces e.g. too low or too high voltage wrong fuel etc. 6) Indifference towards equipment vibrations, unusual sounds caring out of rotating machinery etc.	1mark each for any 4 points

4A-d	**Preventive maintenance**. Preventive maintenance is a system of scheduled, planned maintenance tries to minimize the problem of breakdown maintenance. It is a stich- in- time procedure. It locates weak spots in all equipment, provides them regular inspection and minor repairs there by reducing the danger of unanticipated break downs. The principle of preventive maintenance is that prevention is better than cure. Preventive maintenance involves. i. Periodic inspection of equipment and machinery to uncover conditions that lead to production break down and harmful depreciation. ii. Upkeep of plant equipment to correct such conditions while they are still in a minor stage. The key to all good preventive maintenance programs is inspection. Help can be taken of suitable statistical techniques in order to find how often to inspect.	02 02
4-B	**Answer any one**	**6**
4B-a	**Procedure of safety Audit** : Safety audit is carried out by a team whose members are not involved in the plant or activity being audited. The expertise of the team should be compatible with the type of audit. It is beneficial to include the managers of other plants or units in an audit team as well as one previous auditor of the same unit. Audits are carried out in a formal way using a carefully drawn up checklist of items and descriptive standards for each item. A line manager or supervisor of the	04

	plant under audit should be asked to accompany the auditor inspecting it. He should be informed of all corrections and improvements required by the auditors so that he can start taking the necessary steps before the audit report is submitted to management. The main object of inspection should be to determine whether the layout design and condition of equipment and protective features are upto standard and to ensure that the protective features will work in an emergency. The auditing should give a verbal report to the management on completion of audit followed by a clear and concise written report within two weeks. **Various records to be examined during safety auditing:** 1. Operational safety and health policy. 2. Safety organization chart. 3. Training records on safety , fire and first aid. 4. Records of plant safety inspection. 5. Accident investigation reports 6. Accident and dangerous occurrences, statistic and analysis. 7. Records of test and examination of equipment and structure. 8. Safe operating procedures for various operations. 9. Record of work permit. 10. Record of monitoring of flammable and explosive substances at work place. 11. Medical records of employees. 12. Records of waste disposal. 13. Maintenance procedure records.	02

	14. House keeping inspection records. 15. Record of previous audits.	
4B-b	**Pneumatic conveyor:** **Positive Pressure:**  Air or suitable gas is blown along a pipeline, which carries the bulk solid to be conveyed. Fan or blower is used to deliver air into the pipeline. Feeders are used to introduce the material into the pipeline against the conveying gas pressure. Gas/ solid disengaging device is used at the discharge end of the pipeline, which separates the conveyed bulk solid from the conveying air stream. The cyclone separator or bag filter units are used for this purpose. The clean gas/ air coming out from these devices is fed back for conveying purpose. These systems are useful for picking up solid from one point band delivering them to various discharge points. They are used for free flowing materials upto ¼ inch size. But it is unsuitable for multiple pick up points on account of excess air leakage. OR **Negative Pressure or Vacuum Systems:**	3 3

	 It is similar to domestic vacuum cleaner. Complete removal of solids from the conveyed gas, which otherwise may damage the fan or blowers. These systems do not require separate material feeding devices due to absence of adverse pressure gradients. Hence these systems have simple feeding mechanism but larger air filtration plant. Vacuum systems are useful in installations involving picking up of material from several points and discharging them to common point. Hence these systems are well suited for unloading the material from several hoppers and discharging them into pipeline. **Explanation of any one type of Pneumatic conveyor may be given mark.**	3 3
5	**Answer any 2**	**16**
5-a	**Dry chemical powder fire extinguisher:**	



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Construction: These are gas cartridge type and are activated by a plunger and controlled by a simple squeeze grip action thus enabling the discharge of the dry chemical powder, generally sodium or potassium bicarbonate base or ammonium phosphate base. To operate, remove the safety clip and press puncturing lever down. This will release CO_2gas from the cartridge and pressurize the chamber containing dry chemical. The discharge is controlled by the nozzle located at the end of the hose.

3

Working :On fires involving either liquids in containers or spilled liquids, direct the jet towards the near edge of the fire and with rapid sweeping motion, drive the fire towards the far edge until all the flames are extinguished. On fires in falling liquids, direct the jet at the base of the flame and sweep upwards. On fires in electrical equipments, direct the jet straight at the fire. Where the

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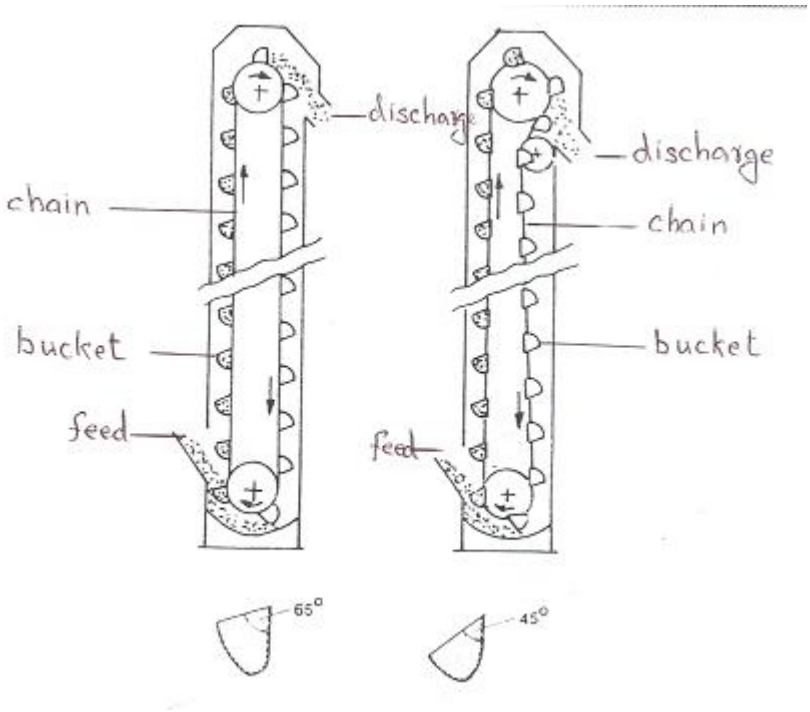
	equipment is closed, direct the jet into any opening with the object of penetrating the interior.	
5-b	**Bucket elevator**  **Construction:** In spaced bucket centrifugal discharge elevator, buckets are mounted on a belt or a chain and are spaced to prevent interference in loading or discharging. In spaced bucket positive discharge elevator, the buckets are mounted on two strands of chain and are snubbed back under the head sprocket to invert them for positive discharge. In continuous bucket elevators, buckets are closely spaced with back of the preceding bucket serving as a discharge chute for the	2 3

	bucket which is dumping as it rounds the head pulley. **Working:** Buckets are loaded partly by material flowing directly into them and partly by scooping material from the boot. As the bucket reaches top, these will be inverted and the material will be off loaded. The empty bucket will again be loaded with material and so on.	3
5-c	**Startup of a plant:** A chemical plant is started at two different times, 1. When it is constructed, erected and to be commissioned first time for production. The procedure here to be followed is to take water in the plant to check the fluid flowing through equipment and pipelines without any leakage, at the desired flow rate, pressure and temperature. If any leakage is observed, it can be rectified. This is the safest and cheapest way of checking the functioning of the plant equipment in total. 2. When plant is stopped for annual major shutdown, then the procedure to be followed for start- up of a plant is i) To take water in the plant to check the fluid flowing through equipment and pipelines without any leakage, at the desired flow rate, pressure and temperature. If any leakage is observed, it can be rectified. Thus is the safest and cheapest way of checking the functioning of the plant equipment in total. ii) Once it is assured that fluid flow takes place without any problem, the total plant water is drained off and water is removed and then slowly	8

	loaded in stepwise and retched to desire capacity in stepwise. It is always advisable to operate the plant with 50% capacity for few days and after full satisfaction of plant working, it is taken up to full capacity	
6	**Answer any 2**	**16**
6-a	**Air Supplied Type:** Here air is supplied to the full face mast on hood so that the wearer gets constant supply of breathable air drawn from a non contaminated area away from working place. This includes- Air line respirators: They use a source of filtered and low pressure compressed air or oxygen, instrument air which is usually at low pressure and free from oil. Fresh air or Suction Hose Masks: Here the wearer draws in air by his own breathing effort, from a source supplying breathable air, placed at a distance. On account of limited hose length, this restricts the free movement of the operator.	4
	Self - Contained Breathing Apparatus: Self contained breathing apparatus is used intermittently, often for rescue purpose. A high efficiency face mask is supplied with clean fresh air from air cylinders worn on the operator's back. Self- Contained Breathing Apparatus will need adequate maintenance and cleaning. It should also have warning systems to indicate when the cylinder is running empty. Extensive training is needed for operators using self - contained breathing apparatus and it is rarely used in normal work. These are designed to supply complete respiratory protection is any concentration of toxic gases or even in environment deficient of	4

	oxygen. These are mainly of three types. a. With compressed air or oxygen cylinder: Here breathable compressed air or oxygen is supplied to the full face piece through a pressure regulating valve from a cylinder carried by the user. The wearer's exhaled breath escapes to the surrounding air through an exhalation valve. b. Oxygen rebreathing or recirculating type: Here compressed oxygen from cylinder passes through a pressure reducing and regulating valve into a breathing bag. The wearer inhales oxygen through a one way inhaler valve. The exhaled CO_2 along with oxygen and moisture passes through a canister containing a chemical, which absorbs CO_2 and moisture and then passes through a cooler. Finally the purified exhaled air flows into the breathing bag, where it mixes with the incoming oxygen from the cylinder. c. Oxygen regenerating type: This type uses the same principle of re breathing apparatus, but function in a different manner. Here CO_2 is absorbed by the chemical in the canister and the moisture reacts with another chemical and this reaction liberates oxygen.	
6-b	**(i)Sources of radiation hazard:** **1.Natural sources:** They are mainly of cosmic radiation received from from the space, and the naturally occurring radioisotopes present in the environment and those contained within the body of the organisms.	2 marks for natural sources and 2

	Another source is the presence of radio nuclides in the lithosphere, hydrosphere and atmosphere. **2. Man made sources:** 1. Nuclear weapons 2. Atomic reactors and nuclear fuel 3. Radioactive isotopes 4. Hospital (X-ray division) The radiation is produced when atoms of natural radio active material decay or split, generating streams of photons vibrating at enormous speeds in wavelike form. Radiation has two basic forms: ionizing and nonionizing. In chemical plants workers may be exposed to various forms of nonionizing radiation. Radiation hazards occurred during testing of nuclear weapons, establishment of nuclear power plants, mining and refining of plutonium and thorium and preparation of radioactive isotope. **(ii) Classification of explosives :** Explosives are divided in to eight classes. 1. Class 1 – Gun powder (KNO_3, C&S) 2. Class 2 – Nitrate mixture 3. Class 3 – Nitro compound class 4. Class 4- Chlorate mixture class 5. Class 5 – Fulminate class (with C, N_2& O_2) 6. Class 6 – Ammunition class 7. Class 7 – Firework class 8. Class 8 – Liquid oxygen explosive class	marks for man made sources ½ mark each

	OR Classes of explosive are : 1. Category X: Those explosives which have a fire or a slight explosion risk. 2. Category Y: Those explosives which have a mass fire risk or moderate explosion risk, but not the risk of mass explosion. 3Category Z: Those explosives which have a mass explosion risk and major missile effect. 4. Category ZZ: Those explosives which have a mass explosion risk and minor missile effect.	1 mark each
6-c	**Functions and responsibilities of plant maintenance department:**1)Inspection 2)Engineering 3) Maintenance 4) Repair 5) Overhaul 6)Construction 7) Salvage 8) Clerical work **1)Inspection:** i) Inspection of the plant facilities to examine their condition and to check for repairs needed. ii) Inspection to ensure the safe and efficient operation of plant equipment and machinery. **2)Engineering :** i) Engineering involves alternations and improvement in existing plant equipment to minimize breakdown. ii) Engineering and consulting services to production supervision. **3) Maintenance** : i) Maintenance of existing plant equipment.	1mark each

	ii) Engineering and execution of planned maintenance, minor installations of equipment building and replacements. 4**) Repair:** i) To carry out corrective repair to alleviate unsatisfactory conditions found during preventive maintenance inspection. **5) Overhaul:** i) Overhaul is a planned, scheduled reconditioning of plant facilities such as machinery etc. ii) Overhaul involves replacement, reconditioning, reassembly, etc. **6)Construction :** i) In some organization, maintenance department is provided with equipment and personnel and it takes up construction job too. **7) Salvage :** i) Maintenance department may also handle disposition of scrap or surplus materials. **8) Clerical work:** i) Maintenance department keeps records at i) of costs, ii) of time progress on jobs pertaining to important features of building and production equipment.	