



WINTER-17 EXAMINATION
Model Answer

Subject Title: Plant Safety & Maintenance

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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.



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Q No.	Answer	marks
1-A	Answer any 3	12
1A-a	<p>Importance of Plant Maintenance :</p> <p>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 reason, it is vitally important that the plant machinery should be properly maintained.</p> <p>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.</p>	4
1A-b	<p>Causes of accident in an industry :</p> <p>1. Technical causes.</p> <p>These are due to un safe condition which are originated from a) Mechanical factors b) Environmental factors.</p> <p><i>Mechanical Factors:</i>(Any two points)</p> <p>i) Unsafe mechanical design or construction. ii) Improper machine guarding. iii) Improper material handling. iv) Broken safety guards.</p>	2



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	<p>v) Leaking acid valve.</p> <p>Environmental factors.: (Any two points)</p> <p>i) Too low a temperature to cause shivering.</p> <p>ii) Too high temperature to cause headache , sweating.</p> <p>iii) Too high humidity</p> <p>iv) Defective and inadequate illumination</p> <p>v) Presents of dusts, fume and smoke.</p> <p>2. Human causes.(Any four points)</p> <p>These are due to unsafe acts by our weakness. This is due to some personal factors such as :</p> <p>i) Age.</p> <p>ii) Health</p> <p>iii) No. of dependents</p> <p>iv) Financial positions</p> <p>v) Home environment</p> <p>vi) Lack of skill and knowledge.</p> <p>vii) Improper attitude towards work</p> <p>viii) Carelessness</p> <p>ix) Inattentiveness.</p>	2
1A-c	Classification of fire and fire extinguishers:	4



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	Class	Description	Suitable type of extinguishes	
	A	Fires involving ordinary combustion materials like wood , paper, cloth etc where effect of water is essential to extinguish.	Soda acid	
	B	Fires in flammable liquids like oil, solvents, petroleum prod, varnish paint where blanketing effect in essential	Foam , CO ₂ , gas, dry chemical powder	
	C	Fires involving gaseous substances under pressure where it is necessary to dilute burning gas at a very high rate with an inert gas or powder.	CO ₂ Gas, chemical powder	
	D	Fires involving metal like Mg, Al K etc. where its burning is reacting to water and which require special extinguishing media or technique	Special powder	
	E	Fires involving electrical equipment where the electrical non conductivity of the extinguishing media is of prime importance	CO ₂ , gas, dry chemical powder but when the electrical equipments are dancercised. Even soda acid or foam is suitable.	
1A-d	Different breathing and respiratory protection equipment: 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:			4



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	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.	
1B-b	<p>Procedure of safety Auditing :</p> <p>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 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.</p> <p>Various records to be examined during safety auditing:</p> <ol style="list-style-type: none">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.	03



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	<ol style="list-style-type: none">5. Accident investigation reports6. 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.14. House keeping inspection records.15. Record of previous audits.	03
2	Answer any 4	16
2-a	<p>Harmful effects of ammonia:</p> <p>1.Inhalation: Very toxic, can cause death., can cause severe irritation of the nose and throat, can cause life threatening accumulation of fluid in the lungs, coughing, shortness of breath.</p> <p>2.Skin contact: the gas irritates or burns the skin, permanent scarring can result, can chill or freeze the skin, burning sensation and stiffness, skin becomes waxy white or yellow.</p> <p>3.Eye contact: corrosive, the gas irritates or burns the eye, blindness can result, can freeze the eye,</p>	2 mark each for any 2



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2-b	Factors for selecting personal protective equipment: i) The nature of the hazardous operation or process. ii) Type of the contaminant and its properties. iii) Duration for which the protection will be needed. iv) Location of the hazardous area. v) State of health of the personnel involved . vi) Functional and physical characteristics and limitation of the protective devices available.	1 mark each for any 4
2-c	Causes of fire: Fire in process industries are due to: 1. Spark and short circuit in electrical system 2. Friction in rotating equipment 3. Open flames, smoking and hot surface 4. Static electricity 5. Leakages of flammable liquids, vapour or gases 6. Lighting 7. Sparks from combustion 8. Spontaneous ignition of trash	1 mark each for any 4
2-d	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 solid to a process. Storage bins or hoppers are generally classified based upon	1



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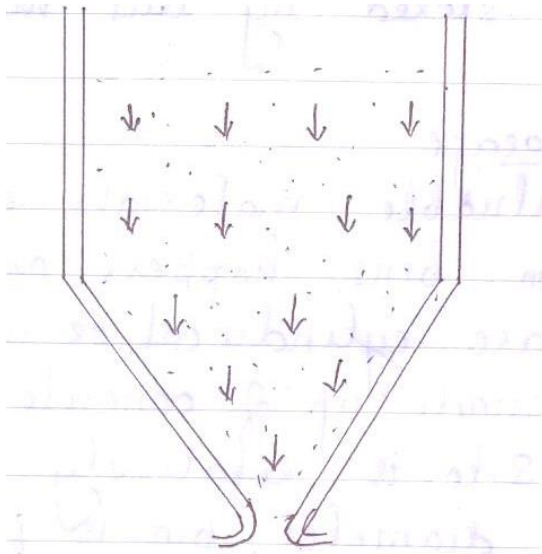
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the flow pattern of bulk material discharged- **core flow**, **mass flow** and **composite flow**. The actual pattern of flow within the container depends upon the nature of bulk solid concerned as well as on the shape of the hopper.

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.
- ii) Uniform and steady flow which is independent of the head of material in the

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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.



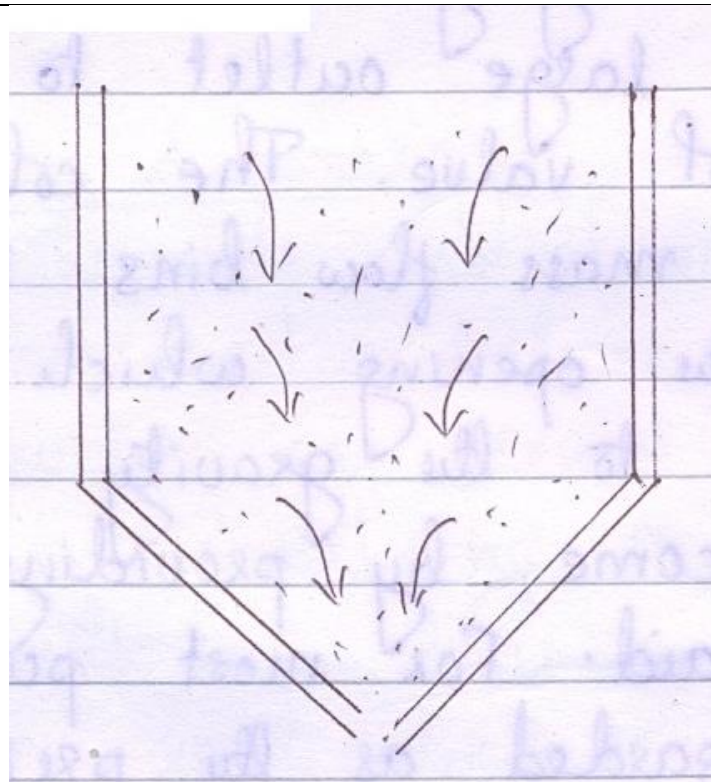
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OR

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-e

ON LINE MAINTENANCE; In a chemical plant it is 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. If we provide a stand by pump in a process pipe line, it is possible to attend the faulty pump, without stopping the production by using a stand by pump.

2



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When a valve is to be attended for its maintenance by removing it from pipe line then blind flange is useful e.g. The suction side valve of a pump is provided with blind flange and the only suction valve can be removed for maintenance without loss of materials.

When the pressure vessels like reactor, distillation column, evaporator is leaking then it is difficult to do maintenance work without stopping the production. When the insulation get damaged due to any reason, it is possible to attend it without stopping the production since insulation is fixed externally.

Only precaution is to be taken if the pipe line or equipment is at high temperature.

e.g. suppose there is a steam trap in a pipe line. If we desired to replace a steam trap, we can close valve 1 and 2 and open 3 & divert the fluid through by-pass line. After replacement of the steam trap close valve 3 and open 1 & 2. Thus it is possible to attend maintenance jobs in the line without stopping the production.

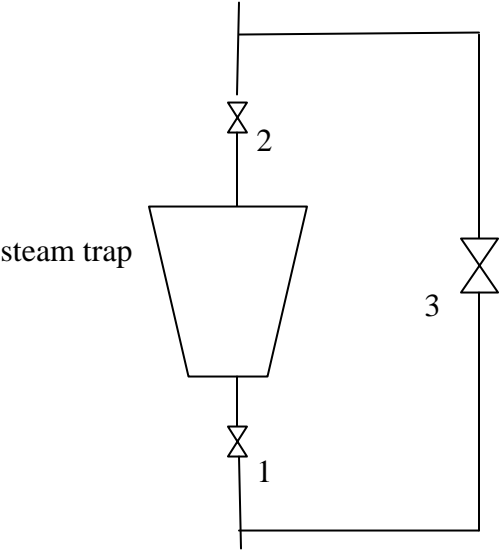


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	 <p>steam trap</p> <p>Any other example given by the student should be considered</p>	
3	Answer any 4	16
3-a	<p>Safety audit is a proactive process by which an organization is able to continually evaluate and monitor the progress of its safety and health programs. Audits are designed to rate an organization's total safety and health program, identify its strength and weakness, show where improvements are needed, and obtain commitment and target dates for correcting problems.</p> <p>Objectives are:</p> <ol style="list-style-type: none">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	4





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	impediments which may result in personal injuries, property damage or business interruption.	
3-b	<p>Predictive maintenance:</p> <p>Predictive maintenance makes use of human sense or other sensitive instruments such as audio gauges, vibration analyser, amplitude meter , pressure , temperature and resistance strain gauges etc. to predict trouble before the equipment fails. Unusual sounds coming out of a 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 an equipment without fear of failure.</p>	4
3-c	<p>Diagram of personal protective device(any 4)</p> <div style="display: flex; justify-content: space-around; align-items: center;"><div style="text-align: center;"><p>Helmet</p></div><div style="text-align: center;"><p>hand gloves</p></div></div>	1 mark each



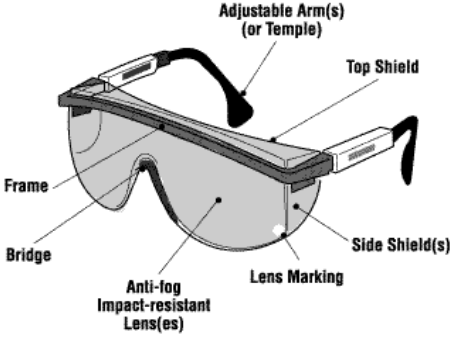



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	 <p>Ear plug</p>  <p>Apron(suit)</p>  <p>Goggle</p> <p>Adjustable Arm(s) (or Temple)</p> <p>Top Shield</p> <p>Frame</p> <p>Bridge</p> <p>Anti-fog Impact-resistant Lens(es)</p> <p>Lens Marking</p> <p>Side Shield(s)</p>  <p>Safety shoes</p>	
3-d	<p>Precautions taken against electrical hazards:</p> <p>The danger of injury through electrical shock is present whenever electrical power is used.</p> <ol style="list-style-type: none">1. All electrical should be adequately insulated, grounded or isolated to	1 mark each for any 4



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	<p>prevent bodily contact with any source of dangerous potentials.</p> <ol style="list-style-type: none">2. To prevent electrical shock, ensure that all equipment are properly grounded.3. To reduce the risk of shock, do not contact any electrical components, and keep the work area dry.4. Check all equipment regularly and wear the proper protective equipment when working with high voltages or currents.5. The primary effects of electrical shock are 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 electrical current is relatively high, the amount of current necessary to kill a person is small. Therefore it is easy to exceed lethal levels of current flow, especially if the skin is broken, wet or damp with sweat.	
3-e	Dry chemical powder fire extinguisher:	4



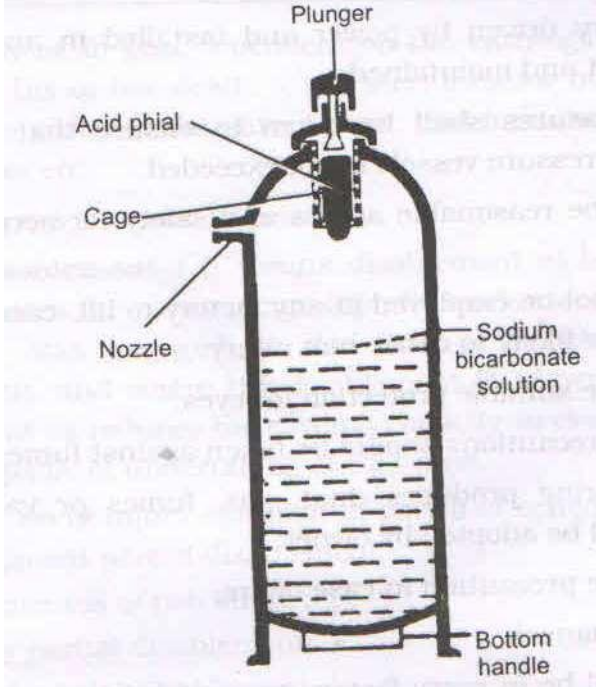
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3-f	<p>Safety precautions in the transportation of flammable liquids:</p> <ol style="list-style-type: none">1. Inflammable liquids shall be transported in rugged pressure resistant safety cans.2. Original containers of inflammable liquids shall be 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 are on an appropriate cart.4. Before transportation details of the packing requirements should be obtained from the hazard data sheet. The packing group for which the chemical	1 mark each for any 4



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	belongs will decide the amount which can be transported at any one time.	
4-A	Answer any 3	12
4A-a	<p>Preventive maintenance.</p> <p>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.</p> <p>The principle of preventive maintenance is that prevention is better than cure.</p> <p>Preventive maintenance involves.</p> <ol style="list-style-type: none">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 the 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.	4
4A-b	<p>Principles of Materials handling includes:</p> <p>i) Planning Principles: In this material handling should be planned and well integrated with production activity to obtain maximum overall operating efficiency.</p> <p>ii) Operating Principles: It includes</p> <p>a) Unit load handling principle:</p>	1 mark each for any 4



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<ul style="list-style-type: none">• Material should handle in bulk over distances.• Fragile or breakable materials should be arranged in trays or in layers separated by wood or card board, the whole being held by strapping. <p>b) Gravity Principle : It suggests that</p> <ul style="list-style-type: none">• Material wherever possible should be moved using most economical gravity (motive) force. <p>c) Flow of materials Principle: According to this material handling efficiency is the greatest when it approaches steady flow of materials, in as straight as possible with minimum of interruptions and minimum of back tracking.</p> <p>iii) Equipment principles: It includes mechanization principle, terminal time principle, dead weight principle, standardization principle, maintenance principle, speed principle & versatility principle</p> <p>iv) Costing Principles:</p> <ul style="list-style-type: none">a) Equipment selection principle:b) Replacement principle: Material handling cost is the lowest if the equipment is used only for its economic retentive period and is replaced by an alternative based on engineering economic principles.c) Handling cost appraisal principle: Periodic analysis of materials handling costs highlights areas of improvements. <p>v) General Principles :</p> <ul style="list-style-type: none">a) Safety principle : Materials handling efficiency increases as working conditions are made safer and safer.b) Training principle This principle suggest that each employee should be given basic training in material handling techniques.	
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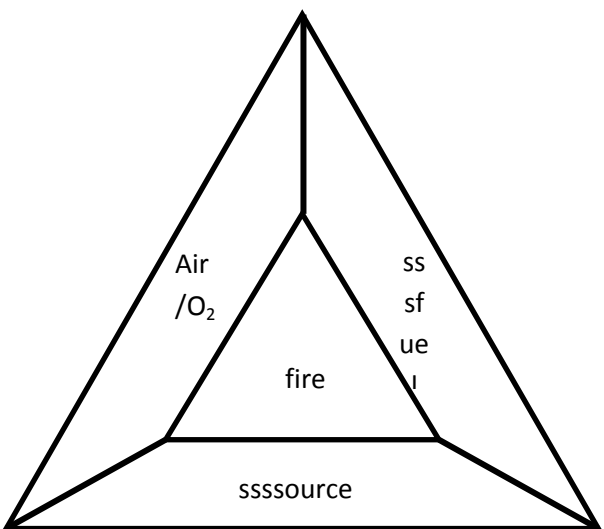


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	<p>c) Identification principle: Material must be kept identified by labeling on pallets and boxes.</p> <p>d) Location principle: All handling equipment should be placed at the right place and at the right time to avoid hunting and delays in materials handling.</p> <p>e) Material treatment principle: All types of materials should be treated as important since material handling costs are not related to the cost of materials.</p>	
4A-c	<p>Fire Triangle:</p> <p>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.</p> 	2



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	<p>Principle of fire extinguishing:</p> <p>Fire may be extinguished by withdrawal of flammable contents, interrupting flammable flow, isolating fuel from air, heat removal to below reaction temperature.</p> <p>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.</p> <p>Isolation of flammable flow from the air is accomplished by blanketing with steam or water spray, foam, CO₂ etc.</p>	2
4A-d	<p>Classification of explosives :</p> <p>Explosives are divided in to eight classes.</p> <ol style="list-style-type: none">1. Class 1 – Gun powder (KNO₃, C&S)2. Class 2 – Nitrate mixture3. Class 3 – Nitro compound class4. Class 4- Chlorate mixture class5. Class 5 – Fulminate class (with C, N₂& O₂)6. Class 6 – Ammunition class7. Class 7 – Firework class8. Class 8 – Liquid oxygen explosive class <p>OR</p> <p>Classes of explosive are :</p> <ol style="list-style-type: none">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	4



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	<p>moderate explosion risk, but not the risk of mass explosion.</p> <p>3) Category Z: Those explosives which have a mass explosion risk and major missile effect.</p> <p>4. Category ZZ: Those explosives which have a mass explosion risk and minor missile effect.</p>	
4-B	Answer any one	6
4B-a	<p>Functions and responsibilities of plant maintenance department: 1) Inspection 2) Engineering 3) Maintenance 4) Repair 5) Overhaul 6) Construction 7) Salvage 8) Clerical work</p> <p>1) Inspection:</p> <p>i) Inspection of the plant facilities to examine their condition and to check for repairs needed.</p> <p>ii) Inspection to ensure the safe and efficient operation of plant equipment and machinery.</p> <p>2) Engineering :</p> <p>i) Engineering involves alternations and improvement in existing plant equipment to minimize breakdown.</p> <p>ii) Engineering and consulting services to production supervision.</p> <p>3) Maintenance :</p> <p>i) Maintenance of existing plant equipment.</p> <p>ii) Engineering and execution of planned maintenance, minor installations of equipment building and replacements.</p> <p>4) Repair:</p> <p>i) To carry out corrective repair to alleviate unsatisfactory conditions found</p>	1 mark each for any 6



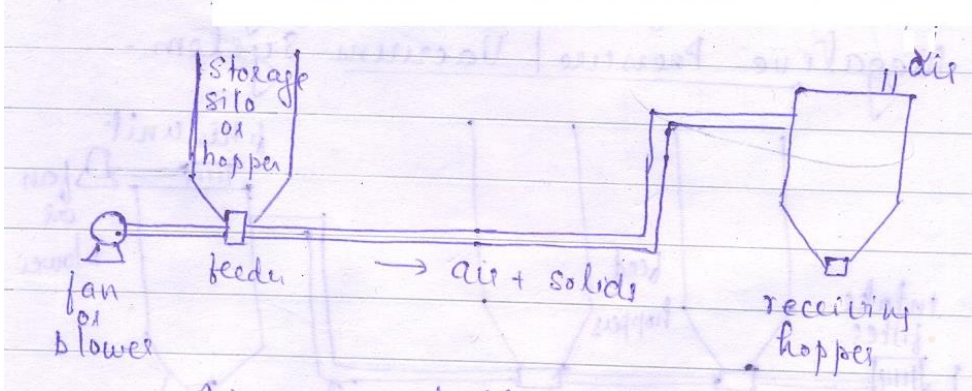
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	<p>during preventive maintenance inspection.</p> <p>5) Overhaul:</p> <p>i) Overhaul is a planned, scheduled reconditioning of plant facilities such as machinery etc.</p> <p>ii) Overhaul involves replacement, reconditioning, reassembly, etc.</p> <p>6) Construction :</p> <p>i) In some organization, maintenance department is provided with equipment and personnel and it takes up construction job too.</p> <p>7) Salvage :</p> <p>i) Maintenance department may also handle disposition of scrap or surplus materials.</p> <p>8) Clerical work:</p> <p>i) Maintenance department keeps records at i) of costs, ii) of time progress on jobs pertaining to important features of building and production equipment.</p>	
4B-b	<p>Pneumatic conveyor:</p> <p>Positive Pressure:</p> 	3

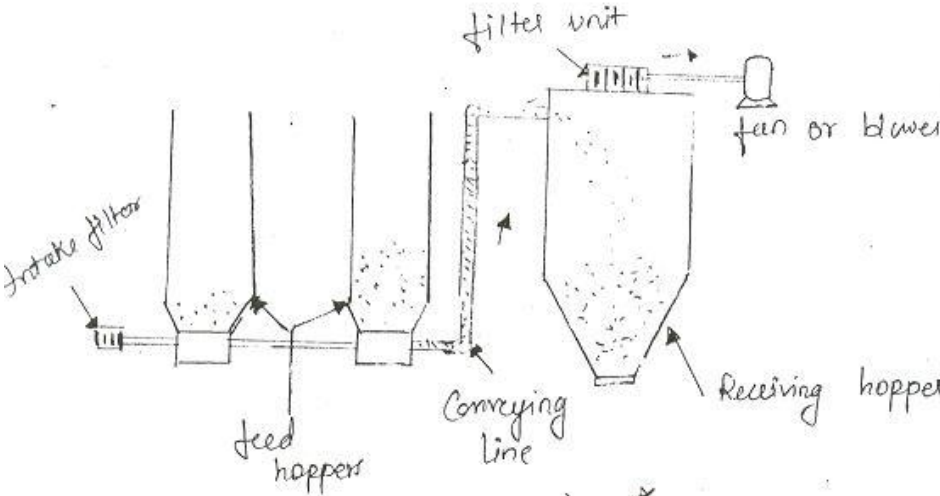


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	<p>Negative Pressure or Vacuum Systems:</p> 	3
5	Answer any 2	16
5-a	<p>Construction & Working of Soda Acid type Fire Extinguisher :</p> <p>Construction : In soda acid fire extinguisher the material used are dry chemical, bicarbonate of soda designed 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.</p> <p>Working:</p> <p>When the plunger is struck, it breaks the acid bottle. The sulfuric acid and the sodium bicarbonate solution react together to release CO₂ gas. The gas generated creates pressure, which forces the water out of the extinguisher nozzle. Before using these extinguisher, it is advisable to check whether these extinguishers are upright type or turn over type. Direct the jet at the base of the fire and sweep it across the area of fire. Attack a vertically spreading fire at its</p>	3 marks for construction on 3



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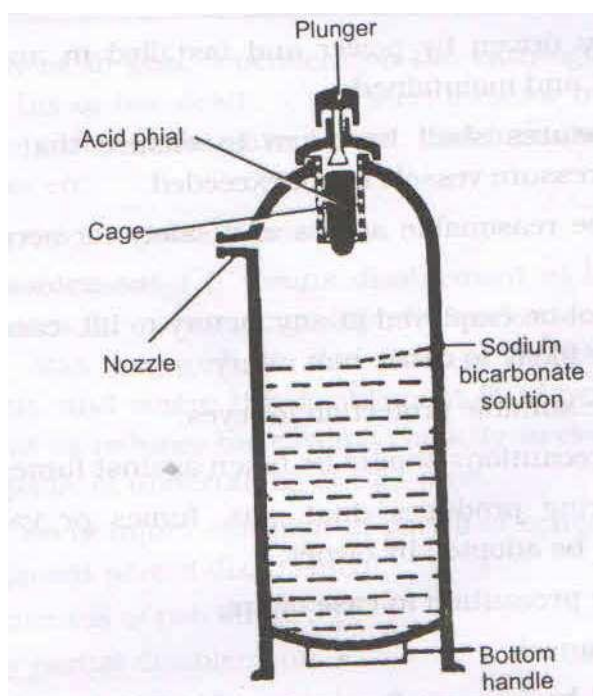
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lowest point and follow it up. Search out for hot spots and ensure that the fire is completely extinguished and that it is not smouldering.



2

5-b

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

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	<p>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.</p> <p>2. When plant is stopped for annual major shutdown, then the procedure to be followed for start- up of a plant is</p> <p>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.</p> <p>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 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</p> <p>Plant shutdown</p> <p>When plant is stopped for annual major shutdown, then the procedure to be followed for start- up of a plant is</p> <p>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</p>	<p>4</p>
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	<p>equipment in total.</p> <p>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 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</p>	
5-c	<p>Shutdown maintenance :</p> <p>Shutdown maintenance is the maintenance work carried out when machine, equipment or plant is not working or is shut down.</p> <p>During shut-down maintenance generally chemical plants are closed half yearly or yearly for carrying out major maintenance work of total plant equipment. The sugar cane factory is stopped, once the sugar cane supply is over. During shut down of the plant, maintenance work like changing of parts, lubrication, overhauling of all the equipment in the plant, cleaning of equipment and plant are done. Maintenance department and process plant people are involved in the process.</p> <p>Important steps in shutdown process are :</p> <ol style="list-style-type: none">1) Identify material storage and laydown areas .2) Designate equipment wash areas.3) Establishing crew- marshalling areas in the event of an emergency .4) Determine what lunch, lavatory and change room facility requirements are required. <p>.Planning and scheduling are concurrent activities for shutdown.</p>	4

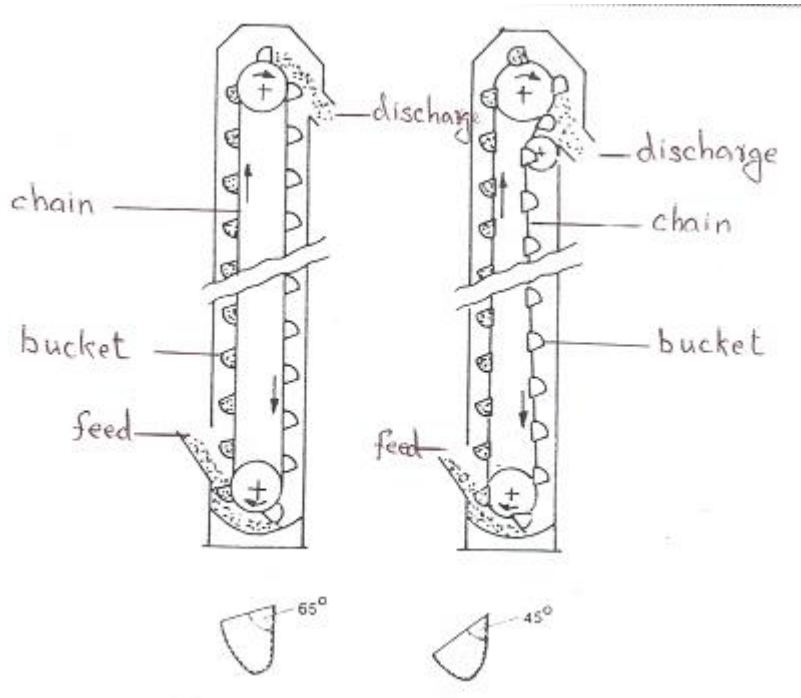


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Subject code

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6	Answer any 2	16
6-a	<p>Bucket elevator</p>  <p>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 bucket which is dumping as it rounds the head pulley.</p> <p>Working:</p>	3



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	<p>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.</p>	2
6-b	<p>Air Supplied Type:</p> <p>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-</p> <p>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.</p> <p>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.</p> <p>Self Contained Breathing Apparatus: These are designed to supply complete respiratory protection is any concentration of toxic gases or even in environment deficient of oxygen. These are mainly of three types.</p> <ul style="list-style-type: none">c. With compressed air or oxygen cylinderd. Oxygen rebreathing or recirculating typee. Oxygen regenerating type	4
6-c	<p>(i) Scheduled maintenance:</p> <p>Scheduled maintenance is a stich-in-time procedure which is aimed at avoiding breakdowns. Breakdowns can be dangerous to life and hence should be</p>	4



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<p>minimized.</p> <p>This method of maintenance incorporates inspection, lubrication, repair and overhaul of certain equipments 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.</p> <p>(ii) Sources and protection of noise hazard:</p> <p>i) Reduction at source: wherever possible it would be advisable to reduce the noise at the source itself. eg change the bearings if it makes noise due to wear.</p> <p>ii) Vibration isolation: In case of machine like reciprocating compressors and power presses, the mechanical vibrations are transmitted through the structures, walls and the floor which increases the noise level at the workplace. Reduction of noise levels can be achieved by,</p> <p>a) Using vibration resilient mounts to fix the machine to foundations.</p> <p>b) Special heavy foundations with a large weight compared to the weight of machine.</p> <p>iii) Vibration Damping: Machine parts, ventilation duct cause noise in this manner. The noise in these cases can be reduced by damping- by stiffening the member.</p> <p>iv) Silencers: Where noise due to movement of gases or air is the problem, silencers are the right solution. Silencers can be used at the inlet/outlet of compressors, exhausts, release of steam and gases and pressure relief valves of pneumatic machines.</p> <p>v) Noise insulation: It may be necessary to insulate the source from all the sides although insulating two or three sides also give reduction of a lower degree.</p>	<p>1 mark each for any 4</p>
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	<p>vi) Noise absorption: Noise absorption material, normally soft and porous, prevent reflection of noise and also convert some of the noise energy into heat energy.</p>	
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