Element 1

WORKPLACE HAZARDS & RISK CONTROL

Office workers are to relocate to new premises. Excluding welfare facilities, outline factors associated with new workplace that should be considered when reviewing the health and safety requirements of the workers.

Factors to consider when reviewing health and safety requirements of office workers relocating to new workplace would be space sufficient enough for the workers to move around with respect to meeting the demands of the job to be performed; Seating arrangements available to workers where possible and such seating arrangements shall be stable and provide good lumbar support along with foot rest if required; Ventilation requirements such as availability of clean and fresh air sufficient enough for the number of occupants with no other contamination; Lighting where possible natural lighting supplemented with artificial lighting with no flicker, glare or velling reflection on tables and display screens, avoiding shadows on vulnerable points such as access, sufficient il-luminance and no significant changes in level of luminance between adjacent areas, availability of emergency lighting; Temperature comfortable enough for the sedentary nature of work performed by office workers (not below 16 degrees); Noise and Vibration if present are adequately controlled; Suitable and sufficient means of access; provision of escape route and sufficient exits that are well designated and lit with uninterrupted power supply.

Outline precautions that should be taken in order to minimize the risks to persons working at sub-zero temperature in cold stores.

Persons working at sub-zero temperature in cold stores are at greater risk of Hypothermia (body core temperature falling below 35 deg.), Frost bite, Necrosis, Freeze burns, Slippery-icy floor, etc., This precautions required to minimize the above risks are having pre-selection medical examination done to identify known aliments that enhances their risk, avoiding draught in the cold stores to prevent flow of breeze; facility to open the access door from inside the cold store if a person is trapped inadvertently inside; means of raising an alarm from inside if a worker is stranded inside the store; Acclimatizing the workers gradually to adapt to climate (Sub-zero temperature); reducing the frequency and duration of exposure with adequate job rotation; Providing of refuges with warm habitat, where possible; arrangement for remote monitoring such as CCTV surveillance; Arrangement for health surveillance; availability of warm food and drinks; provision of warm woolen clothing with adequate face cover (Balaclavas) and slip resistant boots; Training to workers to keep their body warm and to identify early symptoms of medical/ill-health conditions.

(a)Identify 4 hazards that cause Slips and Trips

There are many reasons why people slip or trip, including the floor being poorly maintained with damage to carpets, linoleum and tiles; Changes in level caused by ramps, slopes or kerbs; Slippery causes by oil or water with the spillages being left in place and not cleaned up; ice and snow; highly polished surfaces such as marble or slate; dusty surfaces; Insufficient lighting/shadows (environment); and general obstructions in walkways such as trailing cables, pipes and uncleared rubbish.

(b) For the hazards identify above, outline measures that can be used to control the risk.

Control measures that might be used to reduce the risk of slips and trips include providing designated walkways where possible and maintain the surface condition of the walkways; replacing damaged carpet, linoleum and tiles; using anti-slip flooring materials; highlighting changes in level with hazard warning strips; providing good lighting; introducing procedures for cleaning up liquid spillages and dust, debris and waste; introducing a regime of regular inspection and encouraging the wearing of appropriate footwear.

Identify the control measures that could be implemented to reduce the risk to pedestrians in areas where vehicles are manoeuvring.

Where vehicles are manoeuvring, there shall be control measures to segregate pedestrians from vehicles, such as the provisions of barriers and fencing; site rules which are strictly enforced; the issue of instructions to drivers; and the provision of instruction and training to pedestrians on the precautions that must be observed.

When segregation is not possible, measures to reduce the risk to pedestrians include: the provision of designated safe crossing points and refuges; fitting vehicles with audible or visual alarms for example to give warning of a reversing operation; the use of a banksman to ensure safe vehicle movement in areas where pedestrians are likely to be present; ensuring a good standard of visibility by the provision of mirrors, transparent doors and CCTV; the introduction of a speed restriction on vehicles; the use of trained and authorized drivers particularly for forklift trucks; the provision and use of high visibility personal protective equipment; and the provision of a good standard of lighting which avoids the possibility of glare.

Repair work is to be carried out on the roof of a school.

(a) **Identify control measures to reduce the risk to roof workers** – The control measures required to reduce risk to roof workers would be providing roof edge barriers – installing guard rails; providing safe means of access including reaching heights; providing crawling boards/roof ladders when working on pitched roof; identifying and covering roof lights (fragile surfaces); facilities to raise/lower materials; carrying out survey for overhead hazards including power lines – maintain safe distance if possible or isolate or provide sleeves; provide safety harness and competent persons for work; restrict/prohibit work on severe/adverse weather.

(b) **Identify two control measures to reduce the risk to other persons**. – Control measures to reduce risk to others (vulnerable group – school children, their parents, teachers and staff) include providing on pedestrian passages; area underneath roof and immediate vicinity to be cordoned off and access controlled with signage's and barricading; appoint sentries to monitor/patrol the area; Issue circulars to alert staff and created awareness.

Outline reasons why a person could be injured while using a mobile elevated working platform (MEWP)

A person could be injured while using a mobile elevated working platform (MEWP) due to falls from the working platform; struck by objects falling from the working platform; when trapped underneath a MEWP that has collapsed or toppled; due to contact with overhead power lines; when hit by any slung load; when

the cradle / platform carrying a person collide with nearby structure perhaps due to erratic or unauthorized operation.

Outline precautions to reduce the risk of injury when using MEWP.

The precautions required to reduce risk of injury when using MEWP would be vehicle sited on the firm stable ground with sufficient clearance from obstructions and overheads when operating; inspecting the equipment before use and to ensure it is in a good state of repair; using only competent workers; using outriggers and brakes; erecting warning signs and barriers to avoid collisions; ensuring the platforms is not overloaded; wearing a full body harness; suspending or stop the work during adverse weather. Third party tested and certified equipment shall only be used. Competent supervision shall be ensured. Emergency rescue procedure is available to be prepared in case of any emergency.

Identify eight safe working practices that should be considered to reduce risk when using mobile tower scaffold.

To reduce risk when using mobile tower scaffold, the following safe work practices shall be followed:

- Guard rails must be fitted to the work platform
- Wheels should be locked and turned outwards, when the tower is in use
- Tower must be sited on firm, level ground
- Outriggers should be used where necessary to ensure stability
- Tower must not be overloaded
- People and materials should not remain in platform when the tower is moved
- Care should be taken to avoid overheads when the tower is moved
- People should climb up using ladder through the inside of the tower
- Tower must be built by trained workers

Identify Safe work practices for the use of mobile elevated working platform

Safe work practices while using mobile elevated working platform would be vehicle sited on the firm stable ground with sufficient clearance from obstructions and overheads when operating; inspecting the equipment before use and to ensure it is in a good state of repair; using only competent workers; using outriggers and brakes; erecting warning signs and barriers to avoid collisions; ensuring the platform is not overloaded; wearing a full body harness; suspending or stop the work during adverse weather. Third party tested and certified equipment shall only be used. Competent supervision shall be ensured. Emergency rescue procedure is available to be prepared in case of any emergency.

Emergency rescue procedures should be considered when planning work at height. (a) Give reasons why a person may need to be rescued when working at height.

Emergency rescue procedures need to be developed for reasonably foreseeable events where workers might become trapped whilst working at height such as, for example, cannot climb back after falling on to a safety net or when suspending on a safety harness. Workers if not rescued when trapped or stranded, will

be in a state of panic and might suffer both psychologically and physiologically. Mainly the delay in rescue, when they are suspended on the safety harness for a reasonably prolonged time, might well lead to a medical condition termed as 'Orthostatic intolerance' or 'suspension Trauma'.

Emergency rescue procedures should be considered when planning work at height. (b) Identify methods that could be used to rescue a person when working at height.

The method that could be used to rescue a person when working at height may well be simple, such as putting a ladder up to a net and allowing the fallen person on the net to descend. Other options such as use of Mobile Elevated Working Platform (MEWP), use of a 'Man Basket' suspended in a Mobile Crane or other proprietary rescue systems may also be explored. Whatever may be the method selected, there shall be arrangements in place capable of rescuing stranded worker at height safely and early as possible. Those who are involved in rescue operations should also be trained in the procedures and the equipments needed are available and kept standby in the work locations.

Excavation Work is being carried out on a Construction site. Identify the control measyres needed to rescue the risk to workers.

Control Measures needed to reduce risk to workers whilst carrying out excavation work on a construction site are as follows:

To prevent contact with buried service – their exact location shall be determined by safe means, such as consulting layout drawings, scanning with detection equipment or making trial pits. On identifying their presence, remove soil in the immediate vicinity by hand excavation and also provide adequate support to exposed underground services from getting damaged.

To prevent cave-in and a worker getting trapped or behind alive – excavation sides shall be appropriately supported with timber or aluminium – hydraulic shores or using trench boxes. Alternatively, the sides shall be battered / sloped to required angle of repose or provided with suitable steps (benching techniques). Water accumulation due to rain or ground water would also make the soil loose, hence appropriate dewatering system shall be rigged up kept standby ensuring prevention of possible re-entry of water pumped out.

To prevent fall of men into excavation – provide edge protection to open sides and ends of excavation using hard barrication with appropriate signage. Night shift works shall have additional controls such as adequate illumination and blinkering amber lamps are to be attached to guard rails. Ladders, temporary stairways or ramps shall be provided to prevent fall while gaining access. Walkways fitted with guard rails shall be provided at designated cross points to prevent falls.

To prevent struck-by falling material and vehicle over-run-install toe-boards and if necessary nets and screens onto guard rails. Area in the immediate vicinity (for atleast 1 mtr from edge of excavation) shall be surface encumbrance. Stop logs to be installed to prevent vehicle over-run and trained banksman shall control the vehicles reversing.

To prevent exposure to likely hazardous atmosphere inside deep excavation – a competent person shall carryout gas testing using calibrated detectors and issue a gas free certificate. Ventilation arrangements and emergency rescue arrangements shall remain standby as necessary.

Additionally, workers are to provide with appropriate PPE, instructions and training; excavations inspected by competent person before work starts and during the shift as and when necessary; water sprinkling arrangements for dust suppression; and obtain a permit-to-work and comply with conditions to ensure safe excavations.

Outline precautions that should be taken in order to prevent electrical contact when
(a)excavation near underground cables

The precautions to be taken to prevent electrical contact with underground cables during excavation are as follows:
Primarily locating the exact positions/depth where the cables are buried by referring drawings or using detection system; isolating the power supply to cables, where possible; taking care to avoid damage to the cables such as not using earthmovers ; removing the soil in the vicinity of the underground cables by hand excavation using insulated implements/tools; providing adequate support to cable exposed from soil thereby preventing damage/electrical contact; cordoning off the area with adequate sign boards to caution and exclude workers from gaining access. The activity shall be controlled with a permit-to-work.

(b)Working in the vicinity of overhead power line

Where work has to be carried out in the vicinity of overhead power lines, the power supply to overhead power lines shall be isolated if possible; otherwise sleeves made of insulating materials shall be fixed on them. Access to the area shall be controlled with adequate barricading and security arrangements. Goal posts are to be erected to enforce height restrictions on moving equipment and vehicles. Adequate care would be required while carrying poles and other tall components, such as ladders made of fiber plastic or wood shall only be used. Adequate sign boards are to be placed and workers shall be informed in tool box meeting, about dangers in working near overhead power lines. The work has to be closely supervised.

Identify the main hazards associated with demolition workers (or) Outline the main hazards that may be present during the demolition of a building.

The main hazards associated with demolition workers are falling debris, masonry; Premature collapse of building; Falls from height or on the same level; Services (Electricity, gas and water); Contact with live overheads and buried services; Explosion and fire; Chemical contamination – Lead dust, silica dust, asbestos, gases vapors and fumes; Biological – weils disease, hepatitis (syringes) sewage contamination; Manual handling e.g. Strains, fractures; The use of explosives; Movement of Vehicles; collisions with heavy plant, plant toppling over; Noise and vibration e.g. Heavy plant, pneumatic drills, power tools.

Identify precautions that should be considered to prevent accidents to children who may attempt to gain access to construction site.

The site shall be secured against unauthorized access from children by taking following precautions:

- Provide robust perimeter fence and signs
- Security gates provided at all site access points and manned 24 hrs by security staff
- Good lighting on the site and on the perimeter, with CCTV surveillance at vulnerable points
- Secure all mobile plant
- Remove ladders from scaffolds
- Secure all chemicals in locked storage
- Secure all portable equipment in locked storage
- Cover off or provide barriers for excavations

In addition it can be useful to liaise with local schools to promote safe behavior.

The influence of drugs on workplace can have a significant effect on health and safety.

(a)Identify the possible reasons why a person may be in possession of drugs in the workplace.

The possible reasons for a person to be in possession of drugs in the workplace would be:

Addiction – Drugs are additive and narcotic that significantly impairs the senses and reaction times.

Prescription – Certain drugs are legal and medically prescribed by doctors such as pain killers and hence workers may have access to and be in possession of them in workplace.

Overcome Fatigue – Persons engaged in strenuous work may consume drugs to overcome body pain and fatigue.

Overcome Stress – workers under stress perhaps due to existence of interpersonal issues such as harassment, bullying or conflicts may be possession of drugs.

(b)Outline control measures that an employer could take in order to reduce the misuse of drugs in the workplace.

An employer should establish a clear 'drugs and alcohol' policy that restricts access to alcohol and drugs in the workplace, prohibits worker from being under the influence of drugs. Employer need to identify symptoms of drugs misuse by worker such as sudden mood changes, unusual irritability or aggression, poor time keeping, increased short-term absence etc. Employer shall arrange for drug screening and when found a drug addict worker, shall resort to rehabilitation and treatment. Employer shall have arrangements for disciplinary action on those who refuse assistance or refuse to be tested. Employer shall arrange for provision of information, instruction and training to workers, supervisors and managers on drug abuse and its effect on individual's health as well as organization. Drug and alcohol awareness campaign should also be considered.

Identify the factors to be considered when assessing the adequacy of lighting within an open plan office.

The factors to be considered when assessing the lighting requirements of an open plan office include whether sufficient light (illuminance of task) as indicated by local codes of practice (500 lux for works requiring perception of fine details – HSG 38) is available; whether lighting causes glare, flicker and/or

stroboscopic effects; whether lighting avoids veiling reflections; whether allows people to properly see and discriminate between colors; whether lighting design take account for constraints imposed by the layout of the workplace, for example, an open-plan office large with large windows will have different lighting requirements with small individual offices with few windows; whether furniture and equipment in an open-plan office cause excessive differences in the illuminance between areas – lighting design needs to allow for this; whether suitable for the environment and the type of work, for example not located against the surface of material that may be flammable (paper etc); whether localized lighting with local controls is provided as appropriate; whether it is suitable positioned that it may be properly maintained and replaced; whether emergency lighting is provided.

Element 2

TRANSPORT HAZARDS & RISK CONTROL:

1. **Forklifts are operating in a Busy workplace?**
   Identify control measures to reduce risk of collision with workers.
   Control measures required in a workplace to reduce risk of collision by forklift truck with workers include segregation of vehicles and pedestrians (by fixing physical barriers where possible or with appropriate floor marking),appropriate road marking with fluorescent signs ,maintaining good visibility (mirrors,lightings,etc..) audible warining on vehicles ,fitment of speed limiters on forklift truck,drawing up and enforcement of site rules ,provision of refuges/safe havens ,height of the load should not obscure driver's vision , wearing of high visibility clothing, good standard of house keeping , appropriate training and adequate supervision .
2. **Outline the specific hazards associated with the use of battery – powered forklift trucks & identify the precautions necessary in each case?**

   Following hazards are involved in battery powered FLTs and hence will require measures mentioned against each .
   CHARGING/RECHARGING : The battery charging area are to be kept well ventilated , no smoking or naked light in that area as the charging process evolve out hydrogen gas which is highly inflammable.
   CORROSIVE ACIDS : Suitable Personal Protective Equipment like Rubber gloves (Chemical grade – non soaking , Goggles and face shields etc.., to be worn strictly during battery charging/recharging which has to be done by approved / competent person only including the electrolyte topping up process .Additionally eye wash/shower arrangements are to be made available near battery charging area.
   SHORT CIRCUITS: To guard against short circuits / shock hazards, Insulated tools are to be used as well as the electric circuits are to be well maintained at all times by competent electrician .
   Lastly battery – powered vehicles are quiet – silent running , so to overcome collision hazard and caution people working in vicinity , all personnel to wear high visibility vest /jacket and the vehicle to be fitted with horns and reverse alarm and revolving warning light on top.

3. **Identify the precautions that may be needed to reduce the risk to pedestrians in area where forklift trucks are operating.**

Where forklift trucks are operating, the following precautions will be required:

Pedestrians are to be segregated from forklift trucks by planning separate routes including floor marking for pedestrians as well as forklifts. Workers are to be provides with high visibility clothing. There shall be clearly marked /signed routes with adequate illuminations. Sharp bends shall be avoided. Gangways provided shall be suitably sited having sufficient width and required clearance without obstructing the forklift movement. Speed limits shall be enforced and forklifts trucks are to be fitted with speed limiters (governor). There shall be clear direction signs and door marking to guide an unknown / unaware pedestrian (visitors). The floor conditions must be good(shall have gentle gradients) and maintained free of contamination to prevent skidding . Sufficient parking arrangements and space would be required to avoid reversing .Pedestrians including new visitors to the area are to be made aware and altered of the hazards present.

4. **Outline eight Precautions that should be taken when testing a forklift truck unattended ?**

The precautions required for leaving a forklift truck unattended are as follows :

- Park away from other vehicles on a firm, level space.
- Do not obstruct a traffic rule.
- Do not obstruct a pedestrian rule.
- Do not obstruct emergency escape route.
- Apply the hand brake.
- Lower the fork on the floor and tip the mast forward.
- Switch the power off after bringing the controls to neutral position.
- Remove the key and return it to a responsible person to prevent unauthorized use.

5. **Outline Factors that should be considered when assessing the risk of an incident while driving at work.**

The factors to be considered when assessing the risk of an incident while driving at work are as follows:

Distance travelled - Persons driving long distance may drive long periods without a break and hence are at more risk.

Driving Hours – In order to get to the destination faster , drivers may be tempted to drive for a long period without break , even during odd hours and thus increases the risk of an incident due to fatigue and lapses of attention.

Work Schedules – Poor planning and unreasonable work schedules that don't allow adequate time between trips can cause drivers to take risks.

Stress – Heavy traffic conditions and road works can cause stress to drivers.

Weather Conditions – Adverse weather conditions such as poor visibility , Fog effects, Snow effects , High winds can increase risk of an incident.

Driver Competency – Holding of valid driving license , Adequate experience and appropriate training are important factors to be considered.

Driver fitness – Whether has undergone medical examination, and be passed as fit.

Vehicle Suitability – Whether Suitable for intended purpose and provided with safety equipment such as seat belts ,airbags ,head restraints, emergency triangle , fire extinguisher & First-aid Kit.

Ergonomic Considerations – Adjustability of seat position and vehicle controls to ensure driver comfort and minimize fatigue.

6.(a) Outline reasons why a vehicle may not be able to stop effectively ?

The reasons for a vehicle not stopping effectively could be due to contaminated road conditions following adverse weather such as road is slippery perhaps due to snow or rain ; Inadequate maintenance resulting in brake failure perhaps due to non replacement of worn brake shoes or mechanical failure of break mechanism, Inadequate inspection that results in failure to replace tyres with worn threads, Insufficient reaction time perhaps due to sudden appearance of a person associated with over speeding of a vehicle , failure to respond immediately by the driver perhaps due to incompetency or driving under the influence of alcohol or using mobile phones while driving.

(b) Outline activities associated with vehicles when they are not moving could result in risk of Injury.

Activities associated with stationed vehicles that could result in injury would be :

LOADING : Manual loading can create risk of Manual handling injuries , while mechanical loading perhaps using forklift truck can increase risk of collision .

UNLOADING : Flipping operations can result in risk of overturning or people being struck by the tipped material.

SECURING : Workers require to climb up onto a vehicle to secure the load or to close hatches in case of a tanker has an increased risk of injury due to fall.

COUPLING : Attaching trailers to the vehicles has the risk of collision and crushing.

MAINTENANCE WORK : Mechanics may have to work at height or under the vehicle and may required to work in awkward postures.

7.A new vehicle route is to be provided into the goods delivery area of workplace . Outline features of the vehicle route that could reduce the risk of pedestrians being injured by vehicles.

To reduce the risk of injury to pedestrians , the vehicle route shall have the features such as good design of roads to keep vehicles at a safer distance from pedestrian walkways , provision of barriers for additional

physical protection in some situations (Such as good deliver area)avoiding reversing where possible and if must , shall be controlled by trained banksman, speed limits shall be set and clearly indicated by signage , where required traffic calming measures shall be in a place , crossing points may be implemented to allow the pedestrians to retreat into during vehicle movements , ensuring good visibility for the drivers to have an unobstructed views, Blind spots should be eliminated , area to be well lit for operating in dark areas.

8**. During Redecoration work temporary access is to be provided for office workers through an external storage area where vehicles are operating. Outline the control measures to reduce the risk of injury to the office workers when using this temporary access.**

The control measures to reduce to reduce the risk of injury to the office workers using temporary access routed through external storage cum vehicle operating area include safe stacking of items in external storage that they are stable and would not collapse, height restrictions for stacking that would not obscure vision as well as ensure stability , cordoning off the stacked items in the external storage area with appropriate placard , adequate illumination of area and appropriate citing of luminaries such that they don't create shadows due to stacked items , adequate spacing with stable ground underneath for vehicle movements with arrangements to avoid reversing , sharp bends and gradients , Provision of designated pedestrians walkways , pedestrian crossings in the vehicle manoeuvring area, vehicles operating in the area to be fitted with reverse alarms , horns, etc.., drawing up and enforcement of speed limits for vehicles , Vehicles to be operated by trained operators and controlled by trained banksman ; office workers to be given awareness (toolbox talks) about the hazards present in the temporary access , office workers to be provided with high visibility clothing to wear while using temporary access.

9. Identify factors that may increase the risk of injury to workers who need to walk through a warehouse.

Workers who need to walk through a warehouse are at risk of getting injured by vehicles involved in loading and Unloading of items and may also get injured by collapse of items stacked .The factors that may increase the risk of injury would be not having a designated pedestrian walkway , over speeding of vehicles operating in warehouse such as forklift truck , reversing forklift truck without audible alarm and / or controlled by trained banksman , obstructed vision perhaps due to increased height of stacked materials , inadequate lighting arrangements , overriding safety devices in forklift truck such as speed limiters , unauthorized operations of forklift truck by incompetent persons , poorly maintenance and inspection of vehicles leading to such defects like brake failure, horn not functioning , etc.., items unsafey stacked such as not on stable pallets , not cordoned off , not stacked in a balanced way , excessive height of stack, etc.., inadequate protection of walkways such as spills , trailing cables , obstructions etc.., not highlighting changes in levels in walkways , poor culture such as pedestrians not using walkways , not wearing high visibility jackets perhaps due to inadequate training & supervision.

10.(a) Identify the hazards associated with the use of cement mixer.

Cement mixer is a machine use to manufacture mortars and concrete by mixing different components such as aggregates of different sizes and basically cement. The hazards are mainly de=ue to rotating mixing drum that include.

- Alrborne Powder (Cement)
- Becoming trapped/ entanglement due to lack of protection of the casing (pinch points)
- Blows by moving elements (Impact)
- Electric shocks (when electrically driven)
- Overstrain (Manual Handling)
- The mixer overturning when transported
- Smoke /Fire /Hot exhaust (when engine driven)

(b) Outline Control measures that can be used to reduce risks when using cement mixer.

The Control measures are:

- The mixer is to be situated on a flat , horizontal surface.
- Mobile parts are to be protected by casing.
- Check the state of the leads , lever and accessories regularly as well as the safety devices.
- Never insert arm or a shovel into the drum when it is mixing.
- The casings and other metallic parts of cement mixers are to be earthed.
- They are to be equipped with an emergency stop button .
- Safe storage of petrol and control of Ignition sources.
- The drum should be equipped with a tipping brake to avoid overstrain and uncontrolled movements.
- PPE – Hard hats, waterproof suits , safety goggles and rubber or PVC Gloves.

11. A portable electric sander is being used in the production area of factory.

(a) Identify hazards that may be present

(b) Outline precautions that may be taken to reduce the risk.

(a) The hazards associated with the use of portable electric sander include:
Mechanical hazards such as entanglement (getting wrapped around with rotating abrasive whell), cuts and abrasion (coming into contact with abrasive wheel) and ejection (particles ejected out in the finishing operation and / or ejection of work piece or broken parts of abrasive wheel).
Non mechanical hazards such as noise and vibration while operating and holding in hand , electrical shock due to exposure to indirect or direct contact with electricity , dust arising from the sanding operation and manual handling due to postures that will bbe maintained during working.

(b) The precautions that may be taken to reduce the risk while using portable electric sander are : not carry tool by cord. , never to pull the cord to disconnect , keeping cord away from heat , disconnect when not in use, keeping observers at safe distance , secure work with clamps , avoid accidental starting , use RCD's on electrical tools, maintain good footing and balance , check compability (rpm) of powder tool and abrasive /sanding disc when changing them , wear appropriate PPE (eye & face protection , hearing protection and hand protection); inspect and maintain tools (shall be

subjected to user checks , visual inspection as well as combined inspection techniques- Pat); report defects and remove faulty tools .

12. (a) Identify FOUR hazards associated with Bench – Top grinder .?

Hazards associated with bench – top grinder are :

- Abrasion on contact with rotating abrasive wheel.
- Drawing in at nip – point between wheel & tool rest.
- Ejection of parts of the wheel during normal use.
- Bursting of wheel if heavy load applied.
- Entanglement with the spindle mounting cloth, hair or jewellery etc..,
  Electrical Hazards – eg. Shock due to direct or indirect contact.
- Hot surfaces / parts caused by friction.
- Health Hazards during grinding operations from – Dust , Noise , Vibration .
- Ergonomic Hazards during work .

(b) Other than guard, Outline Four control measures to reduce risks to workers?

Four Control Measures other than guard may be :

- Holding / securing the grinder firmly in its position
- Tool rest adjusted to minimize nip point between rest and wheel
- Provision and use of PPE (impact resistant eye and face protection , hearing protection).
- Installation of LEV to control dust where feasible and requires
- Routine maintenance and inspection including PAT for electrical safety
- Daily check of grinding wheel for cracks/damage
- Avoiding loose clothing to avoid entanglement.
- Job rotation or suitable breaks to minimize/reduce exposure to noise and vibration (If used for Longer duration).

13. a). Identify four hazards associated with the use of photocopier.

The hazards associated with the use of photocopier are:

- Drawing in and entanglement from contact with moving parts
- Electricity with risk of electric shock and fires of electrical origin perhaps due to overloaded sockets or electric sparks.
- Contact with hot parts causing burns
- Health hazards from irritant gas (use of chemicals) evolving from the operation

Element 3

Musculoskeletal hazards & risk control

1.A workers is manually loading boxes of components onto metal shelves

a) Identify four types of injury that worker could suffer while carrying out this risk.

List of potential injuries includes spinal disc compression or prolapsed disc, strains to tendons or muscles, hernia, dislocation or fracture of bones, cuts and abrasions and crushing or impact injuries.

b) Identify factors in relation to the task that could increase risk of injury.

Factors in relation to the task that could increase risk of injury would be :

DISTANCE – to be travelled with the load height of the shelves requiring vertical movements; REPETITON – the need for repetition movements when loading boxes on to shelves; FORCE- the physical force required to perform the task and the strain this puts on the body, perhaps the boxes may have to be pushed or pulled; POSTURE- any requirement to adopt an awkward posture such as bending for picking up, stooping for putting box on to shelves; TWISTING- twisting the trunk when carrying the boxes; REST- work rate that won't allow a worker to rest recover from fatigue.

2. Outline factors that may be considered when carrying out a manual handling risk assessment in relation to : a) LOAD b) INDIVIDUAL

a) factors in relation to load that may have to be considered when carrying out a manual handling risk assessment are weight of the load that it may be too heavy; size and shape of the load that it may be too bulky and awkward, hence difficult to grasp; stability of the load that may have loose contents which may move; rigidity of the load that it may be fragile or soft; outer surface of the load that it may be smooth polished hence difficult to grip; other specific hazards associated with the load that it may be hot or sharp etc..,

b) factors pertaining to individual that are to be taken into account when assessing manual handling risk are gender and age as female mainly pregnant and young persons are more vulnerable ones; physical strength of the individual; stature of the person such as short or lean; health condition of the individual such as pre-existing ailments that aggravate the risk; individual's perception of his limitations; level of training.

3. Outline a good lifting technique that could be adopted by a worker when lifting the load.

A good lifting technique that a worker can follow when lifting the load would be assessing the load that includes its weight, space and size, suitability of gripping, outer surfaces etc.., with respect to his own limitation; positioning of feet (placing one foot front and spread apart as required); bend the knees and keeping the backbone straight; arms have to be close to the body; have a firm grip; lift the object with the help of leg (thigh) muscles; avoid twisting of trunk; look straight (load shall not obscure the vision); move

keeping the load close to the body and rest the load in its destination by bending the knees and keeping the back straight.

4. Give two examples of how a manual handling activity might be avoided.

A manual handling activity can be avoided by using powers equipment (mechanical handling) such as cranes and forklift trucks for lifting and shifting the load; automation of work such as use of conveyor belts; robotics – use of machines to completely supplement manual effort etc.

5. Give the meaning of the term 'Ergonomics'.

The study of the interaction between workers and their work, and is concerned with the design of the workplace, work equipment and work methods with the needs and limitations of the human operator in mind.

6. Identify factors leading to WRULDs.

Factors leading to WRULDs can be related to task being done and the equipment used such as:

REPETITION- the need for repetitive movements when carrying out the task (example –typing for several hours)

FORCE- the physical force required to perform the task and the strain this puts on the body (example – cutting metal wires using pliers)

POSTURE-any requirement to adopt an awkward posture (example –stooping over to pick up)

TWISITING-any twisting action required by the task (example –twisting the wrist when using screwdriver)

REST-work rate that won't allow to rest or recover from fatigue (example- working in-line assembly)

7. Outline the possible risks to health associated with the use of display screen equipment (DSE) (or) Identify the possible health effects that may be caused by the poor ergonomic design of DSE workstation.

Health effects of DSE

1. Musculoskeletal disorders (hand, arm, shoulder & neck)
2. Eye and eyesight problems (temporary visual fatigue)
3. Fatigue and stress (high speed , less breaks, lack of social interaction)

Other minor or alleged health effects

1. Epilepsy (a common chronic neurological disorder)
2. Facial dermatitis (itching , reddening)
3. Radiation on pregnant women –(stress)

8. Identify the main factors to be considered in an ergonomic assessment of a DSE workstation.

Ergonomic assessment of a DSE workstation need to consider factors in relation to equipment and posture such as adjustable height and angle to seat back; good lumbar support; stable chair base (usually with five arms); seat height to bring the hands to a comfortable position on the key board; foot support if user cannot get their feet on the floor –keeping the feet supported prevent excessive pressure on underside of thighs and backs of knees; space for postural change no obstacles under desk(ample legroom)-this allows the worker to fidget and change position as they work; space in front of the keyboard to support hands/wrists during the pauses, a wrist rest can provide further support if required; fore-arms approximately horizontal when hands are on keyboard, minimum extension, flexion or deviation of wrist; screen height and tilt should be adjustable so as to allow comfortable head position.

Factors in relation to environment include good lighting; no distracting reflection; minimise glare (windows); noise to a minimum; comfortable ambience that includes temperature control, air flow (ventilation); no congestion, provision of coffee vending machine etc..,

Other factors in relation to organisation and individual include job rotation, suitable breaks; physical characteristic, training etc.

9. Identify the features of a chair to ensure it is suitable for use at a DSE workstation.

The chairs should be having following features:

Chair to have a stable base, seat height and back should be adjustable to suit different people, the back to provide good lumbar support, there should be arm rest, foot rest to be provide, the chair should be able to be swivelled, tilted and move with ease from one place to another (wheels).

10. Due to DSE use, complaints of neck and back pain in w/place has been reported. Identify the features associated with the workstation that might have contributed to these.

Neck and back pain as a result of DSE use are musculo-skeletal disorders associated with sitting in a fixed position, perhaps with poor posture, for long periods of time. The factors that might have contributed include, in terms seating arrangement, there may not be a chair provided(as is found in some of the billing counters of shopping mall) or the chair provided may not provide good lumbar support; chair may not have arrangement for height adjustment that requires the DSE operator to either look down or up continuously; there may not be a provision for screen height and tilt adjustment that will lead to uncomfortable head position (eye not in line with screen); may be as a result of frequent turning of head perhaps due to incorrect positioning of document holder or there may not be a document holder provided with; frequent usage of phone without headset while using keyboard that requires the operator to hold the phone handset with the support of head and neck; extensive working hours without adequate breaks; work rate imposed that won't allow for regular postural change; and operator's unawareness of these problems perhaps due to lack of training .

11. Outline factors to be considered when undertaking a manual handling assessment of the work undertaken by baggage handlers at large, busy airport.

The factors to be considered when undertaking a manual handling assessment of the work undertaken by baggage handlers at large, busy airport are summarised as follows;

In relation to load, maximum allowable weight of a single baggage; size of the baggage – perhaps bulky and may have inadequate provisions/handle for holding/gripping; stability of the baggage-perhaps may have loose contents that may shift and move the centre of gravity of the load; outer surface of the baggage- may be smooth, sharp etc..,

In relation to baggage handlers, age and gender taking into account restrictions posed by statutes regarding maximum weight that can be handled by a male/female; their physical stature and strength; their vulnerability-young persons, pregnant women etc.., need and level of training; medical examination of new recruits-to identify known ailments; health surveillance programmes- to identify early symptoms and address complaints of backbone problems.

In relation to baggage handling, work rate Imposed(frequency and number of flights visiting airport),volume of passengers handled, number of terminals and vastness of airport(large); distance the baggage to be moved , postures during handling baggage, such as bending, vertical large movements, strenuous pulling/pushing and the feasibility of use of mechanical aids; need for team handling;

In relation to airport environment, adequate illumination for baggage handling during dark hours; floor conditions-uneven, smooth and polished surfaces; noise from idling aircraft engines; generic weather in the airport such as windy, rainy, hot or chilled climate etc..,

12. A goods lift that usually carries meals from the ground floor kitchen to the first floor of a restaurant has broken down. Until the lift can be fixed, workers will have to carry the meals from kitchen to the eating area on the first floor.

Outline factors to consider when undertaking manual handling assessment of this activity.

Structure the answer similar to the answer given above for qn.no.8.

Hints – size of the utensils, no of items in food menu, qty of each item to be prepared, no .of customers visiting, no. of steps to be climbed to reach first floor , & other general point in terms of load, individual, task and environment.

13. In order to minimize the risk of injury when carrying out a manual handling operation

a) Identify types of mechanical aids that can be used to assist the manual handling operation

The different types of mechanical aids that can be used to assist the manual handling operation include trolleys/conventional sack trucks- for shifting loads to a distance; stair climber sack truck- for moving items upward through stairs; suction pads- for gripping loads that have smooth surface such as glass; chain blocks- for lifting heavy loads; ball table and rollers- for moving items horizontally in-line; turn tables- to

avoid over-reaching; keg truck/ drum trolleys- for carrying oil drums; panel lifters- to lift and hold panels for false ceiling works.

b) Other than using mechanical aids, outline ways to reduce risks that could be presented by the load.

Barring mechanical aids, the manual handling risks could be reduced by ways such as splitting heavy loads into smaller lighter loads where possible; team handling for dealing with heavy and larger size load; securing the loose contents of the load to prevent load getting unstable; guarding the sharp edges and concerns of the load with suitable pads; use of appropriate PPE such as suitable gloves for handling hot or cold loads.

Training on good lifting technique such as keeping the back upright, holding the load close to the body etc; adequate break periods are other ways by which the risks of an injury during manual handling operation can be reduced.

14. Outline the precautions that should be taken when using mobile cranes.

The precautions that should be taken when using mobile cranes would be suitability of crane for the task- FOR THE LOAD BEING LIFTED; groud conditions- FIRM AND LEVEL; outriggers- FULLY EXTENTED, BLOCKING PADS PUT UNDERNEATH; obstructions- CLEAR OF STRUCTURAL OBDTRUCTIONS; overhead power lines- KEEP SAFE CLEARANCE; protected area – BARRICADE THE AREA, DISPLAY SIGNAGE; suitable lifting tackle- THIRD PARTY TESTED; correct slinging- QUALIFIED RIGGER / BANKSMAN; competence of personnel- THIRD PARTY CERTIFIE; load near ground if travelling- TO AVOID SWAYING USE TAG LINES; good visibility and communication –ILLUMINATION AND RADIO COMMUNICATION, CLEAR SIGNALS BY BANKSMAN; monitoring wind speed –SUSPEND OPERATIONS DURING HEAVY WINDS/HEAVY RAINS, RAINSTORMS etc.,

15. An engineering workshop uses an overhead crane to transport materials.

a) Identify reasons why loads may fall from the crane.

The reasons for loads falling from an overhead crane in an engineering workshop are failure of lifting tackles – sub – standard or damaged lifting accessories may be used; Overloaded slings – exceeding the lifting capacity/safe working load (SWL) of slings; incorrect slinging – poor slinging method / hitch techniques and /or wrong connections; erratic operation – incompetent rigger / crane operator such as slung load struck to some structure; failure of load bearing parts- defective crane in use perhaps not inspected and certified.

b) Outline precautions that should be taken in order to prevent accidents to workers at ground when overhead cranes are in use.

The precautions that should be taken to prevent accidents to workers at ground level include using a certified and inspected overhead crane and lifting accessories; load securely slung using lifting tackles having adequate capacity; operations controlled by competent persons such as rigger/crane operator should have been assessed by a third party for their competency; load travelling close to the ground; safety devices and trips provided on the overhead crane shall be functional.

Element 4

WORK EQUIPMENT HAZARD & RISK CONTROL

1.Outline four main types of guards and safeguarding devices that may be used to reduce the risk of control with dangerous parts of machinery.

a) Fixed guards have no moving parts, little maintenance is needed, inspection of the moving parts is easier, needs a tool to replace, and no wear and tear, isolated the hazard from human.

b) Interlocked guard is one that is linked to the machine controls by mechanical, electrical, hydraulic or pneumatic means so that the machine will not operate until the guard is closed; and that when the machine is in a dangerous condition, the guard is either prevented from opening or, if it is opened, the dangerous parts of the machine will come to rest.

c) Automatic guard and adjustable guards, through pressure pad mechanism/ linkage mechanism will automatically push the worker away, not allowing him to be on the danger zone. Adjustable guards as in wood cutters will open to the required extent; otherwise they cover the cutting edge.

d). A trip device, on the other hand, operates when a person approaches a danger area. Typical examples are trip bars or probes, pressure mats or photoelectric systems ('light curtains'). Once triggered, the device 'trips' the machine so that it stops or otherwise becomes safe.

2. Describe the principle of operation of

a) Trip device – Trip device operate on the principle of sensing the presence of the operator and stop the machine. They involve use of sensory devices such as pressure mats, trip bars and photoelectric devices that when activated stops the machine. Hence they do not provide physical barrier between the operator and the dangerous parts of machine.

b) Two hand controls - Two-hand controls enables operation of machine when two start buttons are pressed at the same time, thereby ensuring both hands safe and away from danger zone in machine operation. Controls must be more than one hand span to prevent one-handed operation.

c) An interlocked guard – the operation principle of an interlocked guard is to disable power to the machine and the machine will not operate until the guard is in place. Or the act of opening the guard stops the dangerous parts and disables power. Example – Photocopier.

d) Protective appliances include clamps, jigs and push-sticks. The principle is to clamp the work piece, guide the tool and feed the work piece to the cutting edge, thus keeping the hands away from dangerous parts.

3. a) Outline merits and demerits of 'Interlock Guards'

Merits of interlocked guards are the machinery will not operate until the guard is in place (or) Opening the guard stops the dangerous parts and disables power. This will allow frequent access to a machine's dangerous zone by de-energising it and preventing it from operation (e.g. Microwave Oven).

The main limitation (De-merits) of an interlocked guard is that it is (technically) possible to bypass the system so that the machine can be operated with guard open. Other demerit would be it may be more prone to failure as it involves moving parts/ complicated mechanism and hence require regular maintenance which can be done only by Qualified Technicians.

b) Outline merits and demerits of 'Trip devices'

Merits of trip devices are they operate through sensors – it won't be easily possible to defeat its intended purpose by a less skilled worker.

Main limitations / De-merits of trip devices are – They don't provide physical barrier to prevent access; can be over-ridden / avoided (e.g. using platforms to span a pressure mat); May not operate fast enough to prevent harm. At time, may be over sensitive resulting in frequent trips and production delays. So, Management / Operators will be willing / encouraged to bypass or disable them. In addition, frequent trips may also result in operator stress.

4. a) With respect to the operation of machinery identify merits and limitations of two-hand controls as safety device.

The merit of having such a control would be that the machine will only operate when the operator has both hands on the controls that are spaced one hand apart to prevent one-handed operation. Releasing the controls will stop the machine immediately.

The main limitations of two –hand controls would be that there is no physical protection to other parts of the body (only hands are safe). It will be relatively easy for two operators working together to defeat the arrangement(bypass).

b) Outline types of sensitive protective equipment (trip devices) that could be used in-addition to two hand controls to improve safety.

The different types of trip devices that can be considered to improve safety are:

Photoelectric devices – shine beams of light across the access point to dangerous area triggers and stop the machinery when interrupted.

Pressure Sensitive Mats – Mats placed on the floor around an item of the machinery where if a person stands, their weight activate the trip and stop the machinery.

Trip Bars – wands or rods placed close to dangerous part which when touched will stop machinery movement.

5. Outline basic requirements to consider guard/protective devices

The basic requirements for guard and safety devices include,

- The guard should be positioned in such a way that it should be able to isolate the dangerous (hazardous) parts of the rotating / moving parts from human contact (maximum part covered)
- The guard should be suitable for the intended purpose it is provided;
- Guard to meet relevant standards (e.g. located at the correct distance from dangerous zone)
- To be strong and robust enough to withstand the forces applied/ it may be subjected to (probable due to ejection);
- Compatible – must not interfere with machine operation and must not hinder/ obscure vision
- The guard should not be easy to bypass or defeat
- The guard should not have rough or sharp edges
- The guard so provided should not overheat the machine / get overheated during the working process
- The guard should be easy to maintain, and also designed in such a way that it is not required to be removed for machine maintenance.

6. a) Identify the issues that should be considered to help ensure that a new item of work equipment is suitable for use.

For a new item of wok equipment to be suitable for use, certain issues to be considered such as its suitability for the task it is going to perform; the environment in which it is going to be used flammable, dusty, wet or damp); reliability of the item such as having the required safety integrity level; safeguards available; conformance to relevance standards such as having 'CE' mark; need of any statutory certification by third party; ergonomically designed that don't necessitate excessive force or poor posture while operating; ease with which the item can be operated and maintained; ability to deliver the task effectively and efficiently; availability of spares for replacement.

b) Identify measures that could be taken to help ensure that an item of work equipment remains in a suitable condition.

To ensure an item of work equipment remains in a suitable condition, its operation shall be restricted to competent persons. Further there shall be a maintenance regime such as planned preventive maintenance, condition based maintenance or breakdown maintenance as suitable for the item of the equipment. For some items of equipment if deterioration or wear and tear is foreseeable, there shall be an inspection regime that include routine visual inspection and detailed examination and testing where necessary.

7. Outline the hazards associated with the use of material hoist on a construction site.

The hazards associated with the use of material hoist on a construction site are falling objects, such as the load falling from the hoist; the hoist itself falling due to structural failure; being struck by the load during a lifting operation; being entangled in moving parts; misuses (used for lifting passengers); when used for carrying people, falls from height – from a landing level or from the platform of the lift itself; being struck

by landing levels or by other projections while riding on the platform of the lift; electricity leading to electric shock and sparks; noise and vibration; manual handling while loading and unloading material on to platform of the lift.

8. a) Identify four mechanical hazards associated with the use of pedestal drill

The mechanical hazards associated with the use of pedestal drill are:

Entanglement – with the rotating drill or chuck;

Stabbing or puncture – by the drill during normal use or if the bit breaks;

Impact – if struck by the work piece or if the bit jams and work piece rotates;

Drawing in – at nip-points between motor and drive belts.

b). Outline four control measures to reduce the risk of injury to operators of pedestal drills.

The control measures to reduce the risk of injury to operators of pedestal drills would be providing fixed guards over motor and drive mechanisms; providing adjustable (possibly interlocked) guard over chuck and drill bit; clamp to secure work piece to base; providing impact resistant eye / face protection; carrying out routine maintenance including inspection and portable appliance testing for electrical safety; and restricting use to trained operators only.

9. Outline the hazards and risks to which a worker could be exposed when cutting down a tree using petrol driven chainsaw.

They include : contact with moving parts of the chainsaw (the chain in particular); exposure to fumes and dust; manual handling hazards; noise and vibration; ejected particles and fragments from tree; falling objects (ultimately the tree itself); and fire, and explosion hazards from the fuel. In addition, hazards associated with hot parts of the chainsaw, uneven and/or wet ground, the use of fuel / lubricating oils – eye / skin irritation and allergy, and exposure to sunlight are also present.

Other hazards to which a worker could be exposed may be adverse weather – heavy wind / heavy rain, overhead power lines, and likely insect bite from insects in the tree like moth / honey bee etc.

10. a) Identify the hazards associated with the use of a cement mixer.

Cement mixer is a machine used to manufacture mortars and concrete by mixing different components such as aggregates of different sizes and basically cement. The hazards are mainly due to the rotating mixing drum that include,

- Airborne powder (Cement)
- Becoming trapped / entanglement due to the lack of protection of the casing (pinch points)
- Blows by moving elements (Impact)

- Electric shocks (when electricity driven)
- Overstrain (manual handling)
- The mixer overturning when being transported
- Smoke / Fire / Hot exhaust (when engine driven)

b) Outline control measures that can be used to reduce risks when using cement mixer.

The control measures are

- The mixer is to be situated on a flat, horizontal surface.
- Mobile parts are to be protected by casings.
- Check the state of the leads, lever and accessories regularly, as well as the safety devices
- Never insert arm or a shovel into the drum when it is moving,
- The casings and other metallic parts of cement mixers are to be earthed.
- They are to be equipped with an emergency stop button.
- Safe storage of petrol and control of ignition sources.
- The drum should be equipped with a tipping brake to avoid overstrain and uncontrolled movements.
- PPE – Hard hats, Waterproof suits, Safety goggles and rubber or PVC gloves

11. A portable electric sander is being used in the production area of a factory.

a). Identify hazards that may be present

b). Outline precautions that may be taken to reduce the risk.

a). The hazards associated with the use of portable electric sander include:

Mechanical hazards such as entanglement (getting wrapped around with rotating abrasive wheel), cuts and abrasion (coming into contact with abrasive wheel) and ejection (particles ejected out in the finishing operation and/or ejection of work piece or broken parts of abrasive wheel).

Non – mechanical hazards such as noise and vibration while operating and holding in hand, electric shock due to exposure to indirect or direct contact with electricity, dust arising from the sanding operation and manual handling due to postures that will be maintained during working.

b). The precautions that may be taken to reduce the risk while using portable electric sander are: not carry tool by cord; never to pull the cord to disconnect; keeping cord away from heat; disconnect when not in use; keeping observes at safe distance; secure work with clamps; avoid accidental starting; use RCDs on electrical tools; maintain good footing and balance; check compatibility (rpm) of power tool and abrasive/sanding disc when changing them; wear appropriate PPE (eye and face protection, hearing protection and hand protection); inspect and maintain tools (shall be subjected to user checks, visual inspection as well as combined inspection techniques - PAT); report defects and remove faulty tools.

12. a). Identify four hazards associated with Bench – Top Grinder.

Hazards associated with bench-top grinder are

- Abrasion on contact with rotating abrasive wheel
- Drawing in at nip-point between wheel and tool rest;
- Ejection of parts of the wheel during normal use
- Bursting of wheel if heavy load applied;
- Entanglement with the spindle mounting cloth, hair or jewellery etc.,
- Electrical hazards – eg. Shock due to direct or indirect contact
- Hot surfaces / parts caused by friction,
- Health hazards during grinding operations from – Dust, noise, vibration
- Ergonomic hazards during work

b). Other than guard, outline four control measures to reduce risks to workers

- Holding / Securing the grinder firmly in its position;
- Tool rest adjusted to minimise nip point between rest and wheel
- Grinding job done by trained operators only
- Provision and use of PPE (impact resistant eye and face protection, hearing protection etc.,)
- Installation of LEV to control dust where feasible and required
- Routine maintenance and inspection including PAT for electrical safety
- Daily check of grinding wheel for cracks / damage
- Avoiding loose clothing to avoid entanglement
- Job rotation or suitable breaks to minimize / reduce exposure to noise and vibration (if used for longer duration).

13.a) Identify four hazards associated with the use of photocopier.

- Drawing in and entanglement from contact with moving parts
- Electricity with risk of electric shock and fires of electrical origin perhaps due to overloaded sockets or electric sparks
- Contact with hot parts causing burns
- Health hazards from irritant gas (use of chemicals) evolving from the operation

b) Identify the precautions to be taken to reduce the risk to the health and safety of photocopier users.

The precautions to be taken to reduce the risk to the health and safety of photocopier used would be fixed guards enclosing all mechanical hazards and interlocked guards where user's frequent access would be needed. Use over-current protection and residual current devices to prevent/ reduce overheating of the machinery and rick of electric shock. Photocopier shall be installed in a well ventilated room. Routine inspection and periodical portable appliance testing shall be carried out.

14. Outline the measures to be taken to reduce the risk of accidents associated with the routine maintenance of machinery.

When machinery undergoes maintenance many safeguards that have been provided will be w either removed or bypassed. This increases the risk of an accident and hence safe system of work shall be developed incorporating safe work methods and permit-to-work system.

Energy inputs to the machinery have to be isolated with the aid of lockout and tagout system (electrical isolation, blanking of pipes with the help of spades, disconnecting hoses and closing isolating valves etc.,); residual energy shall be dissipated (allowing hot machinery to cool, releasing spring tensions, draining down the residues, releasing pressure etc.,); the maintenance operation to be segregated (isolating the area with suitable barricading and signs; safe means of access shall be established; control over ignition sources will be required where flammables are throughput in the machinery; mopping up and drainage arrangements shall be in place to control spill; fire extinguishing arrangement shall remain standby, where required; adequate ventilation and sufficient lighting arrangements shall be provided; maintenance personnel have to be competent and trained and issued with appropriate personal protective equipments as required for the activity.

Hen machineries are running parallel, they shall be appropriately interfaced and plant operators as are apprised of the condition. There shall be adequate supervision over the job.

15. Identify non-mechanical hazards associated with machinery and give an example in each ease.

Some of the non-mechanical hazards associated with machinery are as given below:

Electricity – used as the energy source as most of the machineries are motor-driven, for example, pedestal drilling machine, photocopier etc.,

Fire and Explosion – flammable substances may be used either as working substances in a closed system, or as fuel or lubricant, for example, ue of flammable refrigerants (propane, butane) in refrigeration system, diesel in engine driven pumps.

Noise – Excessive sound generated by the moving parts of the machinery or the equipment may be operating on compressed air and/or release energy with sound. For example – generators, turbines, cement mixers, etc.,

Vibration- perhaps the machinery is not securely installed on suitable anti-vibration mounts or it may be a hand vibrating tool, for example pneumatically operated concrete breakers.

Hazardous chemicals – substance hazardous to health may be released in the machinery operation as emissions or may be used in the machinery as raw material. for example – cement in cement mixers, carbon monoxide from incomplete combustion of IC engines

Manual handling – machinery operations may involve loading raw material unloading finished product etc., with extreme manual effort. For example – loading of cement, sand and aggregate and unloading of concrete mortar from cement mixer

Biological hazard – machineries may have water systems which may get infected by biological agents, for example cooling tower in refrigeration system

Ergonomic hazard- operation and maintenance of certain machineries may sometimes put workers in awkward posture, for example overreaching for controls, continuous kneeling for certain maintenance work in automobiles

Fall hazard- machinery operation may require to work at height, leading to fall from working platforms or falls on the same level perhaps due to contaminated floor by spillages/ leaks from machinery.

Element 5

ELECTRICAL SAFETY

1(a) Identify the effects on the human body from a severe electric shock.

The effect of electricity on the body includes nervous system damage, cardio-respiratory effect, in particular the risk of fatal injury due to disruption to heart rhythm / lung paralysis / cardiac arrest; muscular contraction resulting in an involuntary grid on the live conductor, thus prolonging current flow through the body; tissue burns with the main sites of damage being the entry and exit points with the possibility of damage to internal organs and fractures or dislocations caused by a resulting fall.

(b). Identify four factors that could affect the severity of injury resulting from contact with electricity.

The factors that increase the severity if a person comes in contact with electricity are how much voltage and how much current has been received or contacted, the body resistance, the tine of contact – higher the voltage, current, and time of contact – more worse the effects. In addition, factors like, whether there is a direct contact or indirect contact, the source of energy viz., alternating current (AC) / direct current (DC), age and health condition of the victim, as well as wetness of body like sweat increases the incidence, as well as the wetness of working surface on which the victim stood, will determine the severity of shock, Finally the path that the current has taken through his body – especially it goes through heart – giving fatal results due to lung paralysis and cardiac arrest.

2. Outline precautions that should be taken to reduce the risk of harm from electrical equipment in a workplace.

The precautions that should be taken to reduce the risk of harm from electrical equipment are carefully selecting them so that they are suitable for purpose and environment of use providing various protective systems such as fuses – a weak link in the circuit, earthing – a low resistance path to earth for fault current, isolation/miniature circuit breakers – over current protection/tripping the power supply, residual current devices – sensitive and rapid tripping device for shock protection, double protection – separating people from conductors using two layers of insulation, reduced and low voltage – so that less current flows during an electric shock; work on electrical equipment should be restricted to competent persons only; all electrical equipment should be subject to user checks, formal visual inspections and combined inspections and testing.

3. Identify the electrical hazards that could be discovered by a visual inspection.

The electrical hazards that could be discovered by a visual inspection would be over – rated fuses or no fuses; wrong connections including makeshift, temporary connections; poor earth connections preventing fuse from working; damaged casing of electric appliances; Incorrect wiring inside plug; Earth wire detached from connection; Overloaded socket; Insulation failure of cables; Poor cable management – cables trapped in machinery, exposed to hot surfaces or corrosive chemicals, continuous flexing, trailing across roads without protection from vehicles run over; Incorrect or damaged sheathing; Poor earth connections preventing fuse from working.

4. Outline range of controls that should be in place to improve electrical safety in a workplace.

The controls that would be required to improve electrical safety at workplace are use of double insulated cables – separating people from live conductors using two layers of insulation; cable management – use of cable drums that includes routing cable overhead or underground with adequate protection from sharp edges, heat and from vehicles run-over, when they cross roads; providing various protective systems such as fuses - a weak link that will melt and break the circuit; providing earthing – a low impedances path to earth for fault current; isolation/miniature circuit breakers – over current protection/ tripping the power supply, use of residual current devices – sensitive and rapid tripping device for shock protection; carefully selecting electrical equipment so that they are suitable for purpose and environment of use; reduced and low voltage where possible (110v CTE) – so that less current flows during an electric shock.

Other operational controls such as work electrical equipment should be restricted to competent persons only; all electrical equipment should be subject to user checks, formal visual inspections and combined inspections and testing; maintaining safe distance from overhead power lines while working at height/using cranes.

5. Outline a range of checks that should be made for electrical safety in a workplace.

Checks for electrical safety in a workplace can be in the form of user checks, Formal visual inspection and combined inspection and testing (PAT).

User checks would involve simple visual inspection carried out by competent person on scheduled basis that would reveal issues such as over-rated fuses or no-fuses; Wrong connections including makeshift, temporary connections; Poor earth connections preventing fuse from working; Damaged casing of electric appliances; Incorrect wiring inside plug; Earth wire detached from connection; Overloaded sockets; Poor cable management – cables trapped in machinery, exposed to hot surfaces or corrosive chemicals flexing, trailing across roads without protection from vehicles run over; Incorrect or damaged sheathing; poor earth connections preventing fuse from working.

Combined inspections and testing would require checks made by competent person such as magnitude of current, voltage using potentiometers, cable layouts, insulation of equipments, functionality test of safety devices such as RCD etc., That are to be carried out on a periodical basis (usually every 3 months or more frequently depending on the usage of electricity and electrical equipments in workplace).

6. Outline examples of faults and bad practices that could contribute to electrical accidents when using portable equipment in workplace.

Faults and bad practices that contribute to electrical accidents when using portable equipment in workplace would be using unsuitable equipment such as not using intrinsically safe equipment in a flammable atmosphere; using equipment in wet or damp conditions; misuse of portable equipment such as inserting wires directly into a socket rather than using a plug; physical abuse such as pulling the flex to plug out or carrying the tool by flex; dragging the flex on rough terrain, driving over the flex running across the road etc; repairs carried out by unauthorized personnel such as using insulation tape on split flex; disconnected earth wire from the plug; continued use of faulty, defective equipment associated with lack of routine inspection, testing and maintenance.

7. Outline how the following two protective measures reduce the risk of electric shock and in each case give an example of its application.

a) Reduced Low voltage

The severity of electric shock depends on magnitude of voltage among other factors. Hence reduced voltage application will considerably reduce the risk of electric shock by reducing the severity of outcome. For example, using reduced low voltage (110 Volts - CTE) for portable electrical tools will mitigate to a great extent the risk of heart fibrillation when worker receives an electric shock. The voltage passing through the victim will only be 55 volts as a tapping taken from the centre taken from the centre of the secondary coil of the step-down transformer is earthed, unless he/she is in contact with both terminals.

b) Double Insulation

Double insulation refers to two layers of insulation provided to live electrical parts. This will reduce the risk of electric shock by reducing the likelihood of electric contact with live parts. For example, using double insulated electric cables will reduce the risk of electric shock, as in the event of damage to outer layer of insulation will still insulation. Also hand-held electrical tools shall also be double insulated ones, which can be identified by a pictogram.

8. A portable electric drill needs periodic inspection and testing before use on a construction site. Identify factors that would determine the frequency of the inspection and testing.

The factors that would determine the frequency of the inspection and testing of a portable electric drill to be used in a construction site include:

- Legal standards and codes of practice (i.e., statutory requirements and best practices, for example, in most countries, a frequency of 90 days for the inspection of portable electrical tools is followed as best practice.)
- Manufacturer's recommendation
- Initial integrity and soundness of the electric drill
- Age of electric drill – subjected to wear and tear

- Working environment n construction site – damp or dusty, rough terrain where there will be a likelihood of mechanical damage
- Frequency and duration of use
- Effects of any modification or repairs to the equipment
- Foreseeable abuse of equipment – work culture such as disconnecting sockets by pulling cords, dragging cables etc.,
- Analysis of previous records of maintenance including both formal inspection and testing

9. Outline practical measures to reduce the risk of injury from electricity when using portable electrical tools.

The practical measures to reduce the risk of injury from electricity when using portable electric tools would be using reduced low voltage such as 110V (Centre tapped to earth); using double insulated tools, where possible; using double insulated cables connected with appropriate plug and sockets; cables appropriately managed using cable drums in order to prevent damage to insulation and exposing live core of flex; using fuses of appropriate rating and trip devices for over-current protection; using residual current devices to reduce risk of electric shock; having an inspection regime that includes all portable electric tools subjected to portable Appliances testing (PAT) by a competent person at regular frequency; usage of tools restricted to competent operators who are to be trained in safe use of portable electric tools; adequate supervision to prevent possible misuse and abuse such as dragging cables, disconnecting tools from sockets by pulling cables etc.,

Element 6

FIRE SAFETY

1.(a) identifly the principle of fire triangle.

The fire triangle represents the fuel, oxygen and a source of ignition, heat or ignition source/energy-that must be present for combustion to occur.

For the fire to occur, all these sides are to be complete, otherwise the fire will not occur. so to extinguish fire any of the three viz. fuel, oxygen or the heat source should be removed or isolated.

Cooling: Removing the heat from fire to extinguish it ; eg : water type fire extinguisher does cooling.

Smothering: cutting off the oxygen supply to fire or sealing off the oxygen not to reach the fire to extinguish fire; foam type fire extinguisher forms a blanket/film of foam layer disallowing air to reach thus extinguishes fire.

Starving the fire and fuel; in this process all the adjacent burning material are removed from the scene of fire (or) the fuel supply value /knob is shut off or closed to avoid any further fuel available to continue /

sustain burning, thus the fire does not have burning material to spread further, thus extinguishes due to starvation.

(b) in relation to classification of fires, given an example of a material (fuel) that falls within each of the classes A,B,C and D.

CLASSIFICATION	TYPE OF MATERIAL	EXAMPLES
CLASS A	SOILD COMBUSTIBLE MATERIAL	WOOD, PAPER ,PLASTIC,CLOTH
CLASS B	FLAMMABLE LIQUIDS AND LIQUIFIED SOLIDS	PETROL, DIESEL, LUBRICATION OILS, WAX, GREASE
CLASS C	FLAMMABLE GASES	ACETYLENE , LPG, PROPANE, BUTANE
CLASS D	FLAMMABLE METALS	SODIUM, POTTASIUM, LITHIUM
CLASS F	COMBUSTIBLE COOKING MEDIA	COOKIN OIL & FATS

2. Identify extinguishing agents that can be used on fires that involve flammable solvents AND give their mode of operation.

In the event of fire of flammable solvents the various extinguishing agent that can be used include:

Foam-That floats over the solvents and spreads quickly over it to seal off the oxygen supply

Caron dioxide-That displace the oxygen from the scene of fire and extinguish the fire by smothering

Dry chemical powder-propelled by a non-combustible gas, it forms a chemical powder cloud over fire and interrupts the chemical chain reaction and also cuts off the oxygen supply. Fire may rekindle as it does not adequately cool the fire.

Water mist- Though water cannot be used as it is denser than solvent, water mist of particle size about 400 microns are effective. It extinguishes the fire by cooling.

3. other than the provision of extinguishing agents, outline precautions that should be taken in order to minimise risk when storing and using flammable solvents

The precaution that should be taken to minimise risk when storing and using flammable solvents at workplace would be storage only in approved containers that are clearly labelled; keeping the storages containers uprights ; storage in well ventilated area to prevent accumulator or build-up of fumes; storage area well secured such as locked storage; segregation to separate incompatible material from each other; identifying and controlling ignition sources in the area such as electrical sparks; keeping minimum quantity of flammable substance in workplace; storage area if unmanned shall have arrangement for fire detection such as smoke/heat/flame detectors integrated into an automatic fire detection system; structure of the storage facilitles shall have passive fire protection such as made of fire retardant material; storage area shall be well designated with adequate warning sign; arrangements for spill control such as standby mop-up kits; for use, when solvents in lesser quantity are transferred to suitable containers they are also to be clearly marked/labelled; control over nearby operations such as prohibiting hot work; Adequate training to workers who handle flammable solvents.

4(a) Identify two methods of heat transfer AND explain how each method contributes to the spread of fire.

CONDUCTION: This refers to heat transferred through the material molecules to molecules through conducting solids like beams, pipes to other parts of the building or structure and this heat igniting materials.

CONVECTIONS: In convection, the hot gases become lighter, rise up through the air travelling to the roof or ceiling of the room – heating it, or travels through the voids or ducts to remote parts of the building heating the materials over there to cause fire if the heat is sufficient enough to raise the temperature in that zero materials to their ignition temperature.

RADIATIONS: Radiation is the emission of heat in the form of infrared radiation as invisible waves of heat of adjacent materials in all directions not in contact with, raising their temperature to the ignition temperature/flash point thus spreading further.

DIRECT BURNING: In this, the existing naked flame from the fire contacts the burning materials kept around, igniting them spreading the fire further.

(b). Identify four sources of ignition that may lead to a fire in the workplace.

The sources of information that may lead to a fire in the workplace could be:

Hot work – Welding, cutting of metals using Oxygen-Acetylene/LPG gases etc.,

Electricity – Overheating (Under-rated cables or overloaded circuits/sockets), Arcing

Smoking – Smoking in prohibited areas, smokers material (Un-extinguished left over)

Static electricity – Fuel transfer (accelerated flow rate, usage of insulated material, no earth bonding)

Friction – Inadequate lubrication of machinery

5. Outline methods of reducing the risks of fire in the workplace.

The fire risk in the workplace can be managed by following ways:

FIRE PREVENTION-having measures to reduce the risk of fire starting such as controlling ignition sources (hot work permit, discipline smoking, controlling electricity, etc..,) controlling fuel/burning material (inventory control/controlled storage of flammable, controlled burning of rubbish, good housekeeping, etc ..,) and controlling oxygen (preventing oxygen enrichment – leaking oxygen house).

FIRE PROTECTION-having measures to reduce the risk of fire spreading such as passive and active fire protection measures .passive fire protection measures include compartmentation , intumescent coatings etc.., to gain integnity against smoke/flames, to maintain stability of structures by ensuring thermal insulation . Active fire protection measures include equipments and systems available for fire fighting (fixed and portable).

FIRE PRECAUTION : having measures to reduce risk to occupants in the event of fire such as detection systems (smoke/heat/flame detectors- adequate and appropriately sited). Automatic alarms with manual backup, means of escape (safe design with necessary resource provision) ,safe assembly point with arrangements for recovery and rescue off-site.

6. Outline measure that should be in place for a successful evacuation of a workplace in the event of fire.

The measures that should be in the place for a successful evacuation of workers in case of fire would be means of raising the alarm (alarm should be audible at all work location/rest areas); means of contacting emergency services ; awareness of when to tackle/not to tackle a fire; well designed fire excavation routes (means of escape wide enough with multiple exits, well designated and illuminated when emergency lighting, integrity against smoke, heat and flames, maintained free of obstructions and leading to safe havens/muster points); provision of alternative routes; provision of stairs (fire retardant) as part of escape route (not to use lifts); provision of emergency exit doors (self closing type, locked open in the direction of travel, final door leas to safe assembly point); nominated fire marshals and their role (mainly assisting people with disabilities, roll call etc.,); excavation in an orderly fashion (ensured by periodic mock drills); procedure and arrangements for disabled persons (provision of temporary refuge); training to all personnel for general awareness and to key persons for their specific role.

7. Identify eight common causes of fire in the workplace.

Some of the most common causes of workplace fires are:

Electrical equipment - faulty wiring, overloaded conductors, misused equipment and incorrect use of electric equipment in inappropriate environments.

Deliberate ignition (arson) – in some cases workplaces may be targeted by a disgruntled employee or an unhappy customer.

Hot work – any work involving arc/naked flame (propane torch, oxy – acetylene cutting, arc welding and grinding)

Smoking – carelessly discarded cigarette butts and matches; smoking in prohibited areas.

Cooking appliances – fat pans left attended

Heating appliances – electric fan heaters and space heaters, mainly when left unattended

Unsafe use / storage of flammables (example petrol, acetone, liquid petroleum gas) – Static sparks can be generated which could ignite a flammable vapour.

Mechanical heat – generated by friction between moving parts or cold work generating sparks.

Chemical reactions – can also generate heat, for example oxidisers.

Incineration –uncontrolled burning of rubbish.

8. Outline factors to consider when carrying out fire risk assessment of a workplace.

The factors to be considered when carrying out a fire risk assessment of a workplace would be the amount of fire load present in the workplace that include the quantity of combustibles and flammables stored, the material with which the structure of the buildings are made and their fire resistance rate; the occupants of the building in workplace and the presence of vulnerable groups such as people with physical challenges; identification and control of ignition sources; the passive fire protection methods that can be adapted to reduce thermal transfer; means of detecting fire in workplace mainly the area that are unmanned; availability of fire extinguishing media; means of raising alarm (audible and visible) that would draw everyone's attention; means of escape that has integrity against smoke; heat and flame; availability of fire marshals; development of fire emergency procedure; training and drills on emergency procedure.

9. With respect to design features of a building

a) Identify two types of emergency warning system that can be installed in the building to help ensure that all workers are made aware of the need to evacuate the building.

The two types of emergency warning systems to make the worker aware of the need to evacuate the building would be

a) Manually operated fire alarm
b) Automatic fire alarm

That is installed in the building to either activate manually or through a centralised fire detection system. The system when activated would alert the workers with the help of sunders (audible alarm) and flash lights (visible alarm)

b. Outline SIX structural measures that can help to prevent the spread of fire and smoke.

The structural measures that would prevent the spread of fire and smoke are generally termed as 'passive Fire Protection'. Examples of such protection would be

The walls, floors and ceilings of the building shall be made of fire retardant material such as concrete, steel etc. the factor to be considered in this case would be the required structure will have structural stability.

The space shall be sub-divided into small areas will definite boundaries to contain the smoke and flames in the event of fire, referred as 'compartmentation'.

All openings in the compartments shall be sealed with intumescent sealants.

To facilities movement of occupants in the buildings, the entrances and exits shall be made of 'Fire –exit doors'.

Fire doors are to be self-closing type, provide with cold sealants nd intumescent strips to maintain integrity against smoke in the event of fire.

Vertical vault openings such as lift shafts etc shall have shutters that will be operated automatically to prevent the upward movement of hot gases and hot air.

The materials used for insulation and wall coverings in the rooms shall be fire retardant in nature.

10. Outline control measures that may be needed to help persons with sensory impairments and /or physical disabilities may be evacuated safely in the event of fire.

Persons with sensory impairments and/or physical disabilities are the most vulnerable group in the event of fire as they cannot hear the emergency alarm or may face challenges in using escape routes during evacuation. The control measures required for their safe evacuation would include assigning responsibilities to co-worker to alert them on hearing emergency alarm when they work in group; provision of visual alarm in addition , such as flashing lights; where required vibrating devices such as pagers shall also be considered; fire marshals designated in the area need to focus on such persons with hearing ailments and ascertain these facilities are available and functional; escape routes shall be wide enough and without level changes to facilities safe movement of persons with physical disabilities; as lift cannot be used during emergencies, refuges are to be provided near stairways to facilities persons with physical ailments to retreat in; fire marshals shall ensure safe evacuation of those sheltered in refuges using appropriate equipments such as ' evac-chair'.

Fire marshals are required to be training to make them their role and responsiability. Vulnerable persons as mentioned above are also to be informed about the arrangements in place during their induction training and subsequent refresher training. Periodic mock drills are also to be conducted to ensure the efficacy of the above emergency arrangements and to avoid any panic.

Element 7

CHEMICAL AND BIOLOGICAL HEALTH HAZARDS & RISK CONTROL

1. **An organisation uses small quantities of toxic chemicals. Identify four routes of entry of toxic substance into the body.**

There are four main routes of entry for the toxic chemical into the body:

INHALATION- the substance is breathed in through the nose and mouth and down into the lungs. This is a significant route of entry for many toxic substances in the form of gas, vapour, mist, fume or dust.

INGESTION- the substance is taken in through the mouth and swallowed down into the stomach and then moves on through the digestive system. Unless there is a mistaken ingestion or cross contamination, this is a less significant route of entry since people are unlikely to swallow deliberately.

ABSORPTION through the skin- the substance passes through the skin and into the tissues beneath and then into the blood stream. Only some substance such as organic solvents can permeate.

INJECTION through the skin- the substance passes through the skin barrier either by physical injection such as needle-stick injury or through damaged skin such as cuts and grazes.

2. **(a) Explain the difference between acute and chronic health effects.**

The acute health effects are as a result of short term exposure to high levels of substance, whereas the chronic health effects would be as a result of repeated or prolonged exposure to low levels of substance. Acute effects are usually quite quick or immediate to occur and generally reversible in nature. Chronic effects are delayed and normally irreversible as they are recognised late in the absence of health surveillance.

b) Identify factors that could affect the level of harm experienced by a worker exposed to a hazardous substance.

The factors that could affect the level of harm experienced by a worker exposed to a hazardous substance would be hazardous nature of the substance such as toxic, irritant, corrosive, carcinogenic etc. frequency and duration of exposure such as single/short term exposure or repeated/prolonged exposure: individual sustainability/vulnerability of worker such as pregnant woman; concentration of hazardous substance in workplace atmosphere such as how much above the workplace exposure limit(does received); availability of immediate first aid measures such as eye wash and shower stations to mitigate the level of harm when exposed .

3. **Identify the sources of information which could be used in the assessment of toxic substances.**

The sources of information that could be used in the assessment of toxic substances would be:

Product labels- that carry information such as substance name, constituents that make the product toxic, warning phrases or symbols that indicate the danger and basic precaution to be taken.

Manufacturers 'safety data sheet – intended to provide end users sufficient information to ensure safe use, storage, transport and disposal.

Exposure limits- workplace exposure limit (WEL) in UK, threshold limit values(TLV) in USA and indicative limit values (ILV) in EU are published by respective government agencies(HSE,ACGIH,EU commission) as maximum reference values to which an average worker may be exposed.

4. **Identify the information that should be included on a manufacturer's safety data sheet supplied with hazardous substance.**

   Information that should be included in the MSDS are : identification of substance/preparation; the manufacturer/supplier details ; composition /information on ingredients; hazard; identification; health effects; first aid measures; fire fighting measures; accidental release measures; handling and storages; exposure controls; personal protective equipment; environmental/disposal considerations; physical and chemical properties; stability and reactivity; toxicological information; ecological information; disposal considerations; transport information; regulatory information; other relevant information.

5. **Outline the control measures that might be required in order to minimise risks to workers.**

   Control measures that might be required in order to minimise risks to workers include preventing exposure to hazardous substance or, if this is not possible, controlled below any relevant workplace exposure limit. A general hierarchy of control can be applied to controlling exposure; eliminate or substitute the substance; change the process; reduce exposure time; enclose or segregate; provide local exhaust ventilation or dilution ventilation as necessary; respiratory protective equipment; other personal protective equipment; personal hygiene practices; health surveillance; and providing information, training, instruction and supervision.

6. **Outline personal hygiene controls to be followed that reduce the risk of ingestion of a hazardous substance.**

   Many Hazardous substances can be put onto the skin and then into the mouth by cross-contamination such as worker's hand gets contaminated and then put on to the mouth involuntarily or alternatively food or cigarette can be cross-contaminated by hand contact and then put into mouth causing ingestion. Hence, it is essential that good hygiene practices are adopted such s hand washing routines when leaving work room; careful removal and disposal of potentially contaminated PPE to prevent cross – contamination to normal clothes; prohibition of eating, drinking and smoking in work areas. This will require the provision of appropriate washing facilities such as water, soap and drying equipment, PPE and work clothes changing facilities and rest and food preparation areas.

7. A). **Identify four forms of hazardous substances for which respiratory protective equipment could be used to reduce the risk of harm.**

   Respiratory Protective Equipment can be used for the following physical forms of hazardous substances:

   Vapour - dispersion of molecules in air by substances that are originally liquid or solid in state such as solvents

   Mists – presence of liquid droplets in air such as (paint etc.,)

   Dust – airborne solid particles such as silica, asbestos fibre.

Gases – Substances rarer or denser than air such as carbon monoxide, hydrogen sulphide, chlorine etc.

B). Outline factors that could reduce the effectiveness of the respiratory protective equipment.

Respiratory Protection – May not be suitable for the Dust / Contaminant level present

Poor fit – Not fitting correctly (Loose or too tight) – Incorrect size / Poor quality

Resistance to use – May not be willing to use as management does not enforce it / Negative safety culture

Uncomfortable – Worker may feel uncomfortable

Incompatibility – Interfering with other PPE / Obstructing other PPEs

Hygiene – Health and Hygiene problems may occur

Supervision – Lack of supervision may be another reason – So people may forget

Deterioration – Poor Maintenance / lack of maintenance and storage, not cleaned regularly

Abuse – Misuse

8. **Outline factors to consider when selecting respiratory protective equipments (RPE) to give suitable protective against exposure to airborne substances.**

   The factors to consider when selecting respiratory protective equipments (RPE) against airborne substances would be suitability of RPE, such as the nature and form of airborne substance. For example, a simple Filtering face – piece Respirator held over the nose and mouth with elastic band, would be sufficient for protection against low concentration sand dust. Whereas, Half-Mask / Ori – Nasal Respirator which comes with a cartridge and rubber sealing. Would be required for a higher level of protection against contaminant. To protect eyes and face against airborne substances, FULL FACE RESPIRATOR that has a built-in visor needs to be selected.

   Too high concentration of contaminant in air, low level of oxygen, presence of toxic contaminants are other important factors that necessitates selecting a RPE that can provide fresh air. For example BREATHING APPARATUS are selected in such scenario which provides fresh air and helps to maintain a positive pressure inside face-piece. Duration of work is also a factor that determines the selection of self contained breathing apparatus (for less duration) or supplied air breathing apparatus (continuous supply of air for more duration).

   Compatibility with other PPE, shape of the user's face and its influence on fit, physical requirements of the job such as need to move freely etc. are other relevant factors that would influence the selection of RPE for an airborne substance.

9. **A). Identify two types of cellular defence mechanism that the body has as a natural defence system.**

   Cellular defence mechanism that the body has as a natural defence system are phagocytes and/or macrophages that scavenges out the hazardous substance when enters into the body; the secretion of defensive substances such as wetness in the nose; the prevention of excessive blood loss and the repair of damaged tissue.

   (B) Give the meaning of the 'maximum allowable concentration'.

Maximum allowable concentration refers to the concentration of airborne substance in the form of dust, vapour, gas etc that is not considered to be harmful to workers and their offspring even after repeated exposure during the period of time up to an entire working life comprising of 8 hours per day and 40 hours per week.

10. **A recent increase in work related ill-health has been noticed among workers who use a solvent for which a workplace exposure limit has been set.**

a) Give the meaning of workplace exposure limit (WEL).

Workplace exposure limit (WEL) is a maximum concentration of airborne substance measured over a reference period to which a worker can be exposed through inhalation without causing ill-health effect.

b) Give possible reasons for increase in work related ill-health amongst the worker.

The increase in work related ill-health cases in spite of established WEL would be for reasons such as WELs are set with reference to male physiology of certain European countries and USA, hence it will have significant impact on race and gender., the environmental parameters such as humidity, temperature etc. in which the tests are carried out, vary largely with actual workplace environment. There may be multiple substances present and the ill-health may be a synergistic effect. Some limits are only ' guidelines'. Some limits do not consider all the possible health effects of a substance such as dermatitis would not be considered with an airborne limit.

11. Workplace exposure limits (WEL) are set for hazardous substance.

a) Identify two types of exposure limits.

Short term exposure limit (STEL)- maximum concentration of airborne contaminates too which employees may be exposed for a short period of time equal to 15 minutes.
Long term exposure limit (LTEL)- maximum concentration of airborne contaminants to which employees may be exposed over their entire working life for a reference period equal to 8 hours per day, 40 hours per week.

b) **Outline two purpose of WELs.**

The purpose of WEL is to combat the ill-health effects of being exposed to very high levels of the substance for quite short periods of time (sudden acute effects), and also to combat the ill-health effects of being exposed to relatively low concentration of substance for prolonged period or all hours of working day through an entire working life time (delayed chronic effects). The aim is to ensure that the exposure to contaminants is below WEL, by having arrangements for monitoring the concentration of airborne substance in workplace along with suitable controls such as extraction system.

c) Outline the limitations of WELs.

Workplace exposure limits are set based on inhalation, whereas other routes are not considered. They are set with reference to male physiology of certain European countries and USA, hence it will have significant impact on race and gender. They becomes invalid if the environmental parameters, such that humidity temperature etc. in which the tests are carried

out, vary largely with actual workplace environment. They don't account for synergistic effect of multiple substances. Some limits are only 'guidelines'. Some limits do not consider all the possible health effects of a substance such as dermatitis would not be considered with an airborne limit.

12. **Outline factors to consider when undertaking an assessment of health risks for a hazardous substance.**

    The factors to be considered when undertaking an assessment of health risks for a hazardous substance would be the hazardous nature of the substance such as toxic, corrosive, irritant, carcinogenic or mutagenic etc., and its chemical, physical or bio-hazardous properties; the form in which it will be present in the workplace, for example, gas, dust, mist or fume etc., the possible routes of entry of the hazardous substance such as inhalation, ingestion, absorption or injection; the possible ill-health effects of exposure to it; the duration, frequency and level of exposure; the number of people who would be exposed including the presence of vulnerable workers such as young persons, expectant and new mothers; the existence of applicable standards such as workplace exposure limit(WEL) with arrangements for monitoring the concentration of airborne substance in workplace; suitability and adequacy of control measures existing in place such as extraction system, health surveillance, personal hygienic practices, appropriate personal protective equipment; availability of required information about hazardous substance (Example MSDS) including details of process in which it will be used.

13. **(a). Identify health risk which could be associated with the wood dust.**

    Wood dust is a 'substance hazardous to health' because it can cause serious non-reversible health problems, such as skin disorders; obstruction in the nose, and rhinitis; occupational asthma (mainly when cedar wood is used) and a rare type of nasal cancer.

    (b). Identify operations which are likely to produce high levels of wood dust exposure.

    The following activities are likely to produce high dust exposures:

- Machining operations, particularly sawing, routing and turning;
- Sanding, by machine and by hand;
- Hand assembly of machined or sanded components;
- The bagging of dust from dust extraction systems;
- Using compressed airlines to blow dust off furniture and other articles probably for housekeeping or for preparing the furniture for coating varnishes and paints;

    (c) .Outline control measures which could reduce the risk from the wood dust

    The control measures to reduce risk from the wood dust would be

    Set Exposure Limits

    These are limits placed on the amount of dust in the air, averaged over an eight-hour working day. Workplace Exposure Limit (WEL) of 5mg/m3 is set by HSE(UK), which must not be exceeded. However, exposure must reduced to as low as 'reasonably practicable'.

    Dust Extraction

Provide dust extraction (also known as local exhaust ventilation or LEV) at woodworking machines to capture and remove dust before it can spread. Extraction system must to take into account the number and type of machines to be connected to it, and the layout of the workshop or factory. Fitting air flow indicators will help to know and maintain required air flow and extraction vacuum.

Education and awareness

Workers need to be educated about the risks from wood dust and the control measures required. They must be aware of the extraction system's functioning and ways to improve efficiency of LEV system; never to sweep up or use compressed air lines as this will disturb the dust and allow it to become inhaled; clean up using a suitable industrial vacuum cleaner.

Respiratory Protective Equipment (REP)

Mask with appropriate cartridge for activities such as sanding may be needed and correct fitment is to be ensured.

Health Surveillance

As workers are at risk of acquiring asthma – a chronic case, health surveillance would be required to identify early symptoms. A low level health surveillance involving workers to complete questionnaire will be sufficient. Where high risk is involved (using red cedar wood), a higher level of health surveillance, including lung function testing, is needed.

14. Outline factors that may reduce the effectiveness of a local exhaust ventilation system (LEV).

The factors that may reduce the effectiveness of a local exhaust ventilation (LEV) are failure to position the hood close enough to the source of emission; damaged ducting; blocked, damaged, unsuitable or incorrectly installed filters; fan inefficiency perhaps due to wear or corrosion of the impeller blades; inappropriate initial design that was made further worse due to process changes; unauthorised alternations such as increasing the number of inlets; a build up of contaminant in the dusting and a blocked/ obstructed outlet; incorrect settings such as angle of dampers; scrubber saturation, and a failure to introduce procedures for the regular maintenance, inspection and testing of the system.

15. Absorbent mats and granules have been used to soak up a chemical spillage. Outline the issues that will need to be considered in relation to the handling, storage and final disposal of the waste materials.

While dealing with a chemical spillage, the issues that are to be considered with respect to handling, storage and disposal of waste are requirement of a storage area of suitable size – TO BE ABLE TO HAVE THE PADS / CLEANED GRANULE WASTE; storage area at suitable location – WELL AWAY FROM THE NORMAL WORK AREA; storage area clearly designated and sign posted; individual containers clearly labelled; Different types of waste stored separately; Incompatible wastes never stored together; storage kept to minimum – NOT TO ACCUMULATE – CLEAR THEM OFF; If necessary protect storage area with bunds; No hazardous waste in general waste skips (Segregation); Ensure storage area secure – TO AVOID UNAUTHORISED PEOPLE.

Environment guidelines, MSDS shall be consulted as required Manufactures' support can be sought when needed; Government regulations are to be met; Suitable PPE and appropriate training for

those handing, Exposure limits are to be ensured by person-in-charge of the operation, while engaging competent persons trained in HAZMAT handling to do the job.

16. (a). Identify three forms of biological agents.

Biological agents are micro – organisms such as:

Fungi – Moulds, yeast and mushrooms mostly harmless to human but some can cause disease such as athlete's foot and farmer's lung, both fungal infections.

Bacteria – Single celled organisms that are found in vast numbers in and on the human body. Some are beneficial while others can cause disease such as legionnaires, leptospirosis etc.,

Viruses – Very small infections organisms that reproduction on living cells of human body. Example – Hepatitis

(b). Identify three possible routes of entry for a biological agent.

The possible routes of entry for a biological agent into the body would be inhalation – airborne micro-organisms, absorption through the skin, injection for example through cut and grazes, exchange of body fluids, and ingestion – contaminated food.

(c). Give two control measures to reduce risk of exposure to biological agent.

In order to reduce the risk of infection from biological organisms we can adopt a number of control measures such as cleaning and disinfecting; the use of personal protective equipment like respiratory protection, aprons and gloves; engineering controls such as containment for example in glove boxes, can also be provided with local exhaust ventilation and the use of microbiological safety cabinets; the introduction of procedures for the disposal of waste; the prohibition of eating or drinking in the work area; vermin control; procedures for site monitoring and health surveillance; immunisation and a good standard of personal hygiene.

17. a). **Identify health risks from blood borne viruses**

Blood borne viruses are Hepatitis (causative agent for jaundice nd liver damage) and HIV – Human Immunodeficiency Virus (Causative agent for AIDS – Acquired Immune Deficiency Syndrome). Contaminated body fluids can cause infection by contact with damaged skin, needle-stick injury and even splashing to the eyes and mouth.

b). Outline the circumstances that a worker may be exposed to blood borne viruses.

Health care workers are more vulnerable to infection while handling body fluids of infected patients and when disposing infected needles. Waste disposal workers are other category of people who may contract infection while incorrect handling of clinical waste. Workers who are engaged in the transportation of body fluids are also vulnerable, who may inadvertently contract infection. Other circumstances that would lead to exposure to BBVs may be through injuries to infected person when occur at workplace such as cuts, bruise crush etc., and workers engaged in acts of tattooing and body piercing.

c). Outline the control measures to overcome the health risks from blood borne viruses.

The control measures to overcome the health risks from blood borne viruses would be correct disposal of potentially contaminated material such as clinical waste; prevention of needle-stick injuries by correct disposal of sharps in a sharps bin; use of PPE such as gloves and eye protection when handling potentially contaminated material; drawing up and enforcement of decontamination and disinfection procedure; vaccination where appropriate (for hepatitis) for vulnerable persons; covering up the wounds; procedures to deal with accidental exposure.

18. **A). Identify health risks associated with exposures to Legionella bacteria**
    Legionella are water-loving soil bacteria that can cause a disease called 'Legionellosiis'. The persons infected by theses bacteria initially develop flu-like symptoms like fever, chills, headache, muscle pain etc. A dry cough soon develops and then progress to pneumonia (difficulty in breathing).

    B). Outline the circumstances that could cause legionella bacteria to be present in the water system
    Legionella bacteria are temperature sensitive and are mostly found in water having temperature range of 20 to 45 degree Celsius. They are killed above 60 degree Celsius. They are present in sediment, sludge, lime scale and organic material that harbour them in water. They can also be found on dead leg of pipelines (no water flow) and where there is stagnant water.

    C). Identify ways in which persons can be exposed to Legionella bacteria
    Water system in the work place may be infected with this bacteria and the contaminated water is then sprayed into the air to create a mist with living bacteria inside the droplets (Example – outdoor cooling towers of air conditioning system). Thus infiltrate into persons who inhale this contaminated air.

19. **A) Identify health risks associated with exposure to Legionella bacteria**
    Leptospira bacteria is the causative agent for the disease 'Leptospirosis' that starts with flu-like symptoms (fever, headache, muscle pain) and in a serious phase involves jaundice causing liver damage (Weil's disease).

    B). Identify workplace circumstances where Leptospira bacteria may be present.
    Leptospira bacteria commonly infect animals such as rats, mice, cattle etc. Infected rats pass their bacteria in their urine, which get inactivated when dried. Rather it would remain viable for long period if entered into water or onto wet surfaces. Contaminated water comes into contact with cuts or gazes, or if ingested then infection may occur. Workplaces that deal with potentially infected animals (dairy farmers) or in wet areas where there may be rats (sewage workers, water sport instructors) are vulnerable for the presence of bacteria.

    C). Outline precautions that will reduce the risks from exposure to leptospira bacteria.
    The precautions to reduce the risks from exposure to leptospira bacteria would be preventing rat infestation by good housekeeping and vermin control (option of rearing cats can also be considered); covering up wounds with water-proof dressings; Good personal hygiene such as hand washing; appropriate PPE mainly the use of gloves; health surveillance of workers having the potential for infection (issuing workers with an 'at risk' card that will allow physician to have an early diagnosis

before causing damage to liver); providing training to workers at risk about their vulnerability and hygienic practices to be adapted.

Element 8

PHYSICAL AND PSYCHOLOGICAL HEALTH HAZARDS & RISK CONTROL

1. **Outline the possible health effects from exposure to high level of noise.**

   The health effects from exposure to high levels of noise may be acute or chronic nature. The acute effects include:
   A). Trauma from loud noise (explosion, burst eardrum), Temporary threshold shift (hearing affected at specific frequency), short term tinnitus (over – stimulation of the auditory nerves)
   B). Secondary effects (stress, loss of concentration)
   The chronic effects include:
   a). Tinnitus (riding in the ear, over-stimulation of the hair cells)
   b). Permanent threshold shift (permanent damage)
   c). Loss of frequency (damage to hair cells)

2. **Give reasons why personal hearing protection may not give the level of protection stated by the manufacturer.**
   Personal hearing protection (Ear plug / Ear muff) may not give the level of protection as stated by the manufacturer for various such as it may be an exorbitant claim from the manufacturer; sub-standard poor quality of the ear plug and/or ear muff; in appropriate maintenance and/or storage resulting in deterioration of original quality when supplied; poor fitment and hence not providing required attenuation perhaps due to inadequate training given to the worker on how to use the ear plug or ear muff; continued usage even after the expiry of its shelf/service life; worker unaware of dangers perhaps due to inadequate signage will encourage a worker from withholding use or may use scarcely; fear of getting exposed to additional hazard such as for example. Personal hearing protection may mask the reversing alarms of vehicles will lead to discontinued usage or intermittent usage; interference with hair or ear rings in case of using ear muff; unaware of consequence on health of not using personal hearing protection and existence of peer pressure may also be the reason for irregular use of hearing protection and thus not achieving the level of protection from noise in workplace as stated by the manufacturer.

3. **Outline control measures that an employer can take to encourage workers to wear hearing protection.**
   The control measures an employer can take to encourage workers to wear hearing protection would be making them aware of dangers associated with noise and consequences of not using personal hearing protection through dedicated training; involving them in selection of personal protective equipment (ear plug/ear muff) which will to a greater extent reduce the compliance concerns regarding use of ear plug; ensuring the ear plug/ ear muff made available for use and allowing a hassle-free access to them; engaging in awareness campaigns using adequate posters and signage to develop a PPE culture; demonstrating leadership by senior managers setting example on wearing hearing protection; identifying people who use hearing protection and recognizing their in public with due awards; enforcing use and taking disciplinary measures against those who violate shall also be considered though it is regarded as a negative way of motivating workers.

4. **Give two examples of noise control techniques, other than personal hearing protection, that would benefit all workers.**
   Best way would be to have Control measures at the noise source, Such as damping (reducing noise resonance from vibrating panels), Silencing (reducing the energy of emissions) etc., and to control the noise transmission path such as absorption (using sound absorbing materials to prevent reflection), insulation (acoustic enclosure) etc., rather than providing hearing protection.

5. **Identify four types of engineering controls that may be used to reduce noise in the workplace and give a practical example of each.**
   Engineering controls that may be used to reduce noise in the workplace include:
   SILENCING – Refers to the suppression f noise generated by the flow of air, gas or steam in dusts and pipes and can be achieved by the inclusion of either absorbing material or baffles. Example – Silencer fitted on to vehicle emission.
   ABSORPTION – Reduces the amount of reflected noise by using materials such as foam or mineral wool. Example – Mineral fibre marine boards (lagging) fitted on to metallic structural members of acoustic enclosures in offshore vessels.
   DAMPING – Used primarily to reduce the amount of noise radiating / reverberating from large panels and is achieved by increasing the stiffness of the panel. Example – embossing onto the panel sheets, rubber-lining the panel doors etc.
   ISOLATION – refers to physical separation of people from the noise source. Example – acoustic booths or havens, fitting flexible bellows in pipes etc.

6. **A). In realtion to noise give the meaning of the term db(A).**
   The term db(A) is a decibel unit for noise. It is based on a logarithmic scale and measures the intensity of sound by mimicking the response of the human ear to different frequency levels. This means that relatively small increase in decibel value actually represent very large increases in intensity. (Example – an increase of 3 db represents a doubling of sound intensity).

   B). Outline control measures that could be help reduce noise levels or exposure to noise in a workplace.
   The control measures that could be used to reduce noise levels or exposure to noise include reducing the speed or energy such as fitting silencers, for example on exhaust pipes and pneumatic equipment; modify the process, for example changing glass to plastic bottles can reduce noise from a packing line, replacing a compresses air rivet gun with a screw fixing in manufacturing process; appropriate maintenance of machinery which otherwise produces noise; damping the machinery parts that sometimes resonate in harmony with noise, for example stiffening large machinery panels by embossing or even adding weight to one side; provision of sound proof enclosures for particularly noisy equipment; placing acoustic screens around machinery; replacing metal gears or bushes with those made of plastic; placing machine on mats made of isolating material; reducing the exposure duration; provision of acoustic haven and hearing protection such as ear defenders and ear plugs with appropriate noise reduction rate and giving workers training on use of these PPE.

7. **A). Outline control measures to reduce levels of noise from cement mixers to which workers on construction site are exposed.**
   To reduce levels of noise from cement mixers, the prime mover used in the machinery shall be an electric motor rather than a diesel engine; if diesel driven then silencers are to be fitted on to engine emissions; the equipment shall be well maintained and lubricated; all loose parts such as covers of panels to be well secured

to prevent them resonating in harmony with other parts of the machinery; inner surface of the rotating drum shall be lined with sound absorbent material; cement mixer sited on firm level ground to avoid vibration and associated noise; operation secluded with suitable distance from other activities to prevent exposure of other workers present on site to noise level.

B). Identify other noise hazards that may be present on construction site.
Other noise hazards that may be present on a construction site include generators for electricity production; breaking of concrete using pneumatic operated breakers; use of compressors for spray painting; surface preparation of metallic structures before applying protective coats such as abrasive lasting operation; cold working of steel plates involving striking with hammers; use of heavy equipments such as excavators, shove/loaders, cranes etc.

8. **A maintenance worker regularly use a hand held grinder, and is exposed to vibration. Identify the symptoms that the worker may experience due to this exposure.**
   The symptoms experienced by the worker using hand held grinder are tingling or pins and needles in the hands and extremities, which are usually acute in nature. Other chronic symptoms would be numbness and blanching of the fingers, swollen painful joints, reduction in manual dexterity, and reduction in the sensation of touch.

9. **Outline six control measures that can be used to reduce the risk from vibration.**
   Control measures required to reduce the risk from vibration would be:
   Eliminate the use of vibrating tools; select low vibration equipment; maintenance of equipment and tools; Reducing grip force required; Reducing exposure time; Introducing health surveillance; provision of gloves with heated pads; Information and training on risks and indication of injury.

10. **The use of a road drill (pneumatic breaker) can expose workers to hand-arm and whole body vibration.**
    A). Identify two health effects from exposure to hand-arm vibration.
    B). Identify two health effects from exposure to whole body vibration.
    C). Outline factors that should be considered when carrying out a risk assessment for workers exposed to vibration when using the road drill (pneumatic breaker).
    D). Outline control measures that could be considered to reduce the risk from vibration caused by the use of the road drill (pneumatic breaker).

    A). Exposure to hand-arm vibration can cause health effects such as numbness and blanching of the fingers; tingling and pain in hands and arms; and a reduction in strength, grip, dexterity and in sensory perception.

    B). Exposure to whole body vibration can cause health effects such a fatigue and headache, back pain which may result in permanent injury, shakiness shortly after exposure has taken place and insomnia.

    C). Factors that should be considered when carrying out a risk assessment for workers exposed to vibration when using the pneumatic breaker include the observation of work practices; the magnitude of the vibration from the equipment and the exposure limit and action values; the duration and frequency of exposure; the condition and maintenance of the equipment and the material on which it is to be used; the temperature in which the equipment is to be used; the existence of any information from the manufacturers; the welfare and rest facilities to be provided; and risk factors connected with individual workers such as existing health conditions or smoking habits.

D). control measure to reduce the risk from vibration caused by the use of pneumatic breaker would be elimination by mechanisation or automation; substituting the tools with lower vibration equipment; reducing the time of exposure of the operatives by providing frequent breaks and/or job rotation; modifying the equipment to improve the grip on the tools and reducing the grip force by the use of improved techniques; introducing a planned maintenance programme for the tools; providing appropriate personal protective equipment such as gloves to keep the hands warm; introducing a programme of health surveillance and providing the workers with information, instruction and training on the hazards associated with the use of the tools and the control measures that should be taken, on recognising the early symptoms both of hand-arm and whole body vibration and how and to whom they should report them.

11. Identify four types of ionising radiation.

Alpha particles – Sub atomic particles emitted by radioactive substance that don't have much penetrating power and can be stopped by skin and paper.

Beta particles – sub atomic particles emitted by radioactive substance that have more penetrating power and can penetrate through skin into living tissues.

Gamma rays – a form of very high electro-magnetic energy that has very high penetrating power.

X-rays – a form of very high electro-magnetic radiation emitted by some radioactive substances and x-ray generators and has very high penetrating power.

12. Outline the main control measures for ionising radiation.

Measures for controlling ionizing radiation can be achieved by three simple principles:

TIME – minimize the duration of exposure as the dose of radiation received is directly proportional to the duration of exposure.

DISTANCE – greater the distance from the radiation source to the exposed worker lower the dose received.

SHIELDING – the type require depends on the type of radiation. Relatively thin shields can contain alpha particles but gamma and x-rays require thicker and denser material such as lead.

Other control measures would be using a source that is low in strength where required; safe and secured storage of radiation source, probably inside purpose-built pits; monitoring the area for radiation using survey meters and personal dosimeters; following good hygiene practices; providing personal protective equipment like aprons, masks etc.; health surveillance of classified workers; providing appropriate training; correct and safe disposal of radioactive substances.

13. Outline the factors that may lead to occupational stress amongst workers.

Factors that may lead to occupational stress amongst workers would be – culture of the organization (such as apportioning blame, bullying, retribution etc.,); work pattern such as shift work, unsociable hours, excessive overtime; existence of fear syndrome such as job insecurity, fear of redundancy; lack of interest or enthusiasm probably due to monotonous work; lack of breaks and control over job probably due to work rate too high or too low; working environment that includes the ambient conditions such as too hot or too cold, inadequate working space, poor ventilation arrangements, poor lighting necessitating excess job concentration, excessive noise level etc., Relationships with supervisors & peers that includes harassment and bullying, fear of violence etc., Lack of communication with the management such as failure to provide feedback; personal & social factors such as inability to cope up with diverse nationality, home influences etc.,; poor service to and from clients; industrial relationship problems; increase in disciplinary issues probably due to lack of enforcement.

Other factors include lack of adequate training, repetitive and often boring work, too much or too little responsibility, and lack of career development.

14. Outline prevention strategies an organization could consider to reduce the risk of violence towards workers.

An organization can reduce the risk of violence towards workers by having measure such as- queue management and providing information(the time customers have to spend waiting to pay- and their experience in the queue); less face to face contact; use" cashless systems"(introduce cheque/draft/token system); check credentials and location of clients before meeting; avoid lone working in high risk areas; call in system for lone workers; pickup/drop from home arrangements for staff working late; employee training to identify the situations leading to violence and handle; change public waiting areas; provide staff vulnerable to violence with escape routes; video cameras, panic buttons, alarms, visible security; protective screens/security codes; wider counters/higher floor staff side.

15. Workers who deal with public may be subject to violent behaviour.

a) Give the meaning of the term 'work related violence'.

The term 'work-related violence' refers to any incident in which a person is abused, threatened or assaulted in circumstance relating to work. Violence is not just restricted to physical assault but also include verbal abuse and acts of aggression, which are more common than and equally serious as assault.

b) Identify reasons why a member of the public may behave violently towards a worker.

The reasons for violent behaviour from public would be as a result of poor queen management associated with no clear information about delays; perhaps with an intent of stealing, where cash and valuables are handled; under the influence of alcohol and drugs or may be due to insanity; as a result of denial or refusal, which a member of the public may crave for from the worker; in an attempt to maintain law and other the worker may sometime encounter violence from the member of public; while receiving and recording complaints, perhaps an agitated complainant (a member of the public) may resort to abuse with the worker.