



Subject Code: 12173

Model Answer

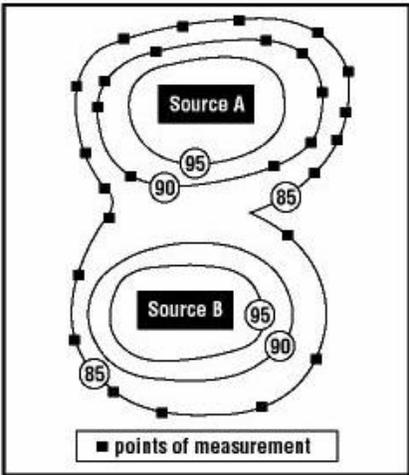
Page No: 1/23

Important Instructions to examiners:

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

Marks

1. Attempt any five of following :	20
a) What is meant by green House effect?	04
Answer: Green House Effect: i. The "Greenhouse effect" is the heating of the Earth. Certain gases in the atmosphere like water vapor, carbon dioxide, nitrous oxide, and methane, trap energy from the sun. Without these gases, heat would escape back into space and Earth's average temperature would be about 60°F colder. Without the greenhouse effect, the Earth would not be warm enough for humans to live. ii. Shorter-wavelength solar radiation from the sun passes through Earth's atmosphere, and then is absorbed by the surface of the Earth, causing it to warm. Part of the absorbed energy is then reradiated back to the atmosphere. iii. The greenhouse gases selectively transmit the infrared waves, trapping some and allowing some to pass through into space. The greenhouse gases absorb these waves and reemits the waves downward, causing the lower atmosphere to warm. But if the greenhouse effect becomes stronger, it could make the Earth warmer than usual. iv. It is named this way because of a similar effect produced by the glass panes of a greenhouse.	04
b) State the effect of air pollution on economy.	04
Answer: Effects of Air pollution on economy: (<i>Any 08</i>) i. Corrosion: The prime air pollutant responsible for metallic corrosion is SO ₂ . Enormous loss due to corrosion is caused to parts of building roofs, railway tracks, overhead wires, metal on bridges and other structures. ii. Damage to building materials: The acid deposition reacts with limestone, marble to cause deterioration. iii. Damage to paints and protective covering: SO ₂ , O ₃ , H ₂ S and aerosols causes damage to	½ each

<p> painted parts and structures as well as various protective coverings on the machineries. iv. Damage to textile dyes and textile fibers. v. Rubber cracking of tyres and electrical insulation. vi. Deterioration of leather and paper. vii. Increased transportation cost in period of smog. viii. Expenditure in connection with the administrative organization of pollution control. </p>	
<p>c) Explain in brief noise mapping.</p>	04
<p> Answer: (Note: Sketch, Definition and one suitable example is desirable.) Noise Mapping: </p> <div style="text-align: center; margin: 10px 0;">  </div> <p style="text-align: center;">Figure: Noise Map</p> <p> i. A Noise Map is a map of an area which is colored according to the noise levels in the area. Sometimes, the noise levels may be shown by contour lines which show the boundaries between different noise levels in an area. </p> <p> ii. Noise map can be drawn for particular area, region or location. A further benefit of having a noise model is that it can be used to assess the effects of transportation and other plans. Thus the effect of a proposed new road can be assessed and suitable noise mitigation can be designed to minimize its impact. </p> <p> iii. For example in industry with noise problem, a noise survey takes noise measurements throughout an entire plant or section to identify noisy areas. Noise surveys provide very useful information which enables us to identify: </p> <ul style="list-style-type: none"> ○ Areas where employees are likely to be exposed to harmful levels of noise. ○ Machines and equipment which generate harmful levels of noise. 	01
<p>d) State the causes of biodiversity loss.</p>	04
<p> Answer: Causes of biodiversity loss: (Any 04) </p> <p> i. Deforestation activities such as cutting trees for timber, removal of medicinal plants, agriculture etc. </p> <p> ii. Production of hybrid seeds requires wild plants as raw material, farmers prefer hybrid reeds, and many plant species become extinct. </p> <p> iii. Increase in the production of pharmaceutical companies made several numbers of medicinal </p>	



Subject Code: 12173

Model Answer

Page No: 3/23

<p>plants and species on the verge of extinction.</p> <p>iv. Removal of forest cover for road laying and also due to soil erosion</p> <p>v. Illegal trade of wild life</p> <p>vi. Population explosion, construction of dam, discharge of industrial effluents use of pesticides etc.</p> <p>vii. Poaching of wild life: Due to poaching, illegal trade and smuggling activities most of our valuable fauna are under threat e.g. Tiger, Deer – for hides, Rhinoceros – for horns, Elephant – for ivory tusk, Sea Horse, Star turtle – sold to foreign market.</p> <p>viii. Human caused reduction: The climate change caused by our release of green house gases in the atmosphere could have catastrophic effects. Woodlands and grasslands are converted for crop production.,</p> <p>ix. Hunting: Over harvesting is responsible for depletion or extinction of many species. Eg. Tiger hunting.</p> <p>x. Fragmentation: Habitat fragmentation reduces the biodiversity because many animals like bears and large cats require large territories to subsist. Some forest birds reproduce only in deep forest or habitat far from human settlement.</p> <p>xi. Commercial products: Smuggling of fuels, hides, horns and folk medicines also affect the biodiversity in an abrupt manner.</p>	01each
<p>e) State the causes of agricultural pollution.</p>	04
<p>Answer: Causes of agricultural pollution: (<i>Any 04 suitable causes</i>)</p> <p>i. The agricultural sector is known for its extensive use of pesticides. This application causes emissions of many toxic chemicals.</p> <p>ii. Emissions of nitrous oxide (N₂O) mainly stem from agriculture, because nitrogen in soils can easily be denitrified by bacteria. Nitrous oxide is emitted during the denitrification process.</p> <p>iii. The application of (artificial) fertilizers causes emissions of ammonia (NH₃), nitrogen oxides (NO_x) and methane CH₄), a greenhouse gas.</p> <p>iv. Slash and burn farming practice, which is often an element within shifting cultivation agricultural systems.</p> <p>v. Soil pollution by acid rain, industrial waste, sewage water etc.</p> <p>vi. Noise pollution caused by machineries used for harvesting and cultivation.</p> <p>vii. Pollution due to exhaust emission from farm equipment and machineries e.g. tractor, power tiller, pesticide spray pump, water pumps etc.</p>	01each
<p>f) What are the sources of water pollution?</p>	04
<p>Answer: Sources of water pollution: (<i>Any 08</i>)</p> <p>i. Industrial discharge of chemical wastes and byproducts.</p> <p>ii. Discharge of poorly treated or untreated sewage.</p> <p>iii. Surface runoff containing pesticides.</p> <p>iv. Slash and burn farming practice, which is often an element within shifting cultivation agricultural systems.</p> <p>v. Surface runoff containing spilled petroleum products.</p>	½ each



Subject Code: 12173

Model Answer

Page No: 4/23

vi. Surface runoff from construction sites, farms, or paved and other impervious surfaces e.g. silt. vii. Discharge of contaminated and/or heated water used for industrial processes. viii. Acid rain caused by industrial discharge of sulfur dioxide. ix. Excess nutrients added by runoff containing detergents or fertilizers. x. Underground storage tank leakage, leading to soil contamination, and hence aquifer contamination.	
g) Define the term air quality and emission standards.	04
Answer: Air quality: The term “air quality” means the state of the air around us. Good air quality refers to clean, clear, unpolluted air. or Air quality is defined as a measure of the condition of air relative to the requirements of one or more biotic species or to any human need or purpose. Air quality can be measured by the presence of contaminants in the air, such as carbon monoxide (CO), nitrogen dioxide (NO ₂), ozone (O ₃), particulate matter (PM _{2.5} and PM ₁₀), sulphur dioxide (SO ₂), and hydrogen sulphide (H ₂ S).	01
Emission standards: Emission standards are the limits prescribed under Rule 115 of the Central Motor Vehicle Rules 1989 for various types of emissions coming out of the vehicles, with a view to controlling environment pollution.	01
Emission standards have prescribed maximum, CO (Carbon Monoxide), HC (Hydrocarbons), NOX (Nitrous oxide) and PM (Particulate matter), levels set by the government which a vehicle would emit when running on roads. All the manufacturers need to implement the same for vehicles being manufactured from the date of implementation e.g. BS-II, BS-III, BS-IV emission norms implemented in India for automotive pollution control.	01
2. Attempt any four of following:	16
a) Explain the concept of ecosystem and enlist the different types of ecosystem.	04
Answer: Concept of ecosystem: Ecosystem is geographical area of variable size where plants animals, the landscape and climate all interact together. or An ecosystem is defined as a natural functional ecological unit comprising of living organisms and their non-living environment that interact to form a stable self-supporting system. Different plants and animals are found in different environments, suitable to them. Any change in that environment may affect their living. Living organisms cannot be isolated from their non-living environment because the later provides materials and energy for the survival of the former.	01
	01

**ii. Chemical tests: (Any 03 parameters)**

The chemical tests carried out on water are to determine:

- Total solids
- Hardness
- Chlorides
- Dissolved gases
- pH value or hydrogen-ion concentration
- Nitrogen and its compounds
- Metals and other chemical substances

a) Total Solids: The total solids in water are due to

- Suspended matter
- Dissolved matter

These are determined separately and then added together. The suspended solids are found by filtering the water through a fine filter. The material retained on the filter is weighed. The filtered water is then evaporated and the residue is weighed. This gives the dissolved matter. The total solids in potable water should not exceed 500 ppm and never more than 1000.

b) Hardness: Hardness is tested by EDTA (ethylene diamine tetracetic acid) test. For this, the water is titrated against EDTA salt solution using Erio Chrome Black T as indicator. The colour changes from red to blue while titrating.

In another method, hardness is tested by the soap solution test. Standard soap solution is added to the water and vigorously shaken for about five minutes. The difference between the soap solution used and the lather factor gives the hardness. For potable water the hardness should vary between 5 to 8 degrees or should not be more than 200 ppm.

c) Chlorides: This test is done to determine the amount of sodium chloride present in the water. The amount of sodium chloride present in the water is determined by adding silver nitrate of known concentration and potassium chromate to the water to be tested. The solution should be continuously stirred. If chlorides are present, then reddish colour will be formed. The permissible limit of chlorides is 250 ppm.

d) Dissolved Gases: Certain quantities of oxygen are found dissolved in surface waters which are absorbed from atmosphere. The amount of dissolved oxygen is found by exposing the sample of water for four hours at 27°C with potassium permanganate of 10% concentration. The quantity of oxygen absorbed should be between 5 and 10 ppm.

e) pH Value or Hydrogen-ion Concentration: This test is conducted to find the acidity or alkalinity of a sample of water.

The pH value is determined by the following two methods:

- Electrometric Method: In this method, a potentiometer is used to measure the electrical pressure exerted by the H⁺ ions. A meter connected to the circuit indicates the pH value directly.
- Colourimetric Method: In this method, chemical reagents or indicators are added to the sample of water. The colour produced is compared with standard colour waters kept in sealed tubes of known pH values. This is a simple test and commonly adopted.



Subject Code: 12173

Model Answer

Page No: 9/23

<p>in coke ovens under high pressure.</p> <p>vii. Construction activities.</p> <p>viii. Celebrations.</p> <p>ix. Electric home appliances.</p>	
<p>f) State the various environment and pollution control acts.</p>	04
<p>Answer: Environment and pollution control acts: (Any 04)</p> <p>i. The Environment (Protection) Act, 1986: authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and /or operation of any industrial facility on environmental grounds.</p> <p>ii. The Environment (Protection) Rules, 1986: lay down procedures for setting standards of emission or discharge of environmental pollutants.</p> <p>iii. The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002: lay down such terms and conditions as are necessary to reduce noise pollution, permit use of loud speakers or public address systems during night hours (between 10:00 p.m. to 12:00 midnight) on or during any cultural or religious festive occasion.</p> <p>iv. The Indian Forest Act and Amendment, 1984: is one of the many surviving colonial statutes. It was enacted to 'consolidate the law related to forest, the transit of forest produce, and the duty leviable on timber and other forest produce'.</p> <p>v. The Wildlife Protection Act, Rules 1973 and Amendment 1991: provides for the protection of birds and animals and for all matters that are connected to it whether it be their habitat or the waterhole or the forests that sustain them.</p> <p>vi. The Forest (Conservation) Act and Rules, 1981: provides for the protection of and the conservation of the forests.</p> <p>vii. The Water (Prevention and Control of Pollution) Act, 1974: establishes an institutional structure for preventing and abating water pollution. It establishes standards for water quality and effluent. Polluting industries must seek permission to discharge waste into effluent bodies. The CPCB (Central Pollution Control Board) was constituted under this act.</p> <p>viii. The Water (Prevention and Control of Pollution) Cess Act, 1977: provides for the levy and collection of Cess or fees on water consuming industries and local authorities.</p> <p>ix. The Water (Prevention and Control of Pollution) Cess Rules, 1978: contains the standard definitions and indicate the kind of and location of meters that every consumer of water is required to affix.</p> <p>x. The Factories Act, 1948 and Amendment in 1987 was the first to express concern for the working environment of the workers. The amendment of 1987 has sharpened its environmental focus and expanded its application to hazardous processes.</p> <p>xi. The Air (Prevention and Control of Pollution) Act, 1981: provides for the control and abatement of air pollution. It entrusts the power of enforcing this act to the CPCB.</p> <p>xii. The Air (Prevention and Control of Pollution) Rules, 1982: defines the procedures of the meetings of the Boards and the powers entrusted to them.</p> <p>xiii. The Atomic Energy Act, 1982: deals with the radioactive waste.</p> <p>xiv. The Air (Prevention and Control of Pollution) Amendment Act, 1987: empowers the central and state pollution control boards to meet with grave emergencies of air pollution.</p> <p>xv. The Motor Vehicles Act, 1988: in order to check the emitted smokes from badly maintained</p>	01 each



automobiles, containing too much of lead, carbon monoxide and particulate matter, a fourth legislation, called Motor Vehicles Act, 1988, has been passed by the parliament. The implementation of exhaust standards framed under Central Motor Vehicles Rules 1989, was to come into force w.e.f. 1-7- 1989.	
3. Attempt any four of following:	16
a) Write the various steps in water treatment.	04
Answer: Purification process of water: (<i>Any 04 suitable steps</i>) i. Screening (Pre-Treatment): Pumps bring "raw" or untreated water, often from lakes or rivers, into the purification plant through screens that exclude fish, weeds, branches and large pieces of debris. Screening may not be necessary for groundwater. ii. Pre-Treatment (aeration): The plant may aerate the water at this point to increase the oxygen content and thus help remove problematic odors and tastes by exchange of gases between water and atmosphere. Aeration is done by bringing water in contact with atmospheric air. iii. Coagulation & Flocculation: The purpose of these two steps is to clear water of the small particles that cause it to be turbid or cloudy. The water is rapidly agitated to disperse coagulant chemicals throughout it. The small particles, including many bacteria, begin to form large clumps called flocs or floccules. In flocculation, the water is mixed gently so that these clumps combine and precipitate out further. iv. Sedimentation: The water and flocs are pumped into sedimentation basins. Here, the flocs settle beneath the water so that they can be removed. v. Filtration: In filtration, the water flows through a multilayer medium such as quartz sand, activated carbon or anthracite coal in order to remove up to 99.5 percent of the solid materials remaining in it. vi. Disinfection: Disinfection kills off disease-bearing organisms in the water. Most water treatment plants use chemicals, generally chlorine compounds, as disinfectants, ultraviolet radiation and ozone gas are becoming more widespread. vii. Corrosion & Scale Control: The pH of the water is adjusted so that it neither corrodes nor deposits too much scale in pipes. viii. Taste & Odor Control: Water purification plants often remove tastes and odors through additional chemical treatment, ozonation or filtration.	01 each
b) List any four sources of air pollution.	04
Answer: Sources of air pollution (<i>Any 04</i>) The main sources of air pollution are: Industries, Agriculture, Traffic, and Energy Generation. i. Emissions of nitrous oxide (N ₂ O) mainly stem from agriculture , because nitrogen in soils can easily be denitrified by bacteria. ii. The application of (artificial) fertilizers causes emissions of ammonia (NH ₃), nitrogen oxides (NO _x) and methane CH ₄), a greenhouse gas.	01 each



<p>"thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash. The heat energy is used for various applications. Incineration reduces the volume of refuse by up to 90 percent at 900-1000°C, leaving behind only ash, and resulting in less need for landfill space. This is the preferred technique for waste management, particularly in the developed countries. Incineration offers environment-friendly technique-free from corrosion, emission of offensive odours and also free from bacteria and wet organic matter which gives off foul odours and gases. The waste heat from incineration can be utilized for supplementing electricity generation for domestic heating, etc. The only drawback is that the technique is costly at present requiring expensive equipment.</p>	
<p>d) Explain in brief Kyoto Treaty.</p>	04
<p>Answer: Kyoto Treaty: The Kyoto treaty is an agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 (but note that, compared to the emissions levels that would be expected by 2010 without the Protocol, this limitation represents a 29% cut). The goal is to lower overall emissions of six greenhouse gases: carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons averaged over the period of 2008-2012. National limitations range from 8% reductions for the European Union and some others to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland. It was adopted for use on 11 December 1997 by the 3rd Conference of the Parties, which was meeting in Kyoto - Japan, and it entered into force on 16 February 2005. As of May 2008, 182 parties have ratified the protocol. Of these, 36 developed countries are required to reduce greenhouse gas emissions to the levels specified for each of them in the treaty with three more countries intending to participate. One hundred thirty-seven developing countries have ratified the protocol, including Brazil, China and India, but have no obligation beyond monitoring and reporting emissions. The United States is the only developed country that has not ratified the treaty and is one of the significant greenhouse gas emitters.</p>	01 01 02
<p>e) Define following terms : i) Turbidity, ii) Chemical O₂ demand, iii) Acidity, iv) Total suspended solids.</p>	04
<p>Answer: i. Turbidity: Turbidity is the cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eye. Turbidity is the measure of water clarity. Turbidity should not be greater than 10 ppm for public water-supply. ii. Chemical Oxygen Demand (COD): Chemical oxygen demand (COD) is a measure of the capacity of water to consume oxygen during the decomposition of organic matter and the oxidation of inorganic chemicals such as ammonia and nitrite. It is expressed in milligrams per liter (mg/L) or parts per million (ppm), which indicates the mass of oxygen consumed per liter of solution.</p>	01 each



Subject Code: 12173

Model Answer

Page No: 14/23

b) Write the sources and effects of radiation.	04
<p>Answer:</p> <p>Sources of radiation: <i>(Any 04 suitable sources.)</i></p> <ol style="list-style-type: none">Natural source: Radon gas that is trapped within buildings. Granite found in home furnishings such as counter tops and furniture tends to emit radon.Anthropogenic source:<ul style="list-style-type: none">Accidents: Nuclear reactor accidents, medical radiation therapy accidents or errors in treatment dose, accidents during the transportation of radioactive material.Terrorist Use of Nuclear Materials: The use of radioactive materials in an RDD or a nuclear weapon by a terrorist is a remote but probable threat.Mining: mining and refining of uranium and thorium are also causes of nuclear waste. <p>Effects of radiation: <i>(Any 02)</i></p> <ol style="list-style-type: none">Hair: The losing of hair quickly and in clumps occurs with radiation exposure at 200 rems or higher.Brain: Since brain cells do not reproduce, radiation kills nerve cells and small blood vessels, and can cause seizures and immediate death.Thyroid: The thyroid gland is susceptible to radioactive iodine. In sufficient amounts, radioactive iodine can destroy all or part of the thyroid.Heart: Intense exposure to radioactive material at 1,000 to 5,000 rems would do immediate damage to small blood vessels and probably cause heart failure and death directly.Cancer.	02
c) Discuss the air pollution in Delhi.	04
<p>Answer: <i>(Note: 04 different examples or areas contributing to air pollution in Delhi are desirable. 01 mark each for each example or area.)</i></p> <p>Air Pollution in Delhi:</p> <ul style="list-style-type: none">Delhi is the fourth most polluted city in the world. Rapid rate of industrialization and migration has created unique challenges for the municipality to overcome.The unexpected growth in the number of vehicles in Delhi is a major concern.The city is regularly choked in thick fog as an array of traffic and heavy industries throw 3,000 ton of pollutants into the air every day.Pollution from thermal power plants contributes 13 per cent of air pollution.There are 28 industrial areas in Delhi. Most of the small scale industries don't have individual facilities to treat liquid waste.The terrible air quality in the Indian capital has just become even worse due to construction work for the common wealth games, large scale construction have taken a toll on Delhi's air quality. Massive building work for October's games and the subsequent traffic congestion are to blame for a large increase in nitrogen oxides in Delhi's environment.Delhi Pollution Control Committee existing in Delhi (DPCC) basically established for controlling pollution in Delhi. The fact that particulate matter has had a downward curve in Delhi over four years is because of the success of the CNG programme. Delhi's air quality got so bad that the Supreme Court recently stepped in and placed a limit on the	

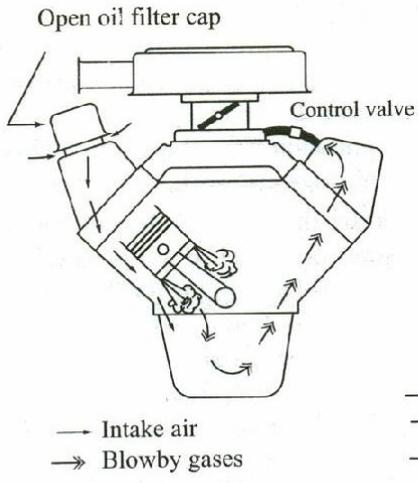
number of new car registrations in the capital.	
d) What are the effects of water pollution?	04
<p>Answer:</p> <p>Effects of water pollution: <i>(Any 04)</i></p> <ol style="list-style-type: none"> i. Human infectious diseases are among the most serious effects of water pollution. These include typhoid, intestinal parasites, and most of the enteric and diarrheal diseases caused by bacteria, parasites, and viruses. ii. Heavy metals from industrial processes can accumulate in nearby lakes and rivers. Heavy metals can slow development; result in birth defects and some are carcinogenic. iii. Industrial waste often contains many toxic compounds that damage the health of aquatic animals and those who eat them. They can cause immune suppression, reproductive failure or acute poisoning. iv. Organic matter and nutrients causes an increase in aerobic algae and depletes oxygen from the water column. This causes the suffocation of fish and other aquatic organisms. v. Sulfate particles from acid rain can cause harm the health of marine life in the rivers and lakes it contaminates, and can result in death. vi. Suspended particles in freshwater reduces the quality of drinking water for humans and the aquatic environment for marine life. Suspended particles can often reduce the amount of sunlight penetrating the water, disrupting the growth of photosynthetic plants and micro-organisms. vii. Pesticides are carried in rainwater runoff from farm fields, suburban lawns, or roadside embankments into the nearest creeks and streams. In terms of general human health effects, pesticides can affect and damage the nervous system, cause liver damage, and cause a variety of cancers. 	01 each
e) Explain with neat sketch positive crankcase ventilation system	04
<p>Answer: <i>(Any 01 type is expected)</i></p> <p>Open type positive crankcase ventilation system:</p> <div style="text-align: center;">  <p style="text-align: center;">(a)</p> </div> <p style="text-align: center;">Figure: Open type Positive Crankcase Ventilation.</p>	02

Figure shows the intake manifold return Positive Crankcase Ventilation (PCV) of open type system. It has a tube leading from crankcase or else the rocker arm cover through a flow control valve and into the intake manifold, usually, through an opening just below the carburetor. To provide proper ventilation of the interior of the engine, fresh air is usually drawn in through a rocker arm cover opposite that containing the PCV system.

02

OR

Closed type positive crankcase ventilation system:

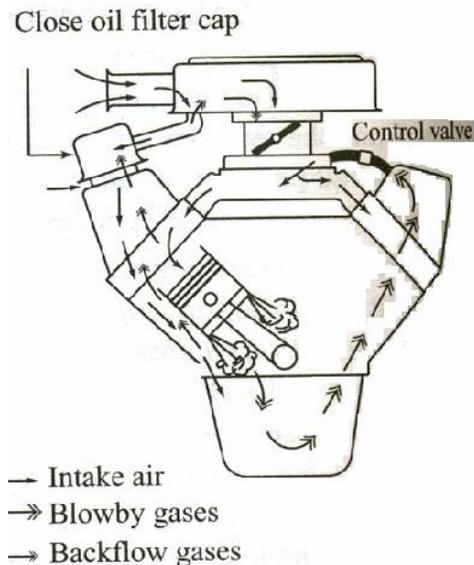


Figure: Closed type Positive Crankcase Ventilation.

The closed PCV system (as shown in fig). has a tube connected between the oil fill tube cap and the air cleaner, both open and closed systems function in the same manner as long as the PCV valve remains unplugged. If the PCV valve plugs, using an open system, the blowby gases exhaust out of the oil fill tube cap and into the atmosphere. With PCV valve plugged it is no longer possible for fresh air crankcase ventilation to occur.

f) Write the strategies for conservation of biodiversity.

04

Answer:

There are two strategies for conservation of biodiversity:

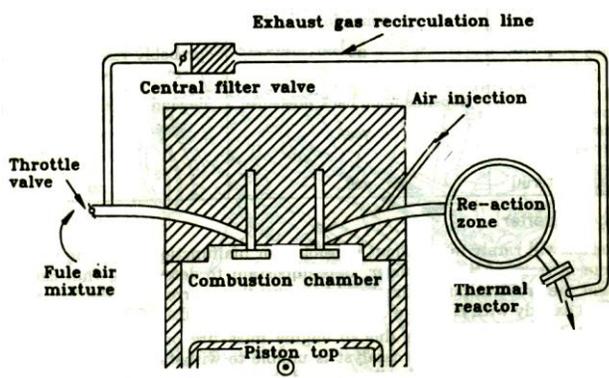
i. In-situ conservation:

- Conservation of species in its natural habitat, in place where the species normally occurs
- The strategy involves establishing small or large protected areas, called protected areas
- Today in world, there are 9800 protected areas and 1500 national parks

Methods:

- Nature or biosphere reserves (Eg) Nilgiri Bio reserve
- national parks and sanctuaries (Eg) Mudumalai, vedanthangal
- on farm and home garden conservation for plants, vegetables and fruits to maintain

02

<p>traditional crop varieties.</p> <p>ii. Ex- situ conservation:</p> <ul style="list-style-type: none"> • It involves maintenance and breeding of endangered plant and animal species under partially or wholly controlled conditions in zoos, gardens and laboratories. • The crucial issue for conservation is to identify those species which are more at risk of extinction. <p>Methods:</p> <ul style="list-style-type: none"> • Long term captive breeding • Shortage term propagation and release • Animal translocation and re introductions • Seed bank • Reproductive technology <ul style="list-style-type: none"> ○ Embryo transfer technology ○ Cloning 	02
<p>5. Attempt any two of following :</p>	16
<p>a) List the different methods of pollution control of S.I .Engine. Explain EGR system with neat sketch.</p>	08
<p>Answer: <i>(list any six- 3 marks, description and fig - 5 marks)</i></p> <p>Various methods / devices / accessories used for pollution control in SI Engine are:</p> <ol style="list-style-type: none"> i. Catalytic converters ii. Evaporation Loss Control Device (ELCD) iii. Crankcase blowby iv. Turbo-Charger v. Variable Valve Timing & Lift (VVT&L) vi. Cylinder Deactivation vii. Electric assisted Choke 	03
	02
<p>Figure: Exhaust gas recirculation system.</p>	
<p>Exhaust Gas Recirculation: Many engines produced after the 1973 model year have an exhaust gas recirculation (EGR) valve between the exhaust and intake manifolds; its sole purpose is to</p>	



<p>reduce NO_x emissions by introducing a metered, and quite small amount of inert gas into the air/fuel mixture, lowering peak combustion temperatures. In the case of EGR, the exhaust gasses are inert enough to serve this purpose.</p> <p>As shown in fig. the exhaust gas is taken through an orifice and passed through control valve for the regulation of quantity of recirculation.</p>	03																																								
<p style="text-align: center;">b) Explain design and operating parameters responsible for emission in C.I Engine.</p>	08																																								
<p><i>Answer: (Any two design parameters and any two operating parameters must be explained only listing without explanation must be given 2 marks. Variation of emission with respect to parameters is given in table below for reference. The credit may be given to suitable explanation of parameters matching to the table.)</i></p> <p>C.I Engine emissions: Important diesel engine variables that influence emissions are:</p> <p>A) Engine Design Variables</p> <ol style="list-style-type: none"> i. Compression ratio ii. Combustion chamber type iii. Combustion chamber design iv. Injection system: injection pressure and timing, nozzle holes, nozzle sac volume <p>B) Operating Variables:</p> <ol style="list-style-type: none"> i. EGR ii. Engine speed iii. Engine load iv. Fuel quality <p>The effect of various design and operating variables on DI diesel engine performance and emissions are summarized in Table.</p> <p>Table: Emission Trends with Engine Design and Operating Variables for Diesel Engines</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 45%;">Parameter (↑ increase)</th> <th style="width: 15%;">NO_x</th> <th style="width: 15%;">HC</th> <th style="width: 15%;">PM</th> </tr> </thead> <tbody> <tr> <td>Engine design variables</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Compression ratio ↑</td> <td>U</td> <td>↘</td> <td>U</td> </tr> <tr> <td>Stroke/Bore ratio ↑</td> <td>→</td> <td>↘</td> <td>↘</td> </tr> <tr> <td>Crevice volume ↑</td> <td>→</td> <td>→</td> <td>↗</td> </tr> <tr> <td>Swirl ↑</td> <td>U</td> <td>U</td> <td>U</td> </tr> <tr> <td>Valve number ↑</td> <td>↘</td> <td>→</td> <td>→</td> </tr> <tr> <td>Fuel injection variables</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Injection pressure ↑</td> <td>↗</td> <td>↘</td> <td>↘</td> </tr> <tr> <td>Retarded injection timing ↑</td> <td>↘</td> <td>↗</td> <td>↗</td> </tr> </tbody> </table>		Parameter (↑ increase)	NO _x	HC	PM	Engine design variables				Compression ratio ↑	U	↘	U	Stroke/Bore ratio ↑	→	↘	↘	Crevice volume ↑	→	→	↗	Swirl ↑	U	U	U	Valve number ↑	↘	→	→	Fuel injection variables				Injection pressure ↑	↗	↘	↘	Retarded injection timing ↑	↘	↗	↗
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Subject Code: 12173

Model Answer

Page No: 20/23

<ul style="list-style-type: none">• Selective catalytic reduction (SCR)• NO_x scrubber• Exhaust gas recirculation <p>iii. VOC abatement</p> <ul style="list-style-type: none">• Flars• Thermal oxidizer• Biofilter• Absorption (scrubbing)• Catalytic converter <p>iv. Acid gas / SO₂ control</p> <ul style="list-style-type: none">• Wet scrubber• Dry scrubber• Flue gas desulfurization.	
<p>Causes of air pollution in cement industry: (<i>writing names of typical pollutants is expected</i>)</p> <p>Cement is manufactured from a suitable mixture of limestone and clay which are first crushed and ground. So typical pollutants from cement industry are SO_x, NO_x, CO, Particulate matter, smoke and lime dust. There is considerable generation of dust which needs to be contained at all stages.</p>	02
<p>Remedies for air pollution in cement industry: (<i>any 2</i>)</p> <ul style="list-style-type: none">i. Dust particles are suppressed by means of spraying water in the areas of dust generation viz, damping, hopper, crusher, etc.ii. The dust carried by the air stream is collected using canvas, wool or terylene filter bags.iii. The older cement plants are provided with wet process rotary kilns with chains at the slurry feed end. These chains help in arresting the dust picked up by the exhaust gas.	02
<p>6. Attempt any two of following</p>	16
<p>a) Classify air pollution. Describe the photochemical air pollution.</p>	08
<p>Answer: Classification of air pollution: Air pollution is classified in different ways as follows:</p> <ul style="list-style-type: none">i. On basis of Source:<ul style="list-style-type: none">• Natural pollution: e.g. pollution due to Volcano, storm, forest fire, etc• Anthropogenic (Human cause) pollution: Pollution due to burning of fuels in furnaces or engines etc.ii. On basis of pollutant:<ul style="list-style-type: none">• Biological air pollution, such as pollens, small insects and microorganisms (bacteria, fungi, yeasts and algae)• Physical air pollution, such as sound, smell, thermal pollution and radioactive radiation• Chemical air pollution, such as ozone, aerosols and ammonia.	02 02



Subject Code: 12173

Model Answer

Page No: 22/23

<p>devote more time to complete their task, which leads to tiredness and fatigue.</p> <p>v. Noise pollution acts as a stress invigorator, increasing the stress levels among people.</p> <p>vi. Sometimes, being surrounded by too much of noise, people can be victims of certain diseases like blood pressure, mental illness, etc.</p> <p>ii) ISO9000 and 14000Standards: The ISO 9000 family of standards is related to quality management systems and designed to help organizations ensure that they meet the needs of customers and other stakeholder. ISO 9000 is a set of five International Standards for Quality Assurance.</p> <p>ISO 14000 is a series of standards being prepared by the International Standards Organization (ISO), for Environment Management System. ISO 14000 group of standards cover the following areas:</p> <ul style="list-style-type: none">i) Environmental Management Systems (14001, 14002, 14004)ii) Environmental Auditing (14010, 14011, 14012)iii) Environmental Labeling (14020, 14021, 14022, 14023, 14024, 14025)iv) Evaluation of Environmental Performance (14031)v) Life-Cycle Assessment (14040, 14041, 14042, 14043) <p>These standards will make aware companies about pollution and its control.</p>	<p>01</p> <p>03</p>
<p>b) i) What is water quality standard? ii) Explain the methods of disposal of radiation waste</p>	<p>08</p>
<p>Answer: i) Water quality standard: <i>(student must write any 8 permissible values out of given below)</i> The Government of India manual on water supply and treatment recommends the following standards for potable water.</p> <ul style="list-style-type: none">i. The physical and chemical quality of water should not exceed the limits shown in tableii. Bacteriological Standards Water in the distribution system shall satisfy all the three criteria indicated as follows:<ul style="list-style-type: none">• E. coli count in 100 ml of any sample should be zero.• Coliform organisms not more than 10 per 100 ml shall be present in any sample.• Coliform organisms should not be detectable in 100 ml of any two consecutive samples or more than 50% of the samples collected for the year.	<p>04</p>



Table: IS standards for potable water

S.N O	Constituents	Recommended permissible limits
01	Total Solids	Less than 500 ppm
02	Hardness	Less than 100 ppm
03	Chlorides	Less than 250 ppm
04	Iron and Manganese	Less than 0.30 ppm
05	Arsenic	Less than 0.05 ppm
06	Lead	Less than 0.10 ppm
07	Copper	Less than 3.0 ppm
08	Fluorine	Less than 1.50 ppm
09	Chlorine	0.1 to 0.2 ppm
10	Dissolved Oxygen (D.O)	5.0 to 6.0 ppm
11	pH Value	6.5 to 8.0 ppm
12	Nitrites	NIL
13	Taste	No objectionable Taste
14	Temperature	10 °c to 15.6 °c
15	Colour	10 to 20 (on platinum-cobalt scale)
16	Odour	0 to 4 Po Value
17	B-Coli	No B-Coli in 100 mL
18	Radiological Emitters	1 MMc/Litre
19	β - Emitters	10 MMc/Litre

- ii) Methods of disposal of radiation waste: *(Student should explain any 2 method out of below, 2 marks each)*

Depending on type of radioactive waste (radwaste) material, wastes must be managed in ways which safeguard human health and minimize their impact on the environment. The radioactive material is classified in to three types as below for disposal:

- i) Low-level Waste: Low-level Waste is generated from hospitals, laboratories and industry, as well as the nuclear fuel cycle. It comprises paper, rags, tools, clothing, filters etc. which contain small amounts of mostly short-lived radioactivity. It is not dangerous to handle, but must be disposed of more carefully than normal garbage. Usually it is buried in shallow landfill sites. To reduce its volume, it is often compacted or incinerated (in a closed container) before disposal. Worldwide it comprises 90% of the volume but only 1% of the radioactivity of all radwaste.
- ii) Intermediate-level Waste: Intermediate-level Waste contains higher amounts of radioactivity and may require special shielding. It typically comprises resins, chemical sludge's and reactor components, as well as contaminated materials from reactor decommissioning. Worldwide it makes up 7% of the volume and has 4% of the radioactivity of all radwaste. It may be solidified in concrete or bitumen for disposal.



Subject Code: 12173

Model Answer

Page No: 24/23

Generally short-lived waste (mainly from reactors) is buried, but long-lived waste (from reprocessing nuclear fuel) will be disposed of deep underground.

- iii) High-level Waste: High-level Waste may be the used fuel itself, or the principal waste from reprocessing this. While only 3% of the volume of all radwaste, it holds 95% of the radioactivity. It contains the highly-radioactive fission products and some heavy elements with long-lived radioactivity. It generates a considerable amount of heat and requires cooling, as well as special shielding during handling and transport. If the used fuel is reprocessed, the separated waste is vitrified by incorporating it into borosilicate (Pyrex) glass which is sealed inside stainless steel canisters for eventual disposal deep underground.