

AR-7156

M. Sc. (FOURTH SEMESTER) EXAMINATION, 2013
CHEMISTRY

PAPER : ELECTIVE

(ENVIRONMENTAL CHEMISTRY)

TIME ALLOWED : THREE HOURS

MAXIMUM MARKS : 60

NOTE : ATTEMPT QUESTIONS OF BOTH SECTIONS AS DIRECTED.

SECTION 'A'

(SHORT ANSWER TYPE QUESTIONS) $10 \times 2 = 20$

NOTE : (ANSWER ALL QUESTIONS. EACH QUESTION CARRIES 2 MARKS)

Q1. WHAT ARE THE NATURAL SOURCES OF ENERGY?

[IDENTIFY ANY FOUR AND COMMENT ON THEIR ABUNDANCE]

ANS 1 • THE FOLLOWING LISTS THE DIFFERENT NATURAL SOURCES OF ENERGY :

SOLAR ENERGY : NON POLLUTING, MOST ABUNDANT ENERGY SOURCE, HIGH INITIAL INVESTMENT, DEPENDENT ON SUNNY WEATHER

WIND ENERGY : NO EMISSIONS, NOT FEASIBLE FOR ALL GEOGRAPHIC LOCATIONS; HIGH INITIAL INVESTMENT, REQUIRES EXTENSIVE LAND USE

HYDROPOWER : NO EMISSIONS, ENVIRONMENTAL IMPACTS BY CHANGING THE ENVIRONMENT IN THE DAM AREA, EXPENSIVE

NATURAL GAS : CLEANEST BURNING FOSSIL FUEL WIDELY AVAILABLE, TRANSPORTATION COSTS ARE HIGH, PIPELINES IMPACT ECOSYSTEMS.

PETROLEUM : HIGH CO₂ EMISSIONS, FOUND IN LIMITED AREAS, ECONOMICAL TO PRODUCE.

BIOMASS : FEWER EMISSIONS THAN FOSSIL FUEL SOURCES, ABUNDANT SUPPLY EMITS SOME POLLUTION AS GAS/LIQUID WASTE.

COAL : EMITS MAJOR GREENHOUSE GASES/ACID RAIN; ABUNDANT SUPPLY HIGH ENVIRONMENTAL IMPACT FROM MINING AND BURNING.

URANIUM : NO GREENHOUSE GASES OR CO₂ EMISSIONS, URANIUM RESERVES ARE ABUNDANT, HIGHER CAPITAL COSTS DUE TO SAFETY

GEO THERMAL : MINIMAL ENVIRONMENTAL IMPACT, FOUND IN FEW AREAS OF THE WORLD, EXPENSIVE START UP COSTS.

★ ANY FOUR OF THE ABOVE MENTIONED SOURCES ALONG WITH A BRIEF DESCRIPTION

SHORT ANSWER TYPE QUESTIONS CONTINUED

Q2. HOW DO YOU DETERMINE THE CHEMICAL PARAMETERS OF A GIVEN WATER SAMPLE? IDENTIFY ANY TWO AND DEFINE VERY BRIEFLY THE METHOD.

ANS2. DEPENDING UPON THE TYPE OF USE OF WATER SEVERAL CHEMICAL PARAMETERS OF A GIVEN WATER SAMPLE ARE EVALUATED. THE TWO MAIN ARE

BOD - BIOCHEMICAL OXYGEN DEMAND [OXYGEN NEEDED FOR BREAKING DOWN OF ORGANIC MATERIALS] BY AEROBIC ORGANISMS
(WINKLER METHOD); (ELECTROMETRIC METER METHOD)
AND
BACTERIOLOGICAL.

PH - (TITRATION METHOD)

COD - (CHEMICAL OXYGEN DEMAND) MEASURED SIMILAR TO BOD; INVOLVE POTASSIUM DICHROMATE BASED OXIDATION (HACH METHOD)

TOTAL DISSOLVED SOLIDS (TDS) - EVAPORATION METHOD

TURBIDITY : (NEPHELOMETRIC UNIT)

HARDNESS : PERMANENT - SULPHATES, CHLORIDES, NITRATES OF Mg/Ca] → TITRATION
TEMPORARY - CARBONATES OF Mg/Ca

TOTAL DISSOLVED NITROGEN - TDN - [KJELDAHL METHOD]

TOTAL PHOSPHOROUS - MOLYBDATE METHOD / ASCORBIC ACID METHOD

TOTAL SULFUR - TURBIDOMETRIC METHOD.

TOTAL CHLORINE - ARGENTOMETRIC / MERCURIMETRIC

★ ANY TWO OF THE ABOVE MENTIONED PARAMETER WITH A BRIEF DESCRIPTION OF THE METHODS INVOLVED IN THEIR DETERMINATION

Q3 IDENTIFY TWO INORGANIC AND ORGANIC PARTICULATE MATTER EACH IN AIR.

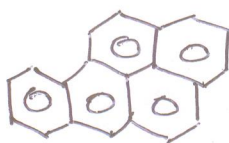
ANS3. THERE ARE SEVERAL ANTHROPOGENIC SOURCES OF PARTICULATES IN THE ATMOSPHERE OF WHICH.

H₂O, HBr, NO₂, SO₂, NH₃, HCl (MATERIALS FORMED BY ATMOSPHERIC REACTIONS)

Ba, Pb, Br, Mn, Ca, Cu, V, Zn, Mg, Ba, Fe, Ti (INTRODUCED VIA MAN MADE ACTIVITIES)

K, Al, Na, Si, Fe, Cl, Ti (FROM NATURAL SOURCES).

CONSTITUTE THE INORGANIC PARTICULATE MATTER



BENZO α -PYRENE AND OTHER POLYCYCLIC (POLYNUCLEAR) AROMATIC HYDROCARBONS PAH

WITH OTHER ORGANIC PARTICULATES HAVING AVERAGE COMPOSITION

C_{32.4} H₄₈ O_{3.8} S_{0.083} HALOGEN 0.065 ALKOXY_{0.12}

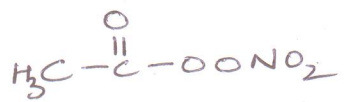
CONSTITUTE ORGANIC PARTICULATE MATTER

★ ANY TWO OF EACH KIND WITH SOURCE

SECTION A

Q4 WHAT IS PAN? IDENTIFY THE ILL-EFFECTS OF PAN VERY BRIEFLY?

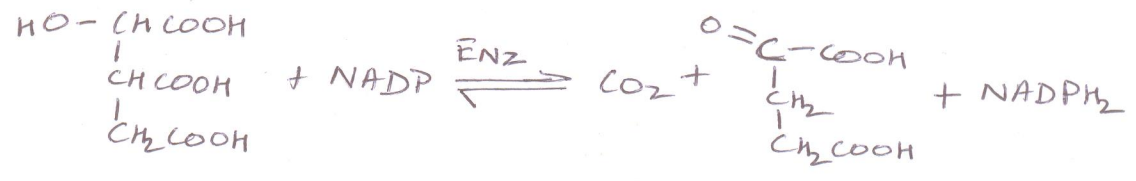
Ans 4. PAN is Peroxy Acyl Nitrates and is described as a phytotoxic photochemical oxidant.



Following are the ill effects associated with exposure to PAN

1. Toxicity of a known homologue is inversely proportional to its molecular weight.
2. Exposure to PAN lowers the sulfhydryl content (oxidation or via acetylation)
3. Several enzymes that use nicotinamides as cofactors are inhibited by PAN
4. Action of PAN on isocitric dehydrogenase enzyme leads to inactivation of the enzyme in the absence of coenzyme or substrate; thus preventing oxidation and decarboxylation of isocitric acid to form α -keto glutaric acid with concurrent reduction of nicotinamide coenzyme.

ie.



★ ANY TWO OF THE ABOVE POINTS ON ILL EFFECTS WITH STRUCTURE AND CLASSIFICATION OF PAN

SECTION A

Q5. IDENTIFY ANY TWO INORGANIC AND ORGANIC COMPONENT OF SOIL. EXPLAIN ITS EFFECT ON SOIL PROPERTY VERY BRIEFLY.

Ans 5.

THE INORGANIC COMPONENTS OF SOIL ARE AS FOLLOWS

1. Ca, Mg, K, Na, H_3O^+

THESE CONTRIBUTE TOWARDS THE CATION EXCHANGE CAPACITY OF SOIL

2. PRESENCE OF HYDROUS IRON OXIDE (RISE IN PH).

PHOSPHATES

3. COMPOSITION OF SOIL CONTAINING CLAY, SILT, SAND (SILICA) SIZED MATERIAL

PROVIDE TEXTURE TO THE SOIL

PERMEABILITY

STRUCTURE

THE ORGANIC COMPONENT OF SOIL IS MADE UP THE FOLLOWING

1. SOIL ORGANIC MATTER IS BROADLY CLASSIFIED AS HUMIC MATERIAL (HM)

A. TERRESTRIAL HM - PRIMARILY FROM PLANT RESIDUE

CONTRIBUTES TO SOIL STRUCTURE AND CATION EXCHANGE CAPACITY

B: NON HUMIC ORGANIC FRACTION IS COMPOSED OF COMPLEX POLYSACCHARIDES
CELLULOSE, HEMICELLULOSE AND PECTIN.

ACTING AS CEMENTING AGENTS

C. LIGNINS, COMPLEX PHENOLIC POLYMERS

D. PROTEINS AND AMINO ACIDS (SOURCE OF NUTRIENT FOR MICROORGANISMS)

★ ANY COMBINATION OF TWO POINTS EACH FOR INORGANIC AND ORGANIC COMPONENT.

SECTION A

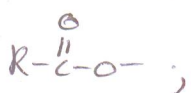
Q6. WHAT IS THE ESSENTIAL DIFFERENCE BETWEEN COMPLEXATION AND CHELATION
[EXPLAIN WITH TWO STRUCTURAL EXAMPLES]

Ans 6.

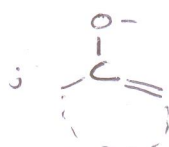


THE ABOVE EXAMPLE REPRESENTS COMPLEXATION; WHERE $\text{CN}^- \rightarrow$ LIGAND SUCH THAT METALS CAN EXIST IN WATER REVERSIBLY BOUND TO INORGANIC ANIONS OR TO ORGANIC COMPOUNDS AS METAL COMPLEXES

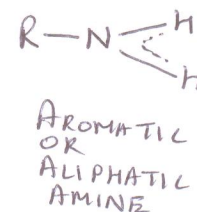
OTHER EXAMPLES OF COMPLEXING LIGANDS ARE



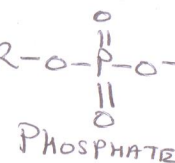
HETEROCYCLIC NITROGEN



PHENOXIDE



AROMATIC
OR
ALIPHATIC
AMINE

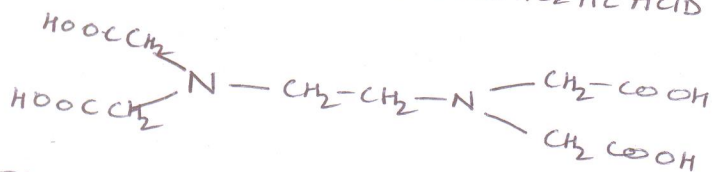


PHOSPHATE

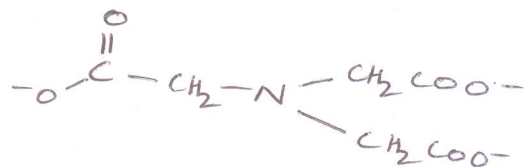
A SPECIAL CASE OF COMPLEXATION IS WHEN THE LIGAND BONDS IN TWO OR MORE PLACES TO A METAL ION; THIS PHENOMENA IS CALLED CHELATION

EXAMPLES OF LIGANDS CAPABLE OF CHELATION:

EDTA - ETHYLENE DIAMINE TETRA ACETIC ACID



NTA - NITRIL O TRIACETIC ACID



★ ANY TWO STRUCTURAL EXAMPLE ALONG WITH THE CLEAR DEFINITION

Q7. WHAT IS ALBEDO? IDENTIFY THE ROLE OF PARTICLES GENERATED BY MANMADE ACTIVITIES ON ALBEDO? [DEFINITION OF DIFFERENT TYPES OF PARTICLES IS ESSENTIAL]

Ans 7. ALBEDO IS THE FRACTION OF SOLAR ENERGY (SHORT WAVE RADIATION) REFLECTED FROM THE EARTH BACK INTO SPACE.

INDUSTRIAL AND MAN MADE ACTIVITIES RESULT IN CHANGE IN ALBEDO THESE ATMOSPHERIC PARTICLES HAVE A COOLING EFFECT ON THE EARTH'S SURFACE DUE TO SCATTERING OF SUN'S RAYS

DARK PARTICLES - DEPOSITED ON SOOT - ABSORB LIGHT - RESULT IN HEATING
 LIGHT PARTICLES - REFLECT SUNLIGHT - RESULT IN COOLING.

GREEN HOUSE GASES EFFICIENTLY TRAP THE REFLECTED LIGHT RESULTING IN HEATING OF THE EARTH $CFC > N_2O > CH_4 > CO_2$

AEROSOLS - COLLOIDAL SIZE PARTICLES

AITKEN - OBTAINED FROM NATURAL SOURCES 0.2 μ IN DIAMETER

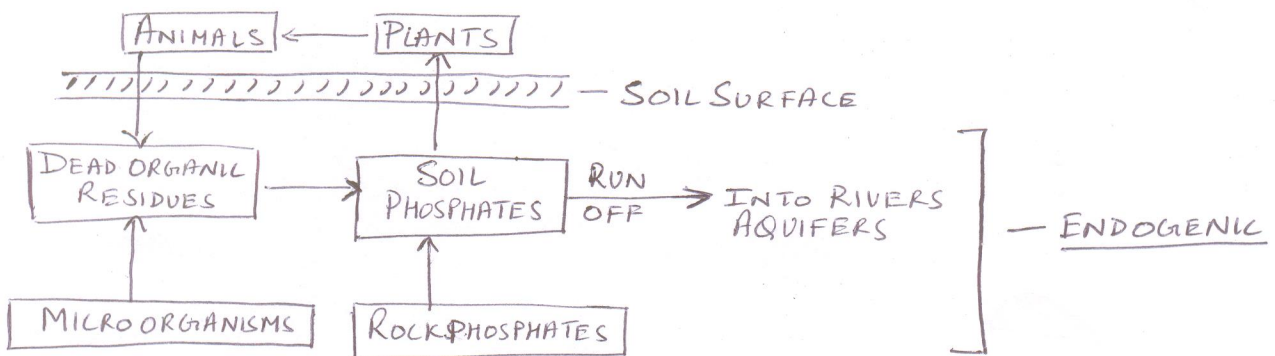
DETERMINE THE HEAT BALANCE THROUGH LIGHT REFLECTION.

Q8. ENDOGENIC AND EXOGENIC CYCLES ARE ASSOCIATED WITH _____ AND _____ RESPECTIVELY. [MENTION ONLY THE PRIMARY DIFFERENCE]

Ans 8. BELOW THE EARTH'S SURFACE
 ABOVE THE EARTH'S SURFACE AND THE SURFACE SOIL

Q9. IDENTIFY THE ENDOGENIC COMPONENTS OF PHOSPHOROUS CYCLE ON LAND?

Ans 9.



* ANY COMBINATION OF THE ABOVE MENTIONED POINTS WITH CLEAR REPRESENTATION OF THE ENDOGENIC PART.

SECTION A

AR-7156

7

Q10. IDENTIFY THE MOST COMMON SPECIES OF OXYGEN IN UPPER ATMOSPHERE?

ANS 10. DOMINANT SPECIES IN IONOSPHERE O_2^+ ; O^+
DOMINANT SPECIES IN STRATOSPHERE O_3
DOMINANT SPECIES IN TROPOSPHERE O_2

NOTE: ANSWER ANY FIVE QUESTIONS,
ALL QUESTIONS CARRY 8 MARKS

SECTION B

LONG ANSWER TYPE QUESTIONS 5 X 8 = 40

Q11. WHAT IS RADIOACTIVE WASTE? WHAT DO YOU MEAN BY MULTI BARRIER APPROACH IN RADIOACTIVE WASTE MANAGEMENT?

ANS 11. RADIOACTIVE WASTE IS ANY MATERIAL THAT IS EITHER RADIOACTIVE BY ITSELF OR IS CONTAMINATED BY RADIOACTIVITY, FOR WHICH NO FURTHER USE IS ENVISAGED.

THE MULTI BARRIER APPROACH IN RADIOACTIVE WASTE MANAGEMENT STARTS WITH THE CLASSIFICATION OF RADIOACTIVE WASTE.

1. HLW - HIGH LEVEL WASTE - THAT IS RADIOACTIVE ENOUGH FOR THE DECAY HEAT TO SIGNIFICANTLY INCREASE ITS TEMPERATURE AND THAT OF ITS SURROUNDINGS [FOR EXAMPLE - SPENT NUCLEAR FUEL]
2. ILW - INTERMEDIATE LEVEL WASTE - WASTES THAT HAS RADIOACTIVE LEVELS THAT ARE HIGHER THAN LOW LEVEL WASTE, BUT DO NOT GENERATE HEAT ON DECAY [FOR EXAMPLE - METAL ITEMS SUCH AS REACTOR COMPONENTS]
3. LLW - LOW LEVEL WASTE - LIGHTLY CONTAMINATED WASTE ARISING DUE TO MAINTAINENCE AND MONITORING
4. VLLW - VERY LOW LEVEL WASTE -
a) L VOLUME (LOW) - FOR DUSTBIN DISPOSAL
b) H VOLUME (HIGH) - FOR BULK DISPOSAL

ONCE CLASSIFICATION HAS BEEN DONE TWO AVENUES ARE AVAILABLE WITH REFERENCE TO INDIA, IN NUCLEAR WASTE DISPOSAL

THEREFORE BASED ON LONGEVITY AND CONCENTRATION OF THE RADIO - NUCLEIDE PRESENT IN WASTE 1. A NEAR SURFACE OR 2. IN DEEP GEOLOGICAL FORMATION APPROACH IS USED. THE PRIMARY AIM OF THE MULTI BARRIER APPROACH IN (NSDF) NEAR SURFACE DISPOSAL FACILITY ENSURES ISOLATION AND RELEASE OF RADIONUCLEIDES BELOW PERMISSIBLE LIMITS.

SECTION B

LONG ANSWER TYPE QUESTIONS CONTINUED

ANS 11 • CONTINUED :

THIS BEING ENSURED BY REGULAR MONITORING AND PERIODIC PERFORMANCE ASSESSMENT OF (NSDFs); PREFERENTIALLY THE NSDF'S ARE CHOSEN BASED ON THE PRESENCE OF THE FOLLOWING ROCK DEPOSITS GRANITE ROCKS, BASALT, SHALES; THESE ENSURE RELEASE OF RADIONUCLIDES BELOW PERMISSIBLE LIMITS TO THE ENVIRONMENT.

Q 12. DEFINE THE DIFFERENT WATER QUALITY PARAMETERS AND STANDARDS. DISTINGUISH BETWEEN PHYSICAL AND CHEMICAL PARAMETERS INVOLVED?

ANS 12 THE FOLLOWING ARE THE DIFFERENT WATER QUALITY PARAMETERS BASED ON

- a) PHYSICAL PARAMETERS
- b) CHEMICAL PARAMETERS
- c) BACTERIOLOGICAL PARAMETERS

BASED ON CPCB (CENTRAL POLLUTION CONTROL BOARD INDIA) RECOMMENDATIONS THE FOLLOWING ARE THE STANDARDS ASSOCIATED WITH EACH CLASS OF WATER QUALITY PARAMETER. (DRINKING WATER)

	DESIRABLE LIMIT	PERMISSIBLE LIMIT
COLOR HAZEN UNITS	5	25
TURBIDITY NTU	5	10
PH	6.5-8.5	6.5-8.5
HARDNESS (AS CaCO ₃) mg/L	0.3	1
TDS	500	2000
NITRATE (mg/L)	45	45
CHLORIDE (mg/L)	250	1000
FLUORIDE (mg/L)	1	1.5
ARSENIC (mg/L)	0.05	0.05
ALUMINIUM (mg/L)	0.03	0.2

THE STANDARD VALUES WILL NOT CHANGE APPRECIABLY DEPENDING ON THE TYPE OF USE OF WATER ENVISAGED. LIKE 1) WASTE WATER DISPOSAL 2) FOR REUSE AND RECYCLE OF WATER IN INDUSTRY OR AGRICULTURE

SECTION B

AR-7156

9

LONG ANSWER TYPE QUESTIONS CONTINUED

ANS 12

CONTINUED :

PHYSICAL PARAMETERS OF WATER SAMPLE ARE LISTED BELOW

COLOR - MAY BE DUE TO THE PRESENCE OF ORGANIC MATTER, METALS (IRON, MANGANESE) OR HIGHLY COLORED INDUSTRIAL WASTE. IT IS DESIRABLE THAT DRINKING WATER IS COLORLESS.

ODOR AND TASTE - MAINLY DUE TO ORGANIC SUBSTANCES, BIOLOGICAL ACTIVITY, INDUSTRIAL POLLUTION.

SINCE TASTE BUDS SPECIALLY DETECT INORGANIC COMPOUNDS OF METALS LIKE MAGNESIUM, CALCIUM, SODIUM, COPPER, IRON AND ZINC.

IT IS DESIRABLE WATER SHOULD BE FREE FROM OBJECTIONABLE TASTE AND ODOR.

PH, BOD, COD, TOTAL PHOSPHOROUS, TOTAL SULPHUR, TOTAL ORGANICS, TOTAL CHLORINE CONSTITUTE THE CHEMICAL PARAMETERS OF A GIVEN WATER SAMPLE. OUT OF WHICH BOD - BIOCHEMICAL OXYGEN DEMAND IS USED BY

CPCB (CENTRAL POLLUTION CONTROL BOARD) IN GAUGING THE LEVEL OF WATER POLLUTION IN THE COUNTRY (INDIA). THE MONITORING

DONE ACCORDING TO THE STANDARDS SET BY GIEM - GLOBAL ENVIRONMENT

MONITORING AND MINARS - MONITORING OF INDIAN NATIONAL AQUATIC

RESOURCES. BOD SHOULD BE BELOW 1 mg/l FOR DRINKING WATER

COD - CHEMICAL OXYGEN DEMAND BELOW 1 mg/l

★ DISTINGUISHING BETWEEN ANY TWO PHYSICAL AND CHEMICAL PARAMETERS WITH BRIEF DESCRIPTION IS ACCEPTABLE.

Q13 WHAT ARE THE MAJOR ENVIRONMENTAL IMPACTS OF PARTICULATE AND AEROSOL IN AIR?

ANS 13 - COLLOIDAL SIZE PARTICLES ARE KNOWN AS AEROSOLS. PARTICLES ARE IMPORTANT CONSTITUENT OF THE TROPOSPHERE; $100/\text{cm}^3$ IN AIR TO $10^5/\text{cm}^3$ IN HIGHLY POLLUTED AIR RANGING IN SIZE 0.1 TO 10μ

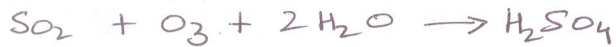
THE EFFECTS OF PARTICLES IN AIR IS DEPENDANT UPON SIZE AND CHEMICAL COMPOSITION.

- 1) PARTICLES SIZE OF 0.1 TO 1μ ARE RESPONSIBLE FOR SEVERAL EFFECTS
 - a) THEY ARE RESPONSIBLE FOR ELECTRICAL PHENOMENA IN THE ATMOSPHERE (CLOUD AND FOG FORMATION)
 - b) MAINTAINING HEAT BALANCE THROUGH LIGHT REFLECTION.

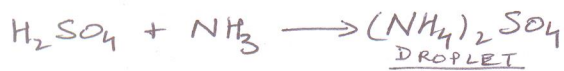
SECTION BLONG ANSWER TYPE QUESTIONS CONTINUEDANS 13CONTINUED:

- c) FORM NUCLEI FOR ICE CRYSTAL AND WATER DROPLET FORMATION
- d) i) NEUTRALIZATION REACTION (IN WATER DROPLETS).
 ii) CATALYTIC EFFECT OF PARTICLES OF METAL OXIDES.
 iii) PHOTOCHEMICAL OXIDATION REACTION.

2. AEROSOL MISTS ARISE FROM SULFURIC ACID [VIA OXIDATION OF SULPHUR DIOXIDE]



WHICH IN TURN REACTS TO PRODUCE THE FOLLOWING



CAUSING DAMAGE TO MANMADE STRUCTURES; DUE TO CORROSION.

3. ORGANIC PARTICULATE MATTER SOURCES RANGE FROM AUTOMOBILES, FUEL COMBUSTION, EMISSIONS FROM VEGETATION.

EXAMPLES - PAH (POLYCYCLIC AROMATIC HYDROCARBONS)

EXERT CARCINOGENIC EFFECT AT $20 \mu\text{g} / \text{m}^3$ LEVEL

THESE PAH REMAIN ADSORBED ON SOOT PARTICLES [WHERE SOOT PARTICLES CONSTITUTE 50% OF PARTICLE LOAD IN URBAN ATMOSPHERE]

FURTHERMORE THESE PARTICULATE MATTER CONTAIN TRACE METALS LIKE Be, Cd, Cr, Mn, Ni, V EXERTING UNWANTED BIOLOGICAL RESPONSE. PRIMARILY PARTICLES OF SIZE BETWEEN $0.1 - 1 \mu$ SIZE REACH IN TO THE HUMAN BODIES VIA RESPIRATION.

★ ALL OF THE ABOVE THREE POINTS WITH CLEAR MENTION OF SOURCE, TYPE, SIZE AND EFFECT OF THE DIFFERENT PARTICLES IMPORTANT.

LONG ANSWER TYPE QUESTIONS CONTINUED

Q14 WHAT ARE THE KEY PROCESSES INVOLVED IN SOIL FORMATION?

Ans 14

THE TWO MAIN PROCESSES INVOLVED IN SOIL FORMATION CAN BE CLASSIFIED AS

PHYSICAL WEATHERING : IT RESULTS IN THE BREAKDOWN OF MASSIVE ROCKS / MATERIALS INTO SMALLER AGGREGATES, EVENTUALLY FINE ENOUGH AND SUFFICIENTLY WELL DEVELOPED THAT THEY ARE CONSIDERED TO BE SOILS

THIS IS BROUGHT ABOUT IN SEVERAL WAYS

FREEZE THAW : ASSOCIATED WITH TEMPERATE REGION, RESULTS IN ENHANCEMENT OF FRACTURING, ALONG THE NATURAL FRACTURE PLANES OF THE ROCK

FIRE : CAUSES EXPANSION OF ROCKS, DUE TO THEIR LOW THERMAL CONDUCTIVITY THE SURFACE EXPANDS MUCH MORE RAPIDLY THAN THE ROCK BELOW LEADING TO STRAIN WHICH IS RELEASED BY FRACTURING.

DEPOSITION OF SALTS IN THE ALREADY FRACTURED SURFACE ; SINCE THE THERMAL EXPANSION COEFFICIENT IS HIGHER THAN THAT OF THE ROCK, THE TEMPERATURE AND PRESSURE CHANGES CAUSES THE FRACTURES TO WIDEN.

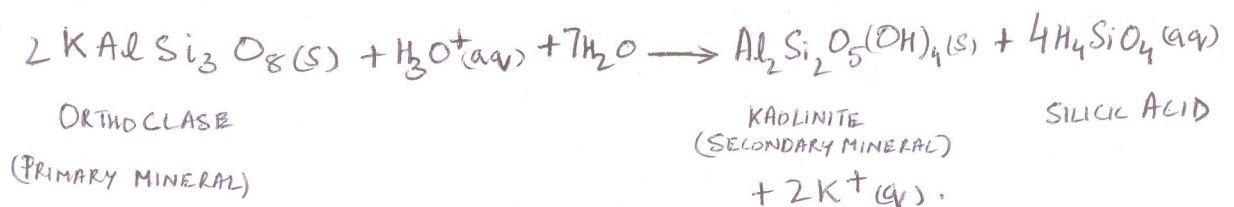
ABRASION : DUE TO EROSION BY WIND, WATER

TRANSPORT : BY WIND AND WATER OF THE FINELY DIVIDED SOIL PARTICLES.

PENETRATION BY ROOTS : ESPECIALLY IN REGIONS WHERE PLANTS ARE GROWING.

CHEMICAL WEATHERING : CAN BE ENVISAGED TO BE OCCURRING SIMULTANEOUSLY WITH THE ABOVE AND OTHER PHYSICAL PROCESSES. THEN CHEMICAL REACTIONS CAN BE FURTHER DIVIDED INTO THOSE MEDIATED BY MICROORGANISMS AND THOSE THAT ARE PURELY ABIOTIC.

FIRSTLY CONSIDERING ABIOTIC REACTION / WEATHERING WITH THE FOLLOWING EXAMPLE.



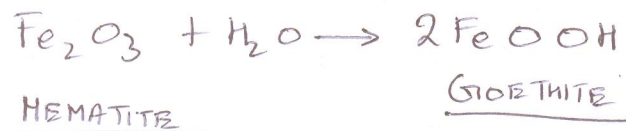
CONSTITUTES A HYDROLYSIS REACTION. SIMILARLY

CHELATION CONTRIBUTES TO CHEMICAL WEATHERING OF IRON AND ALUMINIUM CONTAINING ROCKS.

OXIDATION / REDUCTION REACTIONS : OCCURRING IN ROCKS / PRIMARY MINERALS THAT CONTAIN OXIDISABLE ELEMENTS IN LOW OXIDATION STATES AND THESE IN TURN ARE EXPOSED TO THE ATMOSPHERE.

LONG ANSWER TYPE QUESTIONS CONTINUEDANS 14 . CONTINUED :

EXAMPLE OXIDATION OF IRON IN PRIMARY MINERAL BIODITE PRODUCES A 2:1 LAYER CLAY MINERAL VERMICULITE



THE ABOVE REACTION IS AN EXAMPLE OF HYDRATION REACTION

ION EXCHANGE REACTION : THESE REACTIONS ALTER THE NATURE OF AVAILABLE ELEMENTS AT THE SURFACE EXCHANGE SITES OF SOIL COLLOIDS FOLLOWING WHICH THE MICROORGANISM MEDIATED REACTIONS INTRODUCE NEW SOLUBLE OR INSOLUBLE ORGANIC COMPOUNDS WHICH IN TURN PARTICIPATE IN CHELATION PROCESS.

★ MENTION AND DESCRIPTION OF A MINIMUM OF FOUR PROCESSES IN PHYSICAL AND CHEMICAL WEATHERING (EACH).

Q15. DIFFERENTIATE BETWEEN REUSE AND RECYCLE. IDENTIFY THE VARIOUS STRATEGIES INVOLVED IN WATER REUSE/RECYCLE IN INDUSTRIAL AND AGRICULTURAL PRACTICES.

ANS 15 . CONSIDERING AN ANALYTICAL TERM USED IN INDUSTRY FOR WASTE WATER MANAGEMENT ONE CAN DIFFERENTIATE BETWEEN THE TERMS REUSE AND RECYCLE .

THE TERM IS AS FOLLOWS : WATER PINCH ANALYSIS - WHERE WATER EFFLUENT FROM ONE UNIT IS USED IN ANOTHER UNIT AND DOES NOT RE-ENTER THE UNIT WHERE IT HAD BEEN PREVIOUSLY USED IS TERMED AS REUSE .

WHEREAS RECYCLE ALLOWS THE EFFLUENT/WATER TO RE-ENTER THE UNIT WHERE IT HAD BEEN PREVIOUSLY USED.

LONG ANSWER TYPE QUESTIONS CONTINUEDANS 15 : CONTINUED :

IN INDUSTRY THE RECYCLE OF WASTE WATER INVOLVES VARIOUS STRATEGIES FOLLOWING ARE THE EXAMPLES.

1. WATER HYCINTH APPEARS TO THRIVE ON WASTE WATER/SEWAGE. IT FLOATS ON THE SURFACE AN ITS ROOTS ADSORB THE WASTE MATERIAL INCLUDING TOXIC MATERIALS AND HEAVY METALS

THE ABOVE STRATEGY CAN BE INVOLVED AS A SECONDARY TREATMENT OF WASTE WATER BEFORE RELEASE/ RECYCLE IN THE ENVIRONMENT

AMOUNT OF TREATMENT REQUIRED IS USUALLY MEASURED IN ONE OF THE TWO BASIS A) AMOUNT OF SUSPENDED SOLIDS ; B) BIOCHEMICAL OXYGEN DEMAND (BOD) WHERE BOD IS THE AMOUNT MOLECULAR OXYGEN REQUIRED BY A MICROBIAL POPULATION TO STABILIZE BIODEGRADABLE ORGANIC MATTER.

THEREFORE THE DIFFERENT STAGES OF WATER TREATMENT ENSURES IN ITS REUSE/ RECYLLING.

PRIMARY TREATMENT - PHYSICAL PROCESS - REMOVES 30 TO 60% OF SUSPENDED SOLIDS OF 2.5 TO 5cm IN SIZE

RESPONSIBLE FOR LOWERING OF BOD

FURTHER INVOLVES CLARIFICATION PROCESS RESPONSIBLE FOR REMOVING SETTELABLE SOLDS BY COAGULATION/AGGLOMERATION/FLOCCULATION PROCESS FOLLOWED BY SEDIMENTATION TECHNIQUE.

SECONDARY TREATMENT - INVOLVES BIOCHEMICAL PROCESS WHERE DISSOLVED ORGANIC MATTER ARE OXIDIZED AND BOD IS AROUND 85 TO 90%.

BY USING ACTIVATED SLUDGE (CONTAINING MICROORGANISMS THAT DIGEST RAW SEWAGE)

THIS IS FURTHER PROMOTED BY PURGING WITH OXYGEN INSTEAD OF AIR.

PHOSPHOROUS IS REMOVED BY PRECIPITATION BY LIME (METALLIC HYDROXIDE OF AL).

DEPENDING UPON USE THE COMPOSITION OF WASTE WATER IS CAREFULLY REGULATED THEREFOR A TERTIATRY TREATMENT INVOLVING MEMBRANE BASED FILTRATION MAY OR MAY NOT BE REQUIRED.

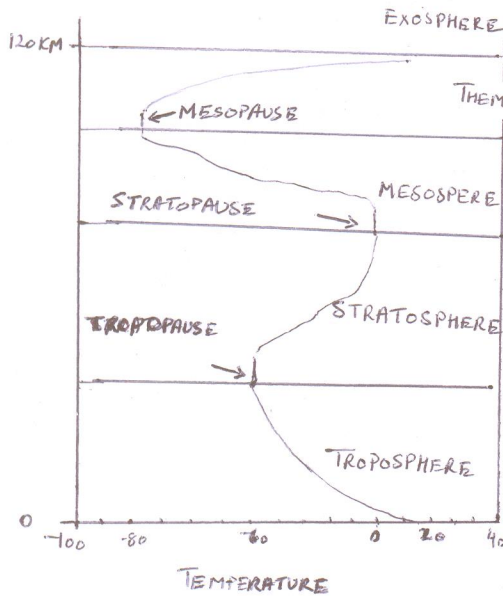
FOR EXAMPLE WHO GUIDELINE FOR WASTE WATER USED FOR IRRIGATION STIPULATES THAT THE WASTE WATER SHOULD CONTAIN NO MORE THAN ONE VIABLE HUMAN INTESTINAL NEMATODE EGG PER LITRE.

* OTHER EXAMPLES FOR PARAMETERS FOR REUSE AND RECYCLE ARE ACCEPTABLE.

LONG ANSWER TYPE QUESTIONS CONTINUED

Q16. IDENTIFY THE REGIONS AND CLEARLY DEFINE THE REACTIONS INVOLVED IN ATMOSPHERIC CHEMISTRY.

ANS 16.

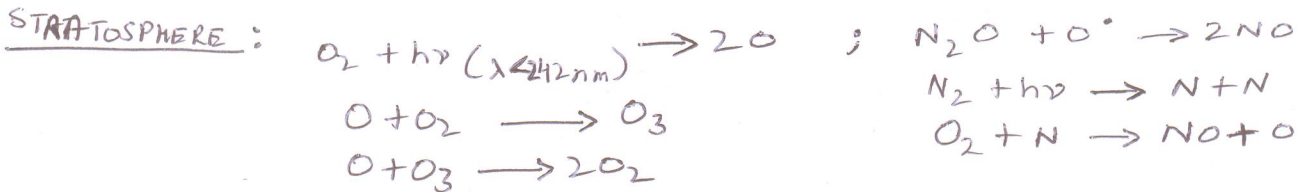


- A) THE REGION ABOVE ABOUT 500KM IS CALLED EXOSPHERE AND IT MAINLY CONTAINS OXYGEN AND HYDROGEN ATOMS
- B) TEMPERATURE INCREASE IS DUE TO ABSORPTION OF ENERGETIC SOLAR RADIATIONS UV/X-RAY RESULTING IN FORMATION OF IONS
- C) REGION DOMINATED BY REACTION OF (OH) RADICAL
- D) OZONE SHIELD FORMATION AND DESTRUCTION
- E) REACTIONS INVOLVED IN VARIOUS NATURAL CYCLES, PARTICULATES, ETC.

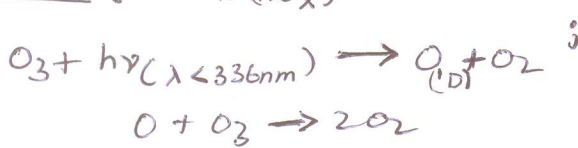
NOT TO SCALE =>

FIG.1. DEPICTS THE DIFFERENT REGIONS OF THE ATMOSPHERE WITH REGIONS INVOLVING TEMPERATURE INVERSION.

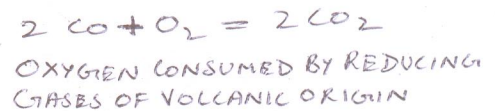
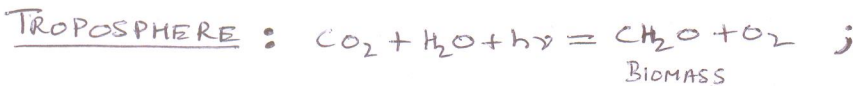
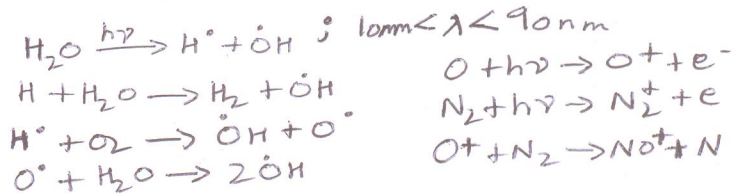
BASED ON THE ABOVE REGIONS OF THE ATMOSPHERE FOLLOWING REACTIONS CAN BE TABULATED



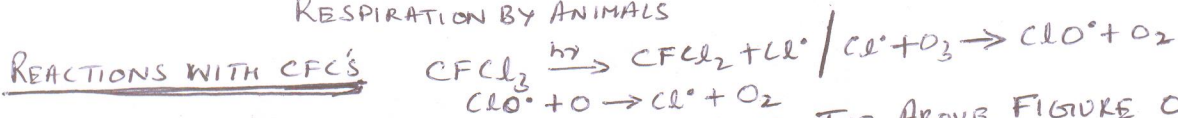
MESOSPHERE : WITH (HO_x)



IONOSPHERE/EXOSPHERE :



RESPIRATION BY ANIMALS



★ AT LEAST FOUR SETS OF REACTIONS WITH THE ABOVE FIGURE OR GENERAL DESCRIPTION OF THE ATMOSPHERE WITH REACTIONS.

LONG ANSWER TYPE QUESTIONS CONTINUED

Q17. WHAT ARE THE DIFFERENT SEGMENTS OF ENVIRONMENTS? [DEFINE EACH SEGMENT CLEARLY].

ANS17. THE DIFFERENT SEGMENTS OF THE ENVIRONMENT ARE FOLLOWS.

ATMOSPHERE : THE ATMOSPHERE IS THE PROTECTIVE BLANKET OF GASES WHICH IS SURROUNDING THE EARTH.

- A) ABSORBS IR RADIATION BY THE SUN AND REEMITTED FROM THE EARTH AND THEREFORE REGULATES THE TEMPERATURE OF THE EARTH.
- B) IT FILTERS TISSUE DAMAGING UV RADIATION BELOW 300nm
- C) SOURCE FOR CO₂ FOR PLANT PHOTOSYNTHESIS AND O₂ FOR RESPIRATION
- D) TRANSPORTS WATER FROM OCEANS TO LAND

HYDROSPHERE : IT IS THE COLLECTIVE TERM GIVEN TO ALL DIFFERENT FORMS OF WATER WHICH INCLUDES ALL TYPES OF WATER RESOURCES SUCH AS OCEANS SEAS, RIVERS, LAKES, STREAMS, RESERVOIRS, GLACIERS AND GROUND WATERS.

LITHOSPHERE : THE LITHOSPHERE CONSISTS OF THE OUTER MANTLE OF THE SOLID EARTH CONSISTING OF MINERALS OCCURRING IN THE EARTH'S CRUST AND SOIL

BIOSPHERE : A) THE REALM OF THE LIVING ORGANISMS AND THEIR INTERACTION WITH THE ENVIRONMENT (ATMOSPHERE, LITHOSPHERE, HYDROSPHERE)
 B) O₂ AND CO₂ LEVELS DEPEND UPON THE PLANT KINGDOM
 C) ALSO IS AFFECTED BY THE VARIOUS NATURAL CYCLES AND RADIATION BALANCE.

ANTHROSPHERE : A) IT IS THAT PART OF THE ENVIRONMENT THAT IS MADE OR MODIFIED BY HUMANS FOR USE IN HUMAN ACTIVITIES.
 B) INCLUDES STRUCTURES USED FOR COMMERCE, MANUFACTURING EDUCATION,
 C) INFRASTRUCTURES INCLUDING WATER, FUEL ELECTRICITY DISTRIBUTION SYSTEMS ETC.

★ ALL OF THE ABOVE INCLUDING A MINIMUM OF TWO POINT DISCUSSION OF EACH SEGMENT