Ecology and Sustainable Development – complete list of questions 2024

Please note: The exam will contain 4 chapters with questions from each of the 4 blocks of questions listed here. In total there will be 40 points achievable (10 for each question chapter). To pass the test 2 conditions must be fulfilled: at least 25 points overall and at least 5 points for each individual chapter of questions. The grading scheme is as follows:
25-28 points = G4, 29-32 points = B3, 33-36 points = U2, 37-40 points = S1

1. **Provide some examples:**
   Each correct entry is 1 point. Each wrong entry is minus 1 point.

- **Energy generated by fusion in the sun is emitted as**
  - radiation (50% IR, 40% VIS, 10%UV)
  - particles (solar wind)
- **The advent of agriculture 10.000 years ago led to**
  - permanent human settlements
  - the domestication of animals
  - use of metal tools
- **Two important innovations in China in the Middle ages are the invention of**
  - printing
  - compass
- **Key innovations of the second industrial revolution:**
  - railways
  - radio
  - electric lightening
  - automobiles
  - pharmaceuticals - modern medicine
- **The five major global religions are:**
  - Christianity
  - Islam
  - Hinduism
  - Buddhism
  - Judaism/sikhism
- **The first three large empires in human history founded about 2.500 years ago were:**
  - Persian Median Empire
  - Qin Empire
  - Roman Empire
- **The three countries holding the largest colonial empires were:**
  - UK
  - Spain
  - France
- **The two major scientific achievements after World War II leading to the Third Industrial revolution are:**
  - invention of transistors
  - understanding of DNA structure
- **Abiotic factors making up the environment of an organism are:**
  - sunlight
  - climate
  - geology

- **The most important macromolecules in living species are:**
  - proteins
  - nucleic acids
  - carbohydrates
  - lipids
- **The organelles in eukariotic cells are:**
  - mitochondria
  - ribosomes
  - chloroplasts
- **Important terrestrial biomes are:**
  - Temperate deciduous forest
  - Temperate grassland
  - Temperate rainforest
  - Tropical rainforest
- **The movement of the tectonic plates of the earth's crust lead to:**
  - volcanic activities
  - earth quakes
  - tsunamis
- **The very high dipole moment of the water molecule gives water special important properties:**
  - liquid state at normal environmental temperatures
  - high solubility for nutrients and gases
  - reduction of temperature extremes on earth
- **The different layers of the atmosphere are called (from bottom to top):**
  - Troposphere
  - Stratosphere
  - Mesosphere
  - Thermosphere
- **The main classes of organic carbon compounds in living species are:**
  - carbohydrates
  - celluloses
  - proteins
- **In the hydrosphere carbon exists as:**
  - dissolved carbon dioxide
  - suspended carbonates
  - dead organic matter
- **The most important autotroph organisms are:**
  - trees in forests on land
  - phytoplankton in the oceans
- **The major processes for release of carbon into the atmosphere are:**
  - Respiration performed by animals
  - Decay of animal and plant matter
  - combustion of organic material
  - production of cement
  - outgassing from oceans
- **Volcanic eruptions primarily release the following substances in gaseous form:**
  - H_2O - water vapor
  - CO_2 - carbon dioxide
  - SO_2 - sulfur dioxide

- **Mechanisms of uptake of nitrogen from atmosphere and soil by plants:**
  - bacteria with nitrogenase enzyme combines gaseous Nitrogen (N2) with Hydrogen to ammonia NH3
  - assimilation (via roots)
- **Fertilizers typically provide the plant nutrients the major ones being:**
  - nitrogen
  - phosphorus
  - potassium
- **Major processes releasing nitrogen into the atmosphere:**
  - combustion of biomass and fossile fuels
  - chemical fertilizers
- **Sources of input of phosphorus to waters and soil:**
  - animal excretions
  - decomposition of organic compounds
- **The major abiotic factors determining the quality, stability and vulnerability of an ecosystem are**:
  - water
  - air
  - soil
  - temperature
  - light
- **Examples for present global ecological crisis are:**
  - climate change
  - loss of biodiversity
- **Examples for past global ecological crisis are:**
  - Permian-Triassic extinction event (volcanic activity -> increased temperature, acid rains, ..)
  - Cretaceous-Tertiary extinction event (asteroids/volcanic)(more recent believes: extreme volcanic)
- **Examples for present regional ecological crisis are:**
  - droughts
  - deforestation
  - destertification
  - extreme pollution(ait, water, soil)
  - rise of sea level
- **Examples for past regional ecological crisis are:**
  - nuclear meltdown at Chernobyl
  - Exxon Valdez oil spill off the coast of Alaska
- **The most important radioactive elements released in the Chernobyl accident were:**
  - Caesium - 137
  - Strontium - 90
  - Iodine - 131
- **Benefits of biodiversity**:
  - Provision of industrial materials (building, materials, fiber, …)
  - Ecosystem services (regulation the chemistry of your atmosphere and water supply
  - Intellectual value (bionics - nanotechnology)
  - Leisure, cultural and aesthetic value (gardening, inspiration)
  - Intrinsic value of biodiversity

- **Persistent threats to biodiversity:**
  - land change
  - pollution (atmosphere, soil and water)
  - fertilizers, pesticides
  - climate change
  - hunting and fishing
- **The most important classes of chemical substances in relation to pollution of the environment are:**
  - fertilizers
  - pesticides
  - detergents
  - waste material (plastics, …)
  - pharmaceuticals
- **The main POPs which have been banned are**
  - aldrin
  - chlordane
  - DDT (Dichlorodiphenyltrichloroethane)
- **The Club of Rome proposed as a basis for future sustainable development the decoupling of**
  - resource use from economic growth
  - environmental impact from resource use
- **Major EU legislation on air pollution:**
  - euro emission standards for road vehicles
  - integrated pollution prevention and control directive
  - national emissions ceiling directive
  - thematic strategy on clean air for europe
  - air quality directives
- **The major primary air pollutants are:**
  - So2
  - Nox
  - PM (particulate matter)
  - VOCs (Volatile Organic Compounds)
- **The major secondary air pollutants are:**
  - O3
  - ammonium sulfate
  - ammonium nitrate
- **Major sources for SO_2 in ambient air of Europe:**
  - power plants (coal, oil)
  - transport using Sulphur-containing fuel (esp, shipping)
- **Major reasons for elevated ozone levels in ambient air of Europe:**
  - road vehicle and ship emissions (VOCs and NOx)
  - high UV radiation
- **Major sources for PM_{10} in ambient air in Europe:**
  - dust from road traffic (minerals)
  - vehicle emissions (carbon)
  - small scale heating (carbon)
  - regional transport of air pollutants (secondary particulate matter)
  - industrial emissions

- **Major sources for $PM_{2,5}$ in ambient air in Europe:**
  - vehicle emissions (carbon)
  - small scale heating (carbon)
  - regional transport of air pollutants (secondary particulate matter)
- **The main measures for the reduction of SO_2-pollution of ambient air in Europe were:**
  - industrial abatement measures (cleaning of fuel and gas)
  - elimination of sulfur frim diesel and gasoline
- **The main measures for the reduction of pollution of ambient air in Europe with Particulate Matter were:**
  - industrial abatement measures (filters for smoke stacks)
  - reduced emissions for diesel passengers cars (mass limit)
  - reduction of small scale heating
  - fuel switch in heating from coal to gas
- **Major causes/sources for biological and chemical water pollution:**
  - industrial waste water discharges (heavy metals, organic toxins and oils)
  - agricultural effluents (pesticides, herbicides leading to ground water pollution, ...)
  - human waste water discharge (eutrophication and bacterial contamination)
  - oil discharges (oil spills die to accidents with tankers)

- **Major inorganic contaminants of water:**
  - nitrates and phosphates from human waste waters, manure and
  - fertilizers
  - chemical waste as industrial by-products
- **Major organic contaminants of water:**
  - insecticides and herbicides
  - detergents
  - hygiene and cosmetic products
  - agropharmaceuticals
  - human medicines, like estrogens
- **Key functions of soil:**
  - supply of water, nutrients and medium for growing
  - store, filter, buffer and transform substances that are introduced into the environment
  - provider of raw materials
  - habitat and gene pool
- **Mitigation of soil contamination arising from waste depostion („landfilling“):**
  - waste reduction and recycling
  - incineration (burning) and pyrolysis
  - composing and mechanical biological treatment
  - banning of disposal of untreated waste in landfills
- **Drivers of increased resource (and energy) use:**
  - population numbers
  - rising income (GDP)
- **Human-caused deforestation and the degradation of forest habitat is continuing primarily due to:**
  - agricultural land
  - timber production
  - expanding human population
  - expansion of infrastructure
  - pastures

- **Impact of deforestation on the environment:**
  - reduced biodiversity and loss of attraction for inhabitants and tourists
  - reduced CO2 storage and extraction
  - CO2 emissions form burning
  - land degradation, dying of the soil layers, eventually desertification
  - affects the amount of water in the soil and ground water
  - reduction of the landscape's capacity to intercept, retain and transport perciptation

- **Genetic modification of seed material allows to produce plants with new properties:**
  - resistance against insects
  - improved nutrient content
  - drought resistance
  - salt resistance
  - resistance against efficient broad band pesticides (roundup ready soy)
- **The most important GM crops are**
  - soy beans
  - corn
  - cotton
  - canola

- **The most important modern fishing technologies leading to an overexploitation of many fish stocks are:**
  - purse seine(fish swarm detected by sonar and up to 200m net layered around the fish)
  - trawling (ship drags nets up to 20.000m²)
  - bottom trawling (lack of selectivity and physical damage to the seabed)

- **The EU has set recycling goals between 50 and 85% for:**
  - household waste
  - construction and demolition
  - electrical and electronic equipment
  - end-of-life vehicles
  - packagaing
- **Major sinks for green house gases are uptake by**
  - oceans
  - plants (photosynthesis)
- **Important Critical Raw Materials for the realization of the Green Deal are:**
  - cobalt
  - neodymium
  - lithium
  - vanadium
- **The main green house gases are:**
  - H2O
  - CO2
  - CH4
  - N20 (nitrous oxide)

- **Major visible impacts of global warming are:**
  - sea level rise
  - retreat of glaciers
  - loss of arctic ice
  - more frequent extreme weather events
  - increased temperature in Mediterranean sea
  - reduction of permafrost extent
- **Main implementation tools of the EU Climate and Energy Policy:**
  - emission trading system
  - effort sharing decision
- **The main reasons for the aging of populations are:**
  - higher life-expectancy
  - lower fertility rate
- **Major drivers of the "Third industrial revolution are:**
  - climate and energy (sustainable production, clean technologies)
  - space exploration
  - global earth observation
  - industry 4.0
  - reduced use of resources, less pollution
  - new energy systems

- **Key elements of the "Third Industrial Revolution" are the development and implementation of the following "sustainable" technologies:**
  - recycling of materials
  - efficient transport systems
  - low carbon electricity generation
  - new global monitoring techniques
- **Major green house gas emission reduction measures for road transport:**
  - better efficiency
  - CO2 neutral biofuels
  - electric cars
  - advanced public transport systems
- **Major green house gas emission reduction measures for buildings:**
  - replacement of heating with oil or gas by heat pumps, biomass
  - increase of energy efficiency of electrical devices (lighting, vacuum cleaners...)
  - passive houses (insulation, PV, heat pumps)
  - energy surplus buildings (PV)
- **Major green house gas emission reduction measures for agriculture:**
  - reduction of N2O emissions: mores efficient fertilizations (precision farming)
  - reduction of CH4 emissions: reduced cattle farming, less meant consumption
  - production of biogas from manure
  - adapt agricultural activities to enhance carbon storage in soils
- **The three sectors with the highest Green House Gas emissions in the EU are:**
  - electricity production
  - road transport
  - industry
- **The major base load/back-up power plants for future electricity production will be:**
  - Hydro power plants
  - nuclear power plants
  - gas and coal power plants

- **The major means to store excess electricity from wind and solar power plants are:**
  - hydro (Kaprun)
  - batteries
  - hydrogen
- **First generation of biofuels (methanol/ethanol or diesel) are produced from**
  - cereals
  - sugar
  - pant oils
- **The major techniques to produce hydrogen in very large quantities as a basis for a "hydrogen economy" are:**
  - high efficiency electrolysis at high temperatures(800 °C)
  - catalytic thermochemical production
- **The four technologies for production of "low carbon" electricity already in operation:**
  - Hydro
  - Solar
  - Wind
  - Nuclear
- **Landmark events in space exploration:**
  - 1957 first human made object in orbit (Sputnik)
  - 1969 first moon landing (Apollo 11)
  - 1970 landing of Venera on Venus
  - 1971 landing of Mars 3 on Mars
  - 1971 first space station (Salyut 1)
  - 1977 Voyager 2 to study outer planets
- **The operational dimension of the EU GMES (Copernikus) programme covers:**
  - land monitoring
  - marine services
  - atmospheric services
  - crisis management

2. Chose the correct figure/answers:

Each correct choice is 1 point.

- Our galaxy, the "Milky Way" is one out of 1 million, 1 billion, 100 billion or 10.000 billion galaxies in the observable universe.
- Our galaxy, the "Milky Way" contains about 200-400 thousand, million, billion or trillion stars.
- One galactic year is equivalent to 1, 50, 250 or 500 million years.
- Our solar system has 6, 7, 8 or 9 planets.
- The diameter of our earth is 6.000, 12.000, 20.000 or 40.000 km.
- The core temperature of our sun is 15.000, 150.000, 15 million or 150 million °C.
- The surface temperature of our sun is approximately 2.000, 5.000, 10.000 or 100.000 °C.
- Our earth has an age of 100 million, 1 billion, 5 billion or 10 billion years.
- Which of the following species does NOT belong to the class of homo erectus: yuanmouensis, australopithecus, neanderthalensis or pekinensis.
- Our species, the homo sapiens developed 20.000, 200.000, 1 million or 2 million years ago.

- The appearance of homo sapiens lead to the extinction of cyanobacteria, dynosaurus rex, homo neanderthalensis and the moa birds.
- The human brain makes up typically 0,1or 2, or 5 or 10% of the body weight.
- The Islamic religion was developed in Arabia in the 2nd, 4th, 7th or 9th century.
- The philosophical school of Athens, were many of the foundations of our civilization were developed, was founded by Socrates, Archimedes, Plato or Cicero.
- During the Middle Ages important innovations were made in the Muslim empire in respect to the production of chemical substances, the conversion of normal metals to gold, printing books, using natural gas as an energy source.
- In the Middle Ages the scientifically most innovative domain in Europe was the Holy Roman-German Empire, the Islamic Empire, the Commonwealth of Nations or the Viking Empire.
- The age of enlightenment led to the principles of the absolutism of the French kings, the idea to found overseas colonies, the French Revolution or Marxism.
- The First and the Second World War brought a massive shift of political power from Europe to Japan, China, USA, Africa.
- Robert Schuman is one of the founding fathers of modern France, the united Germany, the European Union or the United Nations.
- The prime drivers for globalization are the USA, Africa, Russia, Iran. Europ and Japan
- The invention of the World Wide Web in 1989 was made at IBM, Stanford University, CERN or Google.
- The number of internet users globally is in the order of 3, 4.5, 5.5 or 7 billion people.
- The number of internet users has increased during the last 20 years by a factor of 15, 60, 130 or 1.200.
- The percentage of the global population using smart phones is roughly 10, 25, 50 or 85%.
- In the Anthopocene during the last 100 years the consumption of energy and natural resources has increased by a factor of 5, 10, 15 or 25.
- The percentage of the human genome identical with the genes of shimpanzees is 90; 99; 99,9 or 99,99%.
- The human brain contains 100.000, 100 million, 100 billion or 100 trillion cells.
- The human brain making up about 3% of the body mass consumes 3%, 10%, 25% or 50% of the energy.
- The first major European colony “New Spain” was founded after conquest of the Inca empire, the Eastern Seabord of North America, the Aztec empire or the Philippines.
- The first major European colony “New Spain” was founded after conquest of the Aztec empire in the 16th century by Christoforo Colombo, Francisco Pizarro, Hernando Cortes or Vasco da Gama.
- The historically largest empire was China, the Soviet Union, the British Empire or the Mongolian Empire under Genghis Kahn.
- The invention of James Watt enabled the building of skyscrapers, telephone lines, railroads or airplanes.
- The share of world trade carried by shipping is 20, 40, 60 or 90%.
- The global number of air passengers per year is in the order of 1, 3, 5 or 10 billion.

- The number of internet users globally is in the order of 1, 3, 5 or 8 billion people.
- The human DNA contains 1 million, 100 million, 1 billion or 3 billion base pairs.
- The human DNA contains 1.000, 10.000 million, 23.000 or 100.000 genes.
- The difference in the DNA sequence between various people of the human race amounts to 0,1; 1; 10 or 50%.
- The largest number of cells in a human body belong to the liver, blood, nerves or immune system.
- The lithosphere consists mainly of iron oxides, metallic nickel, silicates or carbohydrates.
- The temperature in the core of our earth is about 2.000, 3.000, 5.000 or 10.000°C.
- The mass of the earth is responsible for the magnetic field, the ocean currents, composition of the atmosphere or the gravitational field.
- According to the presently best establish theory the ocean waters of our planet originate from outer space comets, extreme weather event in prehistoric times, water bound in minerals of the earth, reaction of hydrogen with ogygen during the early cooling period of our planet.
- Since 1970 ca 150, 200, 300 or 500 pieces of EU environmental legislation have been produced.
- The temperate deciduous forest grows in a climate which has extremely cold winters, dry summers, stable seasonal precipitation or high winter precipitation.
- The savanna – typical for large areas in Africa - grows in a climate which has extremely cold winters, wet summers, stable seasonal precipitation or high winter precipitation.
- The tropical rain forest grows in a climate which has stable lower temperatures, dry summers, high and stable seasonal precipitation or little winter precipitation.
- Evolution of our biosphere began 1,5; 2,5; 3,5 or 4,5 billion years ago.
- The annual movement of the tectonic plates is in the order of some millimeters, centimeters, meters or kilometers.
- The maximum density of water is at -10°C, 0°C, 4°C or 100°C.
- Seawater in respect to its pH-value is neutral, slightly acidic, slightly basic or strongly basic.
- Unpolluted rain water in respect to its pH-value is neutral, slightly acidic, slightly basic or strongly acidic.
- The large amounts of water on our earth most likely originate from bombardment by asteroids, impact of comets, outgassing of crystalline water from minerals of the mantle, or reactions in our atmosphere.
- Without the green house effect caused by water vapour in our atmosphere to average temperature on our earth would be 5, 10, 30 or 50°C lower. $\approx (-14° \rightarrow -15°)$
- The last ice age ended about 1 million, 100.000, 10.000 or 1.000 years ago.
- The oxygen content of polar sea water is lower, equal or higher compared to tropical ocean water.
- Approximately 60, 70, 75 or 80% of the Earth is covered by water.
- 1, 3, 5 or 10% of the global water resources is fresh water.

- During the ice ages the average global temperature was typically 1, 2, 5 or 10°C lower than now.
- The concentration of water in the atmosphere is highest in the polar region, the temperate zones, the Himalayas or the tropics.
- Photosynthesis of oceanic plants produces carbon dioxide, nitrogen, oxygen or methane.
- The Gulf Stream influences the climate of the west coast of North America, the eastern coast of South America, south east Asia or Western Europe.
- The Gulf stream originated by updwelling of warmer water in the North Atlantic, the Mediterranean Sea, the Caribbean, the Pacific Ocean.
- The Gulf Stream is largely driven by: the magnetic field of the earth, the composition of the atmosphere, the amount of precipitation, the global thermohaline circulation, the trade winds.
- The average content of water in the atmosphere is 1, 2, 5 or 10%.
- The average salt content of ocean water is 1, 2, 3.5 or 10%.
- The ration of nitrogen to oxygen in our atmosphere is 1:4, 1:1, 2:1 or 4:1.
- The oxygen content of the present atmosphere of the earth is 16, 21, 15, 32%.
- The carbon dioxide content of the present atmosphere of the earth is 0,01%, 0,04%, 0,1% or 0,4%.
- The atmosphere protects life on earth by absorbing infrared, visible, UV or microwave radiation.
- The average atmospheric pressure at sea level is about10, 100, 500 or 1000 kPa.
- Available oxygen at the peak of the Mount Everest is about 10%, 30%, 60% or 100% of that at sea level.
- The jet stream blow from west to east, north to south, east to west or south to north.
- The trade winds blow from west to east, north to south, east to west or south to north.
- In the respiration process energy is produced, energy is consumed or no energy change of the system is taking place. (exothermic)
- In photosynthesis energy is produced, energy is consumed or no energy change of the system is taking place.
- Through photosynthesis phytoplankton is responsible for producing about 10%, 25%, 50% or 75% of the oxygen in earth's atmosphere.
- Sunlight delivering the energy for photosynthesis belongs to the ultraviolet, visible, infrared or microwave region of the solar spectrum.
- CO_2 is dissolved in the ocean water and reacts with other elements to form bicarbonate ions, cellulosis, glucose, natural gas, calcium carbonate or various silicates.
- Nitrates contain the chemical group –NO, -NO_2, -NO_3 or -NH_4.
- Ammonium salts contain the chemical group –NO, -NO_2, -NO_3 or -NH_4.
- Fixing of molecular nitrogen from air is done by special fungi, bacteria, specific plant cells or phytoplankton. → Ammonia
- The largest pool of nitrogen on the earth is sea water, the atmosphere, forests or the deserts.
- Plants absorb the nutrient nitrogen from soil if this element is present as nitrate, molecular nitrogen, proteins or chlorophyll.
- One of the most important green house gases is NO, NO_2, N_2O, NH_3 .

- The main source of the air pollutants NO and NO_2 are photosynthesis, burning of fossil fuel, oxidation of NH_3 stored in the soil or decay of organis matter.
- The main source of NH_3 in the air are detergents, burning of fossil fuels, decomposition of fertilisers in the soil or outgassing from permafrost zones.
- Which of these water bodies has the highest oxygen content: Red Sea, Wörthersee in Austria, Bering Sea in the Arctic or the river Rhine. (Map Sea-surface oxygen)
- The main source of oxygen in the air is decay of organic compounds, respiration, dissolution of mineral oxides and carbonates in ocean water or photosynthesis.
- The energy carrier for living cells produced in mitochondria with oxygen is chlorophyll, CO_2, adenosine triphosphate or haemoglobin. (ATP)
- Hemoglobin molecules contain the element copper, silicon, iron or nitrogen to bind oxygen for transport into the cells.
- Chemical fertilizers are responsible for sustaining 10%, 20%, 33%, 50% of the Earth's population.
- Which of the following sea regions has the highest oxygen content in its waters: Mediterranean Sea, the Pacific near the equator, the Indian Ocean or the North Atlantic?
- In the aerobic respiration following the reaction $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ +the net energy gained is approximately 1.000, 2.000, 3.000 or 5.000kJ·mol-1.
- The IUCN red list of endangered species contains 10, 25, 40, 75% of all 105.000 species investigated.
- Numbers of insect species: 10.000, 100.000, 1 million or 10 million insects
- Numbers of plant species: 100.000, 300.000, 750.000 or 1 million.
- Presently about 1, 15, 200 or 1.000 million chemical substances have been registered by Chemical Abstracts Service.
- Presently about 1.000, 10.000, 100.000 or 1 million chemical substances are regularly produced and enter the environment.
- Pollution of the environment with heavy metals mostly originates from fertilisers, industrial waste, plant protection chemicals, or urban effluents.
- The EU Maximum Residue Limit (MRL) for pesticides in ground and drinking water is 1, 10, 100 or 1000 ng/L. 0,1 µg/L
- Which of the following pesticides decays rapidly in the soil: DDT, atrazine, organophosphorous compounds, chlordane.
- The term “biocides” coined by Rachel Carson stands for dangerous fertilisers, POPs, pesticides or certain infectious bacteria.
- The book “The Silent Spring” by Rachel Carson marks the beginning of the civil rights initiative in the USA, of the globalization process in trade, the environmental movement or the women’s liberation drive.
- The influential book “Limits to Growth” published 1972 demands to stop economic growth, to limit the increase of the global population, to decouple economic activity from resource use and environmental pollution, or to reduce the global amount of money in circulation.
- The IPCC publishes authoritative assements on global air pollution, water resources in developing countries, global warming, or future needs in food supply.

- The Earth Summit held Johannesburg 2002 produced an agreement to limit the growth of slums in the megacities of developing countries, to restore the world's depleted fish stocks, to eliminate coal fired power plants for environmental reasons or to stop desertification.
- The NEC-Directive applies to the EU Member States and limits the immision concentration of air pollutants, limits the emission of the green house gas CO_2, limits the emission of several air pollutants like NO_x, SO_2, or defines minimal expenditure for environmental protection measures.
- The status report for emissions by the EU Member States indicates that the legal limits according to the NEC-Directive are frequently exceeded for NO_x due to lack of flue gas cleaning devices in power plants, long range transport from China, growth of road traffic, or widespread small scale household heating.
- $PM_{2,5}$, NO_x, SO_2 or ozone is the air pollutant which affects the largest number of European urban inhabitants with concentrations above immission limit values.
- The most effective instrument for the reduction of emissions of NO_x and PM from road traffic is the NEC-Directive, the Euro Standards (…4,5,6), the Air Quality Directives, or the Convention on Long Range Transport of Air Pollution.
- Roughly 10, 30, 50 or 75% of the European urban population suffer from exposure to concentrations of the air pollutant ozone above immission limit values (2020).
- The air pollutant which has been reduced most in the last decades is NO_x, NMVOCs, SO_2/SO_3 or PM.
- The emission standard for small vehicles Euro6 applicable since 2018 reduces emissions of NO_x for diesel cars by 10%, 25%, 70% or 100% compared to Euro4 (introduced 2005).
- The emission standard for small vehicles Euro6 applicable since 2018 reduces emissions of PM for diesel cars by 10%, 25%, 80% or 100% compared to Euro4 (introduced 2005).
- The Global Atmospheric Watch (GAW) network of the WMO serves mainly to control industrial emissions in the region, monitor background concentrations of air pollutants, provide warnings from extreme weather situations or to observe changes in intercontinental air streams.
- 10, 20, 30 or 50% of the global land surface are covered with forests.
- Agriculture started 40.000, 10.000, 5.000 or 2.000 years ago.
- When people lived on hunting and gathering 1, 10, 100 or1.000 ha of land were needed to support 1 person.
- Modernisation of agriculture has allowed the world population to grow by 20%, 50%, 100% or 200% over the last 50 years.
- Agricultural production accounts for ca 1, 5, 10, 20 percent of the gross world product.
- Area needed for production of 1 kg of vegetable 0,1; 1; 5 or 10 m^2
- Areas needed for production of 1 kg of beef 10, 50, 250, 500 m^2
- Meat makes up ca 5 % of the global food production and uses roughly 5, 10, 25 or 60% of the agricultural land for this.
- Globally only 6, 12, 20 or 30 % of land surface usable for agriculture.
- Agriculture accounts for 30, 50, 70 or 80% of the global consumption of freshwater water.
- By 2030 one, two, three or four billion people will be affected by severe water shortage.
- The share of GM soy within the global soy harvest is 20, 50, 60 or 80% (2019).

- According to the European Commission's Report of Biosafety the consumption of GMOs poses less risks, more risks or equal risks compared to food and feed obtained with conventional breeding techniques.
- Global fish catches amount to 40, 60, 90 or 120 million tons (2022)
- Global aquaculture production amounts to ca 20, 30, 80 or 90 million tons (2022).
- Presently agricultural production uses per capita a land area 1; 0,5; 0,25 or 0,15 ha.
- Since 1850 the global production and consumption of energy has increased by a factor of 5, 10, 20 or 50.
- Roughly 30, 40, 60 or 80% of the present global energy production is from fossil fuels.
- Under a "business as usual" scenario global energy consumption will increase till 2050 by 10, 20, 50 or 100%.
- The share of oil in global total energy production in 2018 was 12, 24, 33 or 45%.
- The share of renewable (hydro, biomass, geothermal, wind and sun) in global total energy production in 2018 was 6, 12, 25, or 40%.
- The share of gas in global total energy production in 2018 was about 12, 24, 33, 50%.
- Electricity consumption is expected to increase till 2050 by 25, 50, 100 or 200%.
- Share of fossil fuels in total primary energy consumption is ca 10, 40, 65, 80% (2018).
- Share of fossil fuels in global electricity production is ca 10, 40, 65, 80% (2018).
- Share of nuclear energy in global electricity production is ca 10, 25, 65 or 80% (2018).
- Share of renewable energies in global electricity production is ca 12, 25, 65 or 80% (2018).
- 10, 30, 50 or 75% of the global known conventional oil reserves have already been consumed.
- 10, 30, 50 or 75% of the global known conventional gas reserves have already been consumed.
- According to the IPCC the temperature increase caused by GHGs between 1850 and now is ca 1, 2, 4 or 6°C.
- The concentration of CO_2 in the air has reached a value of ca 200, 400, 600 or 800 ppm.
- The climate forcing factors of N_2O and methane are roughly 5, 10, 25 or 50 times larger than that of CO_2.
- The present global mean temperature is ca 10, 14, 20 or 25°C.
- Total global annual CO_2 emissions were 24, 36, 50 or 75 Gto/yr CO_2 (2019).
- The annual CO_2-emissions of China are about 10, 20, 30 or 50% of the total global emissions (2019).
- The annual GHG-emissions of the EU-27 are about 2, 8, 15 or 20% of the total global emissions (2019).
- The annual per capita CO_2-emissions of China are about 3, 8, 15 or 25 tons (2019).
- The annual per capita CO_2-emissions of the USA are about 3, 7, 15 or 20 tons (2019).
- The annual per capita CO_2-emissions of the EU are about 3, 8, 15 or 25 tons (2019).
- The largest source sector for the emission of green house gases in the EU is road transport, agriculture, electricity production or industrial processes.
- Under the "business as usual" scenario (IPCC RCP8,5 scenario) total annual CO_2 emissions will rise by 10, 25, 50 or 100% till 2100.

- Under the optimal stabilisation scenario (IPCC RCP2,6 scenario) total annual CO_2 emissions have to decrease by 10, 25, 50 or 100% till 2050.
- According to the IPCC the temperature increase caused by GHGs between 1850 and 2100 will be ca 1, 2, 4 or 6°C under the "business as usual" scenario (RCP8,5).
- According to the IPCC the temperature increase caused by GHGs between 1850 and 2100 will be 0, 1, 2 or 4°C for the optimal stabilisation scenario (RCP2,6).
- The EU has decided to reduce its green house gas emissions by 5, 10, 20 or 40% till 2020.
- The EU has decided to reduce its green house gas emissions by 5, 10, 30 or 55% till 2030.
- The EU emission trading system covers about 100, 1000, 10.000 or 100.000 installations.
- The industrialised regions like Europe and North America have emitted roughly 2, 3, 4, 5 times the amount of the emerging and developing economies, like China and India so far.
- In order to limit global warming to 1,5/ 2°C a global reduction of green house gas emissions of at least 25, 40, 60 or 80% is necessary by 2050.
- The ratio of the global population between the industrial and the hunter-gathering society is about 10:1, 100:1, 1.000:1 or 10.000:1.
- The global population has increased from 1750 till now by a factor of 6, 10, 15 or 20.
- Global population is 6, 7, 8 or 9 billion people (2022).
- By 2050 the global population will have reached 8, 10, 15 or 20 billion.
- Current annual growth rate of the global population is ca 1, 2, 3 or 4%.
- During the last 100 years life expectancy has increased by 10, 25, 50 or 100%.
- During the last 100 years agricultural productivity increased by a factor of 1,5; 2,5; 5 or3 10.
- During the last 100 years labor productivity has increased by a factor of 5, 10, 50 or 200.
- The European Union (EU-27) has ca 3, 6, 10 or 15% of the world population.
- Asia has ca 30, 40, 50 or 60% of the world population.
- The ratio of the fertility rate between Africa and the industrialised countries of the Northern hemisphere is about 1: 1; 2:1; 4:1 or 10:1.
- The population of Europe will remain stable, grow slightly, grow massively or shrink moderately till 2050.
- Life expectancy in Africa is about 5, 10, 25 or 50 % lower than in Europe.
- Till 2050 the population of Africa will grow from now 1,2 billion to 1,5; 2; 3 or 4 billion.
- Presently about 25, 50, 70 or 80% of the global population live in urban areas.
- In developing countries about 10, 25, 50 or 75% of the population live in cities of 1 million or more inhabitants.
- The per capita GDP based on buying power (PPP) in the industrialised countries of the Northern hemisphere is roughly 2 times, 5 times, 10 times or 25 times as high as in Africa.
- The WTO treaty of 1995 created essentially a borderless world for goods and money – covering 60, 80, 95 or 100% of the global production and financial services.
- According to IMF 2021 reports the GDP of all EU member states together is ca 8.000, 16.000, 25.000 or 40.000 billion EUR.
- According to IMF 2021 reports the (average) GDP per capita (measured as Purchasing Power) in the EU is ca 8.000, 13.000, 30.000 or 40.000 EUR.

- The (material) living standard in China (measured as PPP GDP per capita) is about 10, 20, 30 or 60% lower than in the EU.
- The (material) living standard in the EU (measured as PPP GDP per capita) is about 10%, 25% higher or 10%, 30% lower than in the USA.
- The ratio of the (material) living standard in the EU (measured as PPP GDP per capita) between the richest (Luxemburg) and the poorest Member State (Bulgaria) is 1,5:1, 2:1, 5:1 or 10:1.
- In the EU about 10, 25, 40 or 60% of the work force is in industry (without associated services).
- In the EU about 1, 5, 10 or 20% of the work force is in agriculture.
- The GDP growth rate of China was typically 8% per year, that of the EU typically 0%, 2%, 5% or 10%.
- Europe's R&D investments are typically 1 %, 2%, 3% or 5% of the nominal GDP.
- In its trade relations with China the EU during the last decade had a stable balance, an increase of the surplus or an increase of the deficit.
- Among the top 100 companies (according to their value at the stock exchange) are 5, 16, 25 or 38 European companies. it says 19 companies in 2023
- The military expenses of the EU in relation to the biggest investor, the USA, amount to 10%, 35%, 60% or 100%.
- The costs for energy imports of the EU are roughly 1 million, 100 million, 1 billion or 10 billion EUR per day.
- China's share in the global production of computers is 20, 40, 60 or 80% (2016).
- China's share in the global production of mobile phones is 25, 50, 75 or 90% (2016).
- China's share in the global production of electric cars is 25, 40, 60 or 80% (2022).
- According to UNEP 100 million, 600 million, 1 billion or 2,5 billion people are without proper sanitation services.
- According to UNEP 10 million, 200 million, 800 million or more than 1 billion people are without access to safe drinking water.
- According to UNEP 100 million, 600 million, 1 billion or more than 2 billion people are without access to electricity (World Bank 2018).
- According to UNEP 50, 100, 400 or 700 million people are undernourished (World Bank 2018).
- The annual contribution of each EU citizen to development aid is about 25, 100, 500 or 1.000 EUR.
- Africas share of the global land mass is 5, 10, 20 or 40%.
- While the median age of the EU population is 45 years, that of the African population is 22, 30, 40, 50 years.
- Share of renewable energies ("carbon free" electricity) in EU electricity production is ca 30, 50, 60 or 80% (2022).
- Wind energy in EU: Share in electricity production 2022 is 3, 8, 16, 20% in EU
- Solar energy in EU: Share in electricity production 2022 is 3, 5, 8 or 10% in EU
- The share of aviation in EU Green House Gas emissions is 1, 3, 5 or 10%.

- The aim of the “Green Deal” is to reduce EU GHG emissions by 30, 50, 90, 100% by 2050.
- According to the Paris Climate Agreement the national reduction goal of a country or political entity (like the EU) is set by the United Nations, the World Metrological Organisation, the G20 or by the country/political entity itself.
- The share of fossil fuels in total primary energy production in the EU is roughly 20, 40, 70 or 80% (2022).
- The share of the sector electricity production accounts for 10, 20, 30, 40% of the EU GHG emissions.
- The share of the sector idustry production accounts for 10, 20, 30, 40% of the EU GHG emissions.
- The share of the sector road transport accounts for 10, 20, 30, 40% of the EU GHG emissions.
- The share of the sector agriculture accounts for roughly 10, 20, 30, 40% of the EU GHG emissions.
- The share of renewable energy in electricity production in the EU in 2050 should be 40, 60, 80 or 100%.
- To replace 1 TWh/a electricity produced now by fossil fuel 10, 50, 100 or 500 wind turbines are necessary.
- To replace 1 TWh/a electricity produced now by fossil fuel 1, 2, 10 or 100 million m^2 of PV panels need to be installed.
- The substitution of coal by natural gas for energy production can reduce the emissions of CO_2 by 10, 20, 50 or 90%.
- Coal fired power plants typically emit 10, 20, 100 or 800 g CO_{2eq} per kWh electricity produced (calculated for the full life cycle of a plant).
- Hydro power plants typically emit 10, 20, 100 or 1000 g CO_{2eq} per kWh electricity produced (calculated for the full life cycle of a plant).
- Nuclear power plants typically emit 10, 20, 100 or 1000 g CO_{2eq} per kWh electricity produced (calculated for the full life cycle of a plant).
- The average effective electricity output (yield) of an on-shore wind power plant in Europe is 12, 26, 34 or 46% of the (theoretical) peak electricity output.
- The average effective electricity output (yield) of a silicon PV-panel in Europe is 12, 26, 34 or 46% of the nominal peak electricity output.
- On-shore wind power plants typically emit 10, 20, 100 or 1000 g CO_{2eq} per kWh electricity produced (calculated for the full life cycle of a plant).
- Solar power plants typically emit 20, 40, 100 or 1000 g CO_{2eq} per kWh electricity produced (calculated for the full life cycle of a plant).
- Gas power plants typically emit 10, 20, 100 or 500 g CO_{2eq} per kWh electricity produced (calculated for the full life cycle of a plant).

3. Select the correct components by underlining:
Each correct choice is 1 point. Each wrong choice is minus 1 point.

- The center of our galaxy is formed by a supernova, a black hole, a comet or a sun.
- The sun consists mainly of the elements hydrogen, oxygen, nitrogen, helium and argon.
- The first proto states developed about 6.000 years ago in North America, Mesopotamia, South America, Indus valley, Southern Europe, Egypt, Central Africa.
- The first large empires in our history were the Indian Mogul empire, the Persian-Median Empire, the Association of Greek States, the Roman empire, the Inca empire, the Quin empire, the Aztec empire.
- European seafarers who had a major impact on the colonization of the rest of the regions of our world by European nations were Julius Cesar, Christoforo Colombo, Antoine Lavoisier, Vasco da Gama, Gallileo Gallilei, David Livingstone, Raffaelo Santi, Fernao de Magalhaes, George Washington, James Cook.
- Major ideas created in the Age of Enlightment were the sovereignty of reason, absolute powers for the French king, religious belief is more important than scientific findings, evidence of senses as the primary sources of knowledge and advanced ideals such as constitutional government and unification of church and state.
- Major philosophers developing the ideas of the age of enlightment were Nicolo Macchiavelli, Emanuel Kant, George Washington, Francois Voltaire, Jean-Jaques Rousseau, King Henry VIII, Charles-Louis Baron de Montesquieu, Napoleon Bonaparte or Johann Wolfgang von Goethe.
- The principles of the Age of Enlightenment are the basis for the constitutions of China, USA, the EU Member States, Saudi Arabia, North Korea.
- The primary drivers for the global free trade agreement concluded 1995 under the umbrella of the WTO are the UN, Saudi Arabia, the USA, Green Peace, the European Union, Global 2000 and China.
- According to forecasts of major ecomists the three leading economic regions in the world in 2050 will be Australia, China, Japan, India, Great Britain, the European Union, Brasil and the USA.
- Major macromolecules in living species are proteins, water, sodium chloride, lipids, glucose and carbohydrates.
- Which of the following structural elements are present in procariotic cells: cell wall, chloroplasts, mitochondria, cytoplasm, ribosomes, a membrane-bound nucleus encapsulating the DNA.
- Which of the following structural elements are present in prokaryotic and eukaryotic cells: cell wall, mitochondria, cytoplasm, ribosomes, a membrane-bound nucleus encapsulating the DNA.
- Which of the following structural elements are present only in eukaryotic cells: cell wall, mitochondria, cytoplasm, ribosomes, a membrane-bound nucleus encapsulating the DNA.
- The major biogeographic regions of Austria are atlantic, mediterranean, alpine, boreal, continental.

- Major biomes of Europe are boreal forest, desert, temperate deciduous forest, tropical rain forest, savanna, chapparal.
- Major biomes of Africa are tundra, desert, temperate deciduous forest, tropical rain forest, temperate grassland, savanna.
- The two most important factors influencing the type of vegetation on earth are intercontinental air streams, air temperature, ocean currents, precipitation, climate change.
- The two largest biogeographic regions of Europe are the Atlantic, Continental, Mediterranean, Alpine and Boreal regions.
- The core of earth contains mainly the metals aluminium, iron, copper, nickel, cobalt and magnesium.
- Movement of the tectonic plates leads to global warming, volcanic activities, reduction of biodiversity, earthquakes, significant changes in the ocean currents, tsunamis or extreme weather events.
- The water molecule has a very high dipole moment giving water special properties like low solubility for gases like CO_2, high solubility for salts, low boiling point compared to other chemical compounds of similar molecular weight (like methane), high heat capacity of the oceans, blue colour of rivers like the Danube.
- The ocean currents are very important for the good functioning of our ecosystems because they transport nutrients, soil bacteria, heat, sand from the sahara, plastics or marine species.
- The Gulf Stream influences the climate along the East coast of South America, the West coast of Europe, the seashores of Japan, the East coast of North America.
- The huge steady ocean currents are driven by density differences, the magnetic field of the earth, tectonic movements, temperature gradients between Northern and Southern regions, solar activities, steady surface winds or chemical water pollution.
- In the Hadley Cell the air rises in the tropical zone, a stong downwards air flow takes place near the equator, a strong polewards air flow occurs near the surface of the earth, a strong downwards flow dry air masses occurs an mid-latitudes (ca 30°), a massive flow of air masses towards the equator takes place in high altitudes (10km), the air streams are turned eastwards in high altitudes due to the rotation of the earth, strong air streams from west to east are observed near the surface due to the Coriolis force.
- Among the most important carbon components making up the biosphere are carbohydates, polymers, proteins, fatty acids, carbon dioxide.
- In the lithosphere carbon is essentially present as coal, algae, magnesium silicate, inorganic carbonates, crude oil, calcium phosphate, natural gas, or ammonium nitrate.
- Nitrogen is an important element of the bio-geochemical cycle because it is present (in different chemical forms) in proteins, silicate sediments, natural gas, chlorophyll, chemical fertilisers, crude oil or acid rain.
- Autonomous nitrogen uptake by plants is mainly in the form of molecular nitrogen, ammonium ions, proteins, nitrate ions, nitrides.
- The Haber-Bosch process has the following characteristics:
  - It uses nitrogen form air as a raw material.
  - It is an exothermic reaction producing energy.
  - It operates at very high temperatures.
  - The pressure in the reactors is about 100kPa.

- It uses hydrogen from water.
- It is the main chemical process to produce ammonium for chemical fertilisers.

- Phosphorous occurs as an important element in carbonate rocks, cell membranes, coal, inorganic phosphates and sediments, the fertilizer urea, animal excretions, crude oil, acid rain, detergents.
- The major sources for phophates in water are atmospheric deposition, application of fertilizers, dissolution of phosphate containing sediments and use of detergents.
- Oversupply of phosphorous in water bodies leads to algae growth, richer fish population, eutrophication, better water quality for human consumption.
- Free oxygen occurs in the atmosphere, plants, sulfates forming acidic precipitation, metal oxides, water bodies.
- The Permian-Triassic and the Cretaceous-Triassic extinction events could have been caused by asteroid impacts, global cooling due to changes in the earth axis, extensive volcanic eruptions, complete freezing of the oceans ("snowball earth episode"), global temperature increase due to high emissions of green house gases, global sea level rise flooding most areas of the continents.
- Essential chemical components provided by air to living species are sulfur dioxide, oxygen, argon, carbon dioxide, phosphorous, nitrogen, hydrogen.
- Biodiversity hotspots are the grain belt in the Midwest of the USA, the boreal forests in Russia, the Atlantic forest of Brasil, the Rhine valley, the island of Madagascar or the Alpine regions of Austria.
- The most important chemical substances in relation to pollution of the environment are nitrogen, rubber, fertilisers, detergents, wood, paper, iron ores, natural gas, coal, limestone minerals, cement products.
- Major suspected causes for the widespread disease of bees called "colony disorder" are the lack of food, heavily polluted water, the enhanced use of pesticides, excessive air pollution, infection by the Varroa Destructor mite.
- Chemical characteristics of POPs are high water solubility, high lipid solubility, ability for bioaccumulation, low molecular weight, presence of halogens in the molecule, ability to pass through biological membranes, short life time in the atmosphere, present only near emission sources.
- The following substances belong to the POPs: dioxins, ammonium nitrate, carbon dioxide, PAHs, vinylchloride, PCBs, organosphosphorous pesticides, polyethylene.
- The 1992 United Nations Conference on Environment and Development ("Earth Summit") produced the following important documents: the report "Limits to Growth", the Framework Convention on Climate Change (UNFCCC), the report "Our Common Future", the Convention of Biological Diversity (UNCBD), the Sustainable Development Strategy of the EU
- The UN Millennium Development Goals established in 2000 focus on reduction of military expenses, eradication of extreme poverty and hunger, reduction of global population growth, creation of an African Union, promotion of gender equality and empowerment of women,

training of persons above 60 to reduce computer illiteracy and to give a greater political power to emerging economies like China or India.

- The UN Agenda for Sustainable Development 2015 sets goals and indicators for poverty, pensions for older people, gender equality, clean energy, migration from poor to rich countries, redistribution of wealth from upper to lower income levels, climate action, or number of billionaires in this world.
- Policy Acts of the European Union, which had a major impact on the development of the environmental and sustainability policies, are the publication of the book "The Silent Spring", foundation of the club of Rome, the commissioning of the Brundlandt Report, the Single European Act of 1997 (Amsterdam), the founding of Greenpeace, the Gothenburg European Council Decision establishing EU Sustainable Development Policy in 2001, the fall of the Berlin wall, the founding of UNEP, the Climate and Energy Package (a series of Directives to combat climate change).
- Very important air pollutants are ozone, hydrochloric acid, nitrogen, oxygen, particulate matter, pesticides, sulfur, NO_x, polymers, agro-pharmaceuticals, CFCs.
- Major air pollutants are: agropharmaceuticals, chlorophyll, nitrogen, ozone (O_3), ammonium phosphate, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), tributyl tin, water vapour.
- The major health effects caused by air pollution are digestion problems, bronchial irritations, multiple sclerosis, asthma, yellow fever, allergies, or the fatigue syndrome.
- Major sources for the elevated concentrations of NO_2 in the ambient air of Europe are small scale heating, airplanes, automobiles, trains, coal fired power plants, ships, fertilisation in agriculture.
- Major sources for the elevated concentrations of SO_2 in the ambient air of Europe are airplanes, automobiles, trains, coal fired power plants, ships, fertilisation in agriculture.
- Major sources for the elevated concentrations of PM in the ambient air of Europe are small scale heating, airplanes, road traffic, railroads, industry, ships, regional transport of air pollutants, fertilisation in agriculture.
- Major reasons for elevated concentrations of ozone in the ambient air of Europe are emissions from road vehicles, high infrared intensity from the sun, solar wind, strong trade winds, high UV-radiation, small scale heating, low pressure weather systems, emissions from ships.
- The primary air pollutants forming the secondary pollutant ozone are NO_x, SO_2, CFCs, VOCs, benz-a-pyrene, dioxin, DDT.
- Important pieces of EU legislation to limit air pollution are the Water Framework Diorective, the Integrated Pollution Prevention and Control Directives, the Thematic Strategy for Soil and the National Emission Ceilings Directive.
- The major source for the emission of NO_x are road traffic, small scale household heating, nuclear power plants, shipping, railways.
- The major source for the emission of PM_{10} are road traffic, small scale household heating, nuclear power plants, shipping, railways, industry.
- The major source for the emission of $PM_{2,5}$ are road vehicles, nuclear power plants, regional transport, shipping, railways, small scale household heating, industry.

- The major reason for high immission concentrations of ozone are road vehicle and ship emissions, nuclear power plants, regional transport, high UV-radiation, railways, small scale household heating.
- Major mitigation measures for air pollutions from road traffic are the EU Directives (EURO 5, EURO 6, ….); the Emission Trading System, particle traps for diesel engines; the Convention on Long Range Transport of Air Pollutants or the Montreal Convention to ban the use of CFCs.
- The massive reduction of pollution by SO_2 has been achieved by improved road management, elimination of sulfur from diesel and gasoline, particle filters in waste incineration plants, cleaning of the flue gas of power plants, improved motor management for diesel cars.
- General Problems of water resources in Europe: surface water bodies threatened by pollution with nitrate, pollution with pesticides, acidification of lakes in Spain, water scarcity in Northern Europe, occasionally poor bathing water quality, elevated surface water temperatures in Central European rivers.
- The most important anthropogenic pressures on coastal zones in Europe are eutrophication, bacterial contamination of bathing water, pollution of sea water with POPs, growing number of tourists, spill from oil refineries, fueling of ships in the harbors, fish and shellfish farming.
- Major contaminants of water are: oxygen, agropharmaceuticals, calcium carbonate, ethanol, chemical solvents, copper, ozone, pesticides, detergents, sulphur dioxide, dioxin, freons, sodium chloride.
- Industrial wastewater discharges contain ozone, heavy metals, agro-pharmaceuticals, organic toxins, fertilisers, and oxygen or oils.
- The major cause for eutrophication of surface waters is an excessive input of compounds of iron, phosphorous, sulphur, carbon, potassium and nitrogen.
- Important diseases caused by bacterial contamination of water are gastritis, legionellosis, influenza, typhus, polio, cholera, tuberculosis.
- The most common chemicals involved in the contamination of soil are ozone, petroleum hydrocarbons, hydrochloric acid, nitrogen, dioxins, polymers, pesticides, sulphur, PVC, heavy metals, CFCs.
- Major soil problems in Europe are erosion by water and by wind, high salt content in central Europe, pollution with lead from leaded gasoline, a massive extinction of soil bacteria due to global warming, reduced organic carbon content.
- Neolithic founder crops of agriculture are wheat, corn, peas, coffee, lentils, potatoes, barley, bananas and flax.
- In terms of their production volume the three most important food products are beef, soy beans, wheat, milk, rice, potatoes or maize.
- The major genetically modified agricultural products are wheat, maize, barley, soy, tomatoes, rapeseed and apples.
- The most important Critical Raw Materials for the realisation of the EU Green deal are silicon, cobalt, hydrogen, nickel, gold, neodymium, iron, lithium.

- Major suppliers (exporters) of crude oil are South Africa, Venezuela, India, Saudi Arabia, Germany, Nigeria, China, Brasil, Russia.
- Major suppliers (exporters) of natural gas are South Africa, Venezuela, India, Canada, Germany, China, Brasil, Russia.
- The major sources for the green house gas CO_2 are agriculture, burning of fossil fuel, gas and oil exploration, application of fertilisers, biomass burning.
- The major sources for the green house gas CH_4 are agriculture, burning of fossil fuel, gas and oil exploration, application of fertilisers, biomass burning.
- The major sources for the green house gas N_2O are burning of fossil fuel, gas and oil exploration, application of fertilisers, biomass burning.
- These green house gases have a warming effect: halocarbons, stratospheric ozone, N_2O, aerosols, tropospheric ozone, water vapour, methane and cloud albedo.
- These green house gases have a cooling effect: halocarbons, stratospheric ozone, N_2O, aerosols, tropospheric ozone, water vapour, VOCs and cloud albedo.
- Agriculture is responsible for the emission of the GHGs CO_2, CH_4, O_3, N_2O, fluorocarbons, water.
- The world's most spoken first languages are French, English, German, Mandarin Chinese, Portuguese, Spanish, Arabic, Russian, Hindustani or Kisuaheli.
- The three largest religions are Buddhism, Islam, Hinduism, Taoism, Atheism, Christianity, Polytheism, Judaism.
- The three biggest economies (measured as nominal GDP) are Japan, USA, Russia, EU, India, China, Brazil.
- The basis of EU policies for shaping a global partnership for sustainable development is provided by the First Environmental Action Programme of EC, the Johannesburg Declaration, the Water Framework Directive, the Doha Development Agenda, the National Emissions Ceiling Directive, the EU Maritime Strategy, the EMEP network.
- The main technical measures foreseen in the EU to reduce its green house gas emissions by 55% till 2030 are reduction of primary energy use, substitution of coal and oil for heating with gas gained in the EU territory with the fracking technology, reduction of the CO_2 emissions of power plants by installing carbon capture and storage technology (CCS), importing more gas from Russia, outsourcing the energy intensive production of steel and cement to countries outside the EU, increase the production of renewable energy, substitute 50% of the gasoline and diesel used in road traffic by biofuels.
- Major strategic goals of the EU Climate and Energy Policy are increasing the imports of natural gas, increase energy efficiency by 40% by 2030, develop large scale exploration of shale gas in Europe, a goal to raise the share of electricity in total energy consumption to 80% by 2050, outsourcing of energy intensive industry to emerging economies.
- Major results of the Paris Climate Agreement are to limit global warming to 2°C, to set criteria for immigration of "climate refugees" into the EU, to establish a quota for burden sharing in reduction efforts beween industrialised and developing countries, to enhance deforestation in the tropical regions, to reduce the water consumption in dry regions, to implement national action plans for mitigation, to reduce global transport of goods and to replace nuclear energy by wind and solar energy.
- A fuel cell uses nitrogen, CO_2, hydrogen, methane, NO_2, oxygen to produce electricity.

- The “first generation” of biofuels uses the following raw materials: wood, sugar, paper, algae, grass, cereals, organic waste biomass, plant oils.
- Second and third generation biofuels use as raw materials wheat, palm oil, grass, cotton, algae, corn, sugar cane, rape seed, wood, soy beans, crude oil or coal.
- Space missions transporting people were Sputnik, Apollo 11, Voyager, Space Shuttle, ISS.
- The most important launch vehicles for satellites and space stations are called Phoenix, Saturn, Pluto, Juppiter, Sojus, Aphrodite, Ariane, Sputnik.
- Which of the following features apply for Rosetta: carried people to the moon, launched by NASA, launched by ESA, duration of mission 11 years, first analysis of material from Mars, detection of precursors of life on a comet, first pictures of the back-side of the moon.
- Which of the following tasks are foreseen for the Parker sun probe: provide ESA with first-hand experience in studying the surface of the sun, make first analysis of material from Venus, measurement of electrons in solar wind close to the surface of the sun, measurement of alpha particles in solar wind, take first pictures of the back-side of the moon.

4. Complete the following sentences:

Each correct entry is 1 point.

- Our universe began ca 14 billion years ago through the ……Big Bang……..
- The particles emitted by the sun are called ……solar wind……..
- The name of our galaxy is ……Milky Way……..
- 6-10 million years ago the separate evolution of ……Hominins (Homininae)…… from the apes started.
- Homo erectus was the first hominid to control ……fire……...
- Homo sapiens developed some 200.000 years ago in ……Africa……..
- The School of Athens which developed many principal ideas for the Western society was founded by the philosopher ……Plato in 385 BC…….
- The foundations of our governance system were developed in ……Rome from 500BC till 500AD…….
- The compass was invented in the middle ages in ……China……...
- The “Golden Age” of Europe following the Middle Ages is called the ……Renaissance…….
- The steam engine was invented by (Boulton) and ……Watt……..
- One of the groundbreaking masterpieces of scientifically based art is the Vitruvian Man with perfect proportions created by ……Leonardo da Vinci…….
- The discovery of the heliocentric system was made by ……Galileo Galilei……
- The key invention leading to the first industrial revolution was the ……steam engine……..

- The French philosopher who developed the ground-breaking concept of the "separation of power" for governing a country was …Charles-Louis Baron de Montesquieu……..
- The first encyclopedia which had a tremendous influence for the spread of knowledge in the population was compiled by ……Denis Diderot(the one highlighted by the prof)…… infact by Denis Diderot and Jean le Rond d'Alembert.
- The motto of the French Revolution which became a universal principle for democratic governments was: ……freedom, equality, fraternity……..
- The scientist who developed the fundamental laws for chemical reactions was ……Antoine Lavoisier……..
- Justus von Liebig developed in the 19th century the first ……chemical fertilizer…….. providing the key to solve one of the biggest problems of that time.
- The key invention of the 20th century providing the basis for our modern information and communication society is the ……First transistor invented by William Shockley, John Bardeen and Walter Brattain at Bell Labs……..
- The key scientific achievement of the 20th century leading to an in-depth understanding of the biological processes is the elucidation of the structure of …DNA……..
- Robert Schumann is considered as the most important founding father of the ……European Union……
- The important agreement for the liberalisation of global trade has been concluded in 1995 under the umbrella of the……World Trade Organization (WTO)…….
- During the last three centuries the global population has grown by a factor ……10 (true?)…….
- Since 1900 the global energy and resource consumption has grown by a factor ……15 (true?)…….
- A combination of several atoms bound together is called ……molecule……..
- Human DNA consist of 3 billion……base pairs…….
- A structure inside an eukariotic cell performing a specific function is called ……organelle……..
- A structure in an organism composed of several tissues and specialised for a particular function is called …organ……..
- Proteins are formed by chains of …amino acids……..
- The whole set of genes is called ……genome……..
- The building stones of proteins are .....amino acids.....
- All hereditary information is contained in the .....DNA.....
- Protein production is directed by the nucleic acids deoxyribonucleic acid (DNA) and .....ribonucleic acid (RNA).....

- Regions of the DNA which perform the particular coding functions are called genes
- Bacteria in respect to their cell structure belong to the group of prokaryotes
- The first living things on Earth were prokaryotic organisms which developed 3.5 billion years ago.
- In respect to their cell structure complex living species belong to the group of eukaryotes
- Animals, plants, fungi have eukaryotes cells.
- Mitochondria extract energy (ATP) from sugar and fat.
- Chloroplasts produce glucose (sugar) from carbon dioxide and water.
- Ribosomes synthesise proteins
- The catalyst for producing glucose from carbon dioxide and water in chloroplasts of plant cells is called rubisco
- A biome is a climatically and geographically defined area of ecologically similar communities of plants, animals, and soil organisms.
- An ecologically defined area inhabited by a particular species is called a habitat
- A natural unit consisting of all plants, animals and micro-organisms in an area functioning together with all of the non-living physical factors of the environment is called an ecosystem
- The biosphere comprises all the earth's living organism
- The solid outermost shell of our earth is called the ilthosphere
- The outer lithosphere of our earth consists mainly of these chemical compounds: silicates
- The core of our planet consists of iron and nickel and provides for the magnetic field of our earth.
- The core of our earth consists mainly of iron and nickel
- The gravitational field is determined by the mass of the earth.
- Water has its maximum density at a temperature of 4°C
- Phytoplankton is the first step in the oceanic food chains.
- Acidity is expressed as a pH value: pH = negativ logarithm of the hydrogen ion concentration ph = -log(H+)
- The pH scale comprises 14 orders of magnitude.
- Acidic water has a pH value below 7
- Unpolluted rain water has a pH of 5,6 since it is saturated with the acid gas CO_2 - carbon dioxide

- Without the greenhouse effect caused by water vapour Earth's average surface temperature would be ……29……°C lower. -15 as to +14
- The last ice age ended around ……10.000……BC.
- The concentration of water in the atmosphere is ……1……%
- In the top surface zone of the ocean the primary production of biomass by ……pythoplankton…… takes place.
- The zone of the ocean till about 150m deep and rich in fish is called the ……pycnocline zone……..
- The tremendous .....heat capacity..... of the oceans moderates the planet's climate, and its absorption of gases affects the composition of the atmosphere.
- Sea water contains dissolved gases, like .....oxygen..... produced by photosynthetic processes of plants.
- Sea water contains dissolved gases, like .....CO_2..... mainly from exchange processes with the atmosphere.
- The thermohaline circulation in oceans is driven by global ……density…… gradients created by surface heat and freshwater fluxes.
- Our weather is formed in the atmospheric layer called ……troposphere……..
- The major cause for the strong vertical mixing in the troposphere creating our weather is ……convection……..
- The atmosphere protects life on Earth by absorbing .....ultraviolet..... solar radiation.
- Atmospheric pressure is a direct result of the ……total mass……of the air.
- .....cyanobacteria..... were the first oxygen producing species.
- In respect to the energy balance respiration is an .....energy-releasing..... reaction.
- The major driving force for atmospheric circulation is .....solar heating.....
- The .....Hadley cell..... is a circulation pattern that dominates the tropical atmosphere.
- Near the tropopause, as the air moves polewards in the Hadley cell, it is turned eastward by the .....Coriolis..... force creating the subtropical jet streams that flow from west to east.
- The steady winds flowing from east to west near the surface of the earth in the Northern Atlantic ocean are called ……trade winds……...
- Carbon exists in the Earth's atmosphere primarily as .....carbon dioxide CO_2.....
- Organic compounds are produced from CO_2 by autotroph organisms through the process of .....photosynthesis.....
- The energy required for the process of photosynthesis comes from ……sunlight……

$6CO_2$ (carbon dioxide) + $12H_2O$ (water) + light energy → $C_6H_{12}O_6$ (glucose) + $6O_2$ (oxygen)

- In photosynthesis ……glucose (sugar)…….. is produced which provides the energy for the existence and proliferation of cells in plants.
- Photosynthesis can be described by the summary reaction: $6CO_2$ (carbon dioxide) + $6H_2O$ (water) + light energy → $C_6H_{12}O_6$ (glucose) + $6O_2$ (oxygen)
- chlorophyll is the catalyst for photosynthesis.
- Photosynthesis takes place in cell organelles called chloroplasts
- The Haber-Bosch-Process produces NH_3 according to this reaction: $N_2 + 3H_2 = 2\ NH_3$
- NO and NO_2 in the atmosphere react with hydrocarbons to form ozone which is a major component of summer smog.
- …Burning fossil fuels…… has caused a massive increase of the NO_x flux into the atmosphere contributiong to the increased acidity of precipitation.
- The main source for N_2O is the use of nitrogen fertilizers in agriculture
- NO_x react in the presence of UV-radiation with hydrocarbons in the atmosphere to form the air pollutant ozone.
- The ……Haber-Bosch……. process now produces 100 million tons of nitrogen fertilisers per year.
- Oversupply of waters with ……phosphorous…… from household effluents contributes to eutrophication.
- The main source of oxygen within the biosphere and atmosphere is photosynthesis
- Through photosynthesis, ……plants and phytoplanton…… are responsible for about half of the oxygen produced in the Earth's atmosphere.
- The main way oxygen is lost from the atmosphere is via respiration by animals and bacteria
- The reaction for respiration is: $C_6H_{12}O_6$ (glucose) + $6O_2$ (oxygen) → $6CO_2$ (carbon dioxide) + $6H_2O$ (water) + ATP (energy) 2880 kJ · mol-1
- In the human body oxygen is transported in the blood streams in cells called red blood cells (erythrocytes)
- In the human body oxygen is transported in the blood streams being bound to a molecule called ……hemoglobin molecules…….
- A hemoglobin molecule contains four heme groups in which oxygen is bound to ……iron…….atoms.

- Erythrocytes contain as a carrier for oxygen from the lung to the cells of organisms millions of ..... molecules. hemoglobin
- In the hemoglobin molecule oxygen is temporarely bound to an …….. atom enabling transport to the various body cells through the blood stream. iron
- Respiration performed by animals: involves the breaking down of ..... (or other organic molecules) into carbon dioxide and water. glucose
- In the absence of oxygen decay of animal and plant matter causes a break down of the the carbon compounds to ..... methane CH_4 (if no oxygen is availabe)
- The lowest trophic level in an aquatic food chain is made up of ……. phytoplankton
- The supercontinent which existed on our planet 250 million years ago is called ……... Pangaea
- The most distinct species disappearing through the Cretaceous-Tertiary extinction were the …… dinosaurs (dinosaurs, mosasaurs, plesiosaurs, pterosaurs and many species of plants and invertebrates)
- The extinction of the dinosaurs in the Cretaceous-Tertiary period enabled the development of a new dominating species, the ……... "modern mammals"
- The worst accident in a nuclear power plant happened 1986 in …… Chernobyl (Ukraine)
- The conservation of biological diversity has become a global concern and is addressed in the ....., which is an international treaty of 1992 (Rio). Convention on Biological Diversity
- Nearly one fifth of the land in the EU is protected under the Habitats Directive and the Birds Directive and is commonly know as ..... areas. Natura 2000
- The UN Codex Alimentarius sets maximum levels for ….. pesticide ……. residues in food.
- The persistent pesticide …… is the most effective mean to combat the spreading of malaria. dichlorodiphenyltrichloroethane (DDT)
- The persistent pesticide DDT is the most effective mean to combat the spreading of ……... in developing countries. malaria
- Organic substances which resist degradation and thus remain in the environment for a very long time are called …….. Persistent organic pollutants (POPs)
- Among the most important classes of pesticides are …… Herbicides …… for the control of weeds.
- POPs typically contain the element ..... chlorine POPs are frequently halogenated, usually with chlorine.
- Public awareness of environmental pollution was first raised massively in 1962 by …….. through her battle against the uncontrolled use of pesticides in agricultural production in the USA. Rachel Carson

- The report "Our Common Future" commissioned by the UN and presented 1987 contains the universally accepted definition for ……Sustainable Development (SD)……..
- A main activity of the ……Establishment of the UN Environment Programme (UNEP)…….. is publishing special reports on the global state of the environment with special focus on developing countries.
- The IPCC was established in 1988 jointly by the WMO and ……UNEP……..
- A main activity of the ……IPCC……. is publishing scientific assessments of global warming. Intergovernmental Panel on Climate Change
- UNFCCC stands for ……The Framework Convention on Climate Change……..
- The .....Millennium Development Goals (MDGs)..... are eight goals that were set up in a UN Conference in 2000 to support the developing countries.
- Emissions of air pollutants are measured as ……amounts……...(tons/year)
- Air quality is measured as ……immission concentrations……. (microgram/m^3).
- A significant fraction of Europe's population suffers from summer smog, whose main chemical component is ……Ozone……...
- The air pollutant ozone is formed by reaction of VOCs with ……hydrocarbons and nitrogen oxides under sunlight providing UV-radiation……
- The .....National Emissions Ceiling Directive 2016/2284..... requires all Member States to report information annually concerning emissions and projections for four main air pollutants.
- The air pollutant .....Ozone.....is formed from VOCs and NO_x in presence of UV radiation.
- Agricultural .....effluents (runoff)..... can lead to bacterial contamination of ground or surface waters.
- A widely-used measure of eutrophication is the determination algal and cyanobacterial biomass from the .....chlorophyll..... concentration.
- An .....eutrophic..... lake is a lake with high primary productivity, the result of an excessive nutrient content.
- An .....oligotrophic..... lake is a lake with low primary productivity, the result of low nutrient content.
- European water problems: There is a widespread acidification of lakes in ……Northern Europe…….
- Detergents are the major source for the element ……phosphorus……. in waste water leading to eutrophication.

- The EU legislation from 2000 requiring integrated impact-based river basin management based on an ecosystem approach is called Water frame work Directive
- Agriculture is the main source of nutrients (and other chemicals) to surface waters leading to eutrophication and groundwater pollution.
- The Law of the Sea treaty deals with aspects of overfishing and grants coastal states exclusive fishing rights for a 200 mile zone.
- The function establishing the relation between the per capita GDP of a country and the per capita primary energy consumption is called the Kutznets Curve curve.
- The new technology to exploit gas reserves in deep rock formations by hydraulic cracking of the rock layers is called fracking
- The Keeling's curve shows the increase of atmospheric concentrations of CO_2 which roughly matches the amount of fossil fuels burned per year.
- The Boreal region has huge carbon stocks which could emit gigatons under conditions of strong global warming leading to a non-linear acceleration of temperature rise.
- The world's most spoken first language is Mandarin Chinese
- The globally biggest economy is USA (list country or region).
- Basis for the EU Development strategy towards Africa, the Caribbean and Pacific (ACP) is the Cotonou Partnership Agreement of 2000.
- CCS stands for Carbon Capture and Storage
- CO_2 can be used to produce methane by reaction with Hydrogen
- The chemical reaction to produce methane from CO_2 and hydrogen is methanation
- The first human made object to orbit our planet was called Sputnik
- The first landing of people on the moon was achieved with a NASA mission called Apollo 11
- The powerful mirror telescope orbiting our earth to explore the galactic evelution of our universe was called Hubble Space Telescope.
- The largest infrared telescope sent to space searching for ogygen and water in galactic objects is called Herschel Space Observatory. James Webb?
- The pioneering ESA mission to Comet 67/P Churyumov-Gerasimenko was called Rosetta
- The powerful European rocket for launching spacecrafts is called Ariane 6

- The newly established EU earth observation system to monitor global change is called ……Copernicus……
- The Comprehensive Global Earth Observation System established in cooperation of EU, USA, Japan etc has the acronym ……GEOSS…….