نموذج اجابة إمتحان مادة جـ 642: جيوكيمياء النظائر البيئية

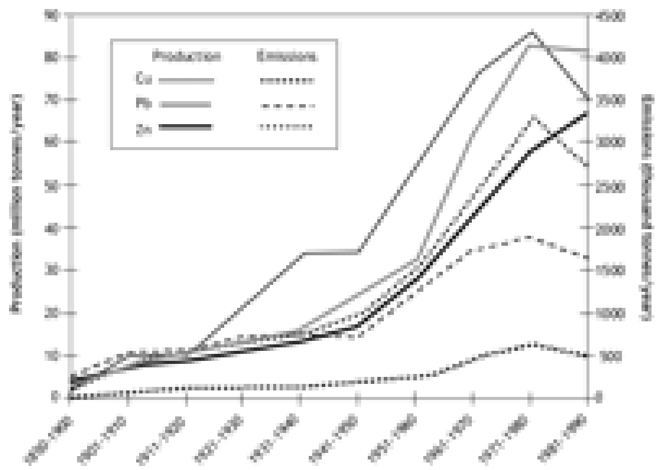
1- Mention some impacts of heavy metals contamination in soil on human health with examples.

The main threats to human health from heavy metals are associated with exposure to lead, cadmium, mercury and arsenic. These metals have been extensively studied and their effects on human health regularly reviewed by international bodies. Heavy metals have been used by humans for thousands of years. Although several adverse health effects of heavy metals have been known for a long time, exposure to heavy metals continues, and is even increasing in some parts of the world, in particular in less developed countries, though emissions have declined in most developed countries over the last 100 years. Cadmium compounds are currently mainly used in re-chargeable nickel-cadmium batteries. Cadmium emissions have increased dramatically during the 20th century, one reason being that cadmium-containing products are rarely re-cycled, but often dumped together with household waste. Cigarette smoking is a major source of cadmium exposure. In non-smokers, food is the most important source of cadmium exposure. Recent data indicate that adverse health effects of cadmium exposure may occur at lower exposure levels than previously anticipated, primarily in the form of kidney damage but possibly also bone effects and fractures. Many individuals in Europe already exceed these exposure levels and the margin is very narrow for large groups. Therefore, measures should be taken to reduce cadmium exposure in the general population in order to minimize the risk of adverse health effects. The general population is primarily exposed to mercury *via* food, fish being a major source of methyl mercury exposure, and dental amalgam. The general population does not face a significant health risk from methyl mercury, although certain groups with high fish consumption may attain blood levels associated with a low risk of neurological damage to adults. Since there is a risk to the fetus in particular, pregnant women should avoid a high intake of certain fish, such as shark, swordfish and tuna; fish (such as pike, walleye and bass) taken from polluted fresh waters should especially be avoided. There has been a debate on the safety of dental amalgams and claims have been made that mercury from amalgam may cause a variety of diseases. However, there are no studies so far that have been able to show any associations between amalgam fillings and ill health. The general population is exposed to lead from air and food in roughly equal proportions. During the last century, lead emissions to ambient air have caused considerable pollution, mainly due to lead emissions from petrol. Children are particularly susceptible to lead exposure due to high gastrointestinal uptake and the permeable blood-brain barrier. Blood levels in children should be reduced below the levels so far considered acceptable, recent data indicating that there may be neurotoxic effects of lead at lower levels of exposure than previously anticipated. Although lead in petrol has dramatically decreased over the last decades, thereby reducing environmental exposure, phasing out any remaining uses of lead additives in motor fuels should be encouraged. The use of lead-based paints should be abandoned, and lead should not be used in food containers. In particular, the public should be aware of glazed food containers, which may leach lead into food. Exposure to arsenic is mainly *via* intake of food and drinking water, food being the most important source in most populations. Long-term exposure to arsenic in drinking-water is mainly related to increased risks of skin cancer, but also some other cancers, as well as other skin lesions such as hyperkeratosis and pigmentation changes. Occupational exposure to arsenic, primarily by inhalation, is causally associated with lung cancer. Clear exposure-response relationships and high risks have been observed.

Although there is no clear definition of what a heavy metal is, density is in most cases taken to be the defining factor. Heavy metals are thus commonly defined as those having a specific density of more than 5 g/cm3. The main threats to human health from heavy metals are associated with exposure to lead, cadmium, mercury and arsenic (arsenic is a metalloid, but is usually classified as a heavy metal).

Heavy metals have been used in many different areas for thousands of years. Lead has been used for at least 5000 years, early applications including building materials, pigments for glazing ceramics, and pipes for transporting water. In ancient Rome, lead acetate was used to sweeten old wine, and some Romans might have consumed as much as a gram of lead a day. Mercury was allegedly used by the Romans as a salve to alleviate teething pain in infants, and was later (from the 1300s to the late 1800s) employed as a remedy for syphilis. Claude Monet used cadmium pigments extensively in the mid 1800s, but the scarcity of the metal limited the use in artists' materials until the early 1900s.

Although adverse health effects of heavy metals have been known for a long time, exposure to heavy metals continues and is even increasing in some areas. For example, mercury is still used in gold mining in many parts of Latin America. Arsenic is still common in wood preservatives, and tetraethyl lead remains a common additive to petrol, although this use has decreased dramatically in the developed countries. Since the middle of the 19th century, production of heavy metals increased steeply for more than 100 years, with concomitant emissions to the environment (Fig. 1).



Global production and consumption of selected toxic metals, 1850–1990. Source:

At the end of the 20th century, however, emissions of heavy metals started to decrease in developed countries: in the UK, emissions of heavy metals fell by over 50% between 1990 and 20001.

Emissions of heavy metals to the environment occur via a wide range of processes and pathways, including to the air (e.g. during combustion, extraction and processing), to surface waters (via runoff and releases from storage and transport) and to the soil (and hence into groundwaters and crops) (see Chapter 1). Atmospheric emissions tend to be of greatest concern in terms of human health, both because of the quantities involved and the widespread dispersion and potential for exposure that often ensues. The spatial distributions of cadmium, lead and mercury emissions to the atmosphere in Europe can be found in the Meteorological Synthesizing Centre-East (MSC-E) website

1- Give short report on the bioindicators in soil, water and atmosphere.

Bioindicators provide a range of techniques to assess the impacts of air pollution from reactive nitrogen (N) compounds on statutory nature conservation sites. They complement physical monitoring of atmospheric concentrations and deposition and risk assessment based on the critical loads approach by providing site-based information on atmospheric N concentrations, N deposition and/or ecological impacts. • Appropriate bioindicators for N may be applied by sampling at one time to compare results between different locations. In particular, local-scale transects can help identify the impacts of a nearby point source of reactive N emissions to the atmosphere. • The repeated application of bioindicator methods over time provides the basis for biomonitoring. In general, biomonitoring reflects changes over periods of several years, although short-term changes can also be monitored (over several weeks and months). • This report reviews the wide range of bioindicator and biomonitoring methods for N and incorporates the results of a field test of several of the methods. In addition, datasheets are provided that summarize the key characteristics, advantages and limitations of the different methods. • Bioindicator methods can be grouped into several contrasting approaches: Biochemical methods (based on an accumulation of N or a chemical/physiological response to N), Species composition methods (based on previously characterized species preferences) and Transplant methods (based on the response following transplanting of either locally native species or standardized plants). • Nitrogen accumulation methods include measurement of plant tissue N concentration, amino acids, substrate N and foliar ammonium. The accumulation methods provide the closest link to atmospheric N deposition. Results show that the smaller and more available the chemical pool, the larger the magnitude of response, with increasing responses from: total N < substrate N < foliar ammonium. • Biochemical response methods include analysis of enzymes such as nitrate reductase and emissions of nitrous oxide from soils. These methods are useful to demonstrate physiological effects, but tend to be less well correlated with atmospheric N deposition due to interactions with environmental conditions. • Species composition methods are of particular interest to the statutory conservation agencies since they relate directly to changes in plant communities due to excess atmospheric N. 'Ellenberg' N preference scores for higher plant and bryophyte species can be used to score the overall community for nitrogen. The limitation of this approach is that a wide range of other factors may also affect species composition. • Lichens are particularly sensitive to atmospheric reactive N, particularly ammonia. Detailed approaches are available to score lichen responses to N, but require more development for UK conditions. There is also the potential to refine simple methods that can be applied by non-experts. • The use of standardized grass plants has been shown to provide a robust method for monitoring the deposition and effects of N. The method can be applied in situations of complex terrain where physical estimates of deposition are difficult and as a graphic demonstration of impacts to stakeholders. It has a key advantage that exposure periods of only a few weeks are necessary.