

M507 – Health effects of hazardous substances – Revision questions

Section 6 – Dose-response curves and toxicity testing

1. What is a dose-response curve? What types of information does it show?
(Page 57)
 - Plots data on a graph relating amount of substance on one axis against the percentage of the test population showing a particular response
 - No-effect level
 - Threshold dose
 - Levels at which a set percentage of the test population show a specific effect e.g. LD50, LC50 etc
2. What do you understand by the term ‘threshold’ in regard to toxicology?
(Page 59)
 - Maximum quantity of a substance that does not produce an effect (or minimum quantity that does produce an effect)
 - It can be determined for a group or population (dose-response curve) but the actual threshold level for a particular person will vary from one person to another.
 - Threshold concept is important as it permits toxicologists to make judgements about potential risk to humans from exposure to chemicals
 - Carcinogens often have no safe threshold level, or it is difficult to identify a threshold level
3. What is the relevance of the slope of a dose-response curve?
(Pages 62 and 63)
 - Useful for predicting toxicity of a substance at specific dose levels
 - Steep curve indicates that particular care may need to be taken to prevent excessive exposure as most people may be affected at levels only slightly higher than threshold levels
 - Relatively flat slope suggest effects of increase in dose is generally minimal and that there is much greater variation in likelihood of effect occurring in the whole exposed population
4. What are the main approaches to toxicity testing / evaluation that may be undertaken?
(Pages 63 and 64)
 - Data on human exposures – epidemiological studies
 - Analogy with similar chemicals
 - ‘In vitro’ tests on cells or tissues in test tubes or Petri dishes
 - Animal testing – mainly rodents

5. What are the main types of toxicity tests that may be undertaken to determine specific information on a substance and its effects?

(Pages 65 to 76)

- Toxicokinetic studies – determines how a substance is absorbed, distributed, metabolised and excreted
- Acute toxicity tests
 - Acute systemic toxicity – provide information on the effects of exposure to a single, relatively high dose
 - Acute irritation studies – provide information on the effects of exposure to a substance on skin, eyes etc for a few hours
- Sensitisation studies – involve a series of exposures to a substance, then after a break a lower level of exposure is used to establish whether the test animal has become ‘sensitised’ to the substance producing an immune response
- Repeated dose toxicity studies - provide information on the effects of repeated exposure to relatively high levels over a long period of time (28 days, 90 days or 1 or 2 years)
- Genotoxicity studies – wide range of tests looking at the potential of a substance to induce genetic damage
 - Ames test – screening test – on bacteria
 - Tests on rodents
- Reproductive and developmental toxicity studies
- Carcinogenicity studies – an extension of the two year repeated dose toxicity studies

6. What are the main types of allergy assessment methods that may be undertaken to determine specific information on a substance and its effects?

(Pages 77 to 80)

- Lung function tests (spirometry) – assess and differentiate between asthma, pulmonary fibrosis, chronic obstructive pulmonary diseases etc
- Bronchial challenge tests
- Skin prick allergy tests – all forms of allergies (inhaled, ingested, skin)
- Patch testing – skin allergies – can also differentiate between allergic and irritant reactions
- Serological tests – analysis of blood serum for specific IgE antibodies