

Gupta's MCQ & Review Series 10 in Toxicology- Toxic Effects of Plants

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10.1 Introduction

This chapter deals with the toxic effects of some of the common poisonous plants such as *Abrus precatorius*, Castor plant, Croton, Calotropis, *Semecarpus anacardium*, *Capsicum annum*, Colchicum, Ergot, Nicotine, Strychnine, etc. Ingestion of these plants may cause toxicity of different nature. It is well established that most of the experimental data are available on laboratory animals and reported in veterinary literature. Attempts have been made to summarize information as relevant to animals and human being exposed to different poisonous plants. The chapter begins with key points relevant to the topic followed by the text that is in the form of short problem-solving questions and answers, multiple choice questions, fill in the blanks, true / false, and matching of statements as related to adverse effects of various plants. At the end of the chapter, answers to various objectives questions have been summarized.

10.2 Key Words

- Different portions of the plant (root, stem, leaves, seeds) often contain different concentrations of a toxic substance.
 - Certain environmental conditions such as climate, type of soil influence and the age of a plant affect the synthesis of some toxins.
 - Plants contain substances that may exert toxic effects on skin, lung, cardiovascular system, liver, kidney, bladder, blood, nervous system, bone, and the endocrine and reproductive systems.
 - Contact dermatitis and photosensitivity are common skin reactions with many plants. Gastrointestinal effects range from local irritation to emesis and/or diarrhea.
 - Cardiac glycosides in plants may cause nausea, vomiting, and cardiac arrhythmias in animals and humans.
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10.3 Short Problem-Solving Questions and Answers

Q.1. How poisonous plants are responsible for toxicity in animals?

- Many plants commonly used as food possess toxic parts, are toxic unless processed, or are toxic at certain stages of their lives. Some only pose a serious threat to certain animals (such as cats, dogs, or livestock) or certain types of people (such as infants, the elderly, or individuals with pathological vulnerabilities). Most of these food plants are safe for the average adult to eat in modest quantities.

Q.2. Name the active toxic principle(s) of *abrus precatorius*.

- Active principles are: N-methyl tryptophan, Glycyrrhizin (lipolytic enzyme – the active principle of liquorice), Abrin (Toxalbumin also known as phytotoxin), Abrine (amino acid), Abralin (glucoside) and Abrie acid.

Q.3. Name the active toxic principle(s) of croton plant

- Seed and oil extracted from the seeds are extremely toxic. Seed oil known to have tumor promoting diesters. Active principles are Croton (toxalbumin) and Crotonoside (glycoside).

Q.4. What are toxic principles of Calotropis plant?

- Toxic parts include stem, branches, leaves and the milky white latex (madar juice). Important toxic principles are: Uscharin, Calotoxin, Calotropin and Gigantin

Q.5. What are the important toxic principles Semecarpus anacardium?

- Semicarpol (monohydroxy phenol compound) and Bhilawanol (alkaloid).

Q.6. What are the important principles of Capsicum annum?

- Capsaicin (8-Methyl-*N*-vanillyl-6-nonenamide) is an active component of chili peppers. It is an irritant for mammals, including humans, and produces a sensation of burning in any tissue with which it comes into contact.

Q.7. What is the toxic principle of Eucalyptus Globus plant?

- Eucalyptol (cineole).

Q.8. What are the important toxic principles of Colchicum plant?

- Alkaloid colchicine and demecolcin

Q.9. What are the important oleander plants?

- a) Nerium odourum: Common names – White/Pink oleander, Kaner.
- b) Cerbera thevetia: Common names – Yellow oleanders, Peela Kaner, Exile, Bastard oleander.
- c) Cerbera odollam: Common names – Dabur, Dhakur, Pilikibir all parts of the plant are poisonous, especially fruit with kernels or seeds and the nectar from the flowers, which yields poisonous honey.

Q.10. What are the toxic principles of Nerium odourum?

- Nerium odourum has nerin, containing cardiac glycosides: (i) neriodorin, (ii) neriodorein, (iii) karabin, (iv) oleandrin, (v) folinerin and, (vi) rosagerin.

Q.11. What are the toxic principles of Cerbera thevetia?

- Cerbera thevetia has glycosides: (i) thevetin (one-eighth as potent as ouabain which is similar in action to digitalis, (ii) thevitoxin, is less toxic than thevetin and, (iii) nerifolin, which is more potent than thevetin, (iv) peruvoside, (v) ruvoside and, (vi) cerberin.

Q.12. What are the toxic principles of Cerbera odollam?

- Cerbera odollam contains glycoside, cerberin.

Q.13. Describe in brief the mode of action of oleander plants?

- Oleanders act like digitalis, toxic doses can produce malignant dysrhythmias and cardiac failure, cardiac arrest and convulsions. Oleanders are absorbed easily via skin and GI route.

Q.14. What are the toxic principles of aconite plant?

- Toxic principles are Diterpene alkaloids known as:

- a) Aconitine
- b) Misaconitine
- c) Hypaconitine.

These alkaloids are sparingly soluble in water and considered as most virulent poison with sweetish taste. Other alkaloids present in small quantities in the plant are: picraconitine, pseudoaconitine, and aconine.

Q.15. What is the mode of action of aconite toxins?

- Diterpene alkaloids are known as cardiac and neurotoxins that can cause conduction block and paralysis through their action on voltage-sensitive sodium channels in the axons. This can result in initial neurological stimulation, followed by depression of myocardium, smooth and skeletal muscles, CNS and peripheral nervous system. Aconite is absorbed via skin and oral route. Symptoms generally appear within 30 to 90 min after ingestion of the poison and lasts up to approximately 30 hr.

Q.16. What are the toxic principles of nicotine plant?

- Lobeline is the chief constituent of nicotine plant (Indian tobacco), obtained from the leaves and tops of *Lobelia inflata*, an alkaloid similar to nicotine, but less potent than nicotine, and is used in antismoking tablets and lozenge.

Q.17. What is the source of strychnine?

- Strychnine is a spinal poison caused by *strychnos nuxvomica*, kuchila plant. It contains alkaloids such as, *Stichnine, Brucine and Loganine*.

Q.18. What are invasive plants?

- Invasive plants are plant species that can be harmful when introduced to new environments. These plants can reproduce quickly and thrive in different habitats. Invasive plants can grow in natural areas (forests, grasslands and wetlands), managed areas (cultivated fields, gardens, lawns and pastures), and areas where the soil and vegetation have been disturbed (ditches, rights of way and roadsides).

Q.19. Why phenothiazine tranquilizers are contraindicated in dhatura intoxication?

- In dhatura intoxication, anticholinergic symptoms are seen. As phenothiazines also possess anticholinergic activity, they are contraindicated for controlling CNS excitation in dhatura intoxication.

Q.20. What is prussic acid poisoning?

- Prussic acid is also known as hydrocyanic acid (HCN). Prussic acid is not normally present in plants but under certain conditions, several common plants can accumulate large quantities of cyanogenic glycosides which can convert to prussic acid. It is a potent, rapidly acting poison, which enters the bloodstream of affected animals and is transported through the body. It then inhibits oxygen utilisation by the cells so that, in effect, the animal dies from asphyxia.

Q.21. Which animal species are more susceptible to prussic acid poisoning?

- Ruminant animals (cattle and sheep) are more susceptible to prussic acid poisoning than monogastric animals (horses and pigs).

Q.22. Why monogastric animals less susceptible to prussic acid poisoning?

- The lower pH in the stomach of the monogastric helps to destroy the enzymes that convert cyanogenic glycosides to prussic acid.

Q.23. What is cyanide poisoning?

- Cyanide poisoning is a form of histotoxic hypoxia because the cells of an organism are unable to use oxygen, primarily through the inhibition of cytochrome c oxidase enzyme.

Q.24. What is the toxic principle of cyanogenic plants?

- cyanogenic glycosides or cyanogens (amygdalin, prunasin, dhurrin, linamarin). Hydrogen cyanide (HCN) is formed when the glycosides are hydrolyzed by enzymes in plants or by rumen microorganisms:

Q.25. Name the compounds that produce cyanide ions?

- Common poisonous cyanide compounds include hydrogen cyanide gas and the crystalline solids, potassium cyanide and sodium cyanide.

Q.26. Why cyanide has more affinity for cytochrome oxidase than hemoglobin, which also contains iron?

- Cyanide has more affinity for ferric (Fe^{3+}) form of iron. In hemoglobin, iron is present in ferrous (Fe^{2+}) form whereas cytochrome oxidase has ferric (Fe^{3+}) iron. Hence, cyanide prefers cytochrome oxidase.

Q.27. Why Halogeton glomeratus and Oxalis pescaprae commonly cause oxalate poisoning?

- The oxalates present in the above plant species are soluble. Hence, these plants cause oxalate poisoning. In *H. glomeratus*, both sodium and potassium oxalates are present whereas in *O. pescaprae*, only potassium oxalates are present.

Q.28. How do oxalates damage the body?

- These chemicals are present in plants (and some animal foods) that bind with minerals in the body, such as magnesium, potassium, calcium, and sodium, creating oxalate salts. Most of these salts are soluble and pass quickly out of the body. However, oxalates that bind with Calcium are practically insoluble and these crystals solidify in the kidneys (kidney stones) or the urinary tract, causing pain and irritation. These crystals can then easily settle out as sediments from the urine, causing kidney stones

Q.29. Name the compounds that produce cyanide ions?

- a) hydrogen cyanide gas
- b) crystalline solids such as potassium cyanide and sodium cyanide.

Q.30. How does cyanides are produced in nature?

- Cyanides are produced by certain bacteria, fungi, and algae and are found in a number of plants. Cyanides are found in substantial amounts in certain seeds and fruit stones, e.g., those of apricots, apples, and peaches. In plants, cyanides are usually bound to sugar molecules in the form of cyanogenic glycosides and defend the plant against herbivores. Cassava roots (also called manioc), an important potato-like food grown in tropical countries (and the base from which tapioca is made), also contain cyanogenic glycosides.

Q.31. The consumption of which cassava root is responsible for chronic form of cyanide toxicity in humans?

- Chronic form of cyanide toxicity observed in humans due to consumption of cassava root is Konzo.

Q.32. What is mechanism of cyanide toxicity?

- The cyanide ion halts cellular respiration by inhibiting the enzyme cytochrome c oxidase found in the mitochondria. It attaches to the iron within this protein. The binding of cyanide to this enzyme prevents transport of electrons from cytochrome c to oxygen. As a result, the electron transport chain is disrupted, meaning that the cell can no longer aerobically produce ATP for energy. Tissues that depend highly on aerobic respiration, such as the central nervous system and the heart, are particularly affected. This is an example of histotoxic hypoxia.

Q.33. What is the mode of action of cyanide ions in animal toxicity?

- In acute cyanide poisoning, cyanide ions (CN^-) bind to, and inhibit, the ferric (Fe^{3+}) heme moiety form of mitochondrial cytochrome c oxidase. This blocks the fourth step in the mitochondrial electron transport chain (reduction of O_2 to H_2O), resulting in the arrest of aerobic metabolism and death from histotoxic anoxia. Tissues that heavily depend on aerobic metabolism such as the heart and brain are particularly susceptible to these effects. Cyanide also binds to other heme-containing enzymes, such as members of the cytochrome p450 family, and to myoglobin. However, these tissue cyanide "sinks" do not provide sufficient protection from histotoxic anoxia.

Q.34. what is the lethal dose of cyanide in animals?

- The acute lethal dosage of hydrogen cyanide (HCN) in most animal species is ~ 2 mg/kg. Plant materials containing ≥ 200 ppm of cyanogenic glycosides are dangerous.

Q.35. What is odoratism or osteolathyrism?

- The lathyrism resulting from the ingestion of lathyrism odoratus seeds (sweet peas) is often referred to as odoratism or osteolathyrism, which is caused by a different toxin (beta-aminopropionitrile) that affects the linking of collagen, a protein of connective tissues.

Q.36. What is neurolathyrism?

- Neurolathyrism is a neurological disease of humans and domestic animals, caused by long-term feeding/ eating of seeds of certain legumes of the genus *Lathyrus*. There is gradual weakness of muscles followed by paralysis leading to death due to respiratory failure.

Q.37. What is the toxic principle of lathyrism?

- *Lathyrus* grain contains high concentrations of the glutamate analogue neurotoxin β -oxalyl-L- α , β -diaminopropionic acid (ODAP, also known as β -N-oxalyl-amino -L-alanine, or BOAA)

Q.38. Which toxin (s) is produced by Zearalenone?

- Zearalenone (ZEN), also known as RAL and F-2 mycotoxin, is a potent estrogenic metabolite produced by some *Fusarium* and *Gibberella* species, *Fusarium verticillioides*, and *Fusarium incarnatum*. These species produce toxic substances of considerable concern to livestock and poultry producers, namely deoxynivalenol, T-2 toxin, HT-2 toxin, diacetoxyscirpenol (DAS) and zearalenone.

Q.39. Why pigs and cattle differ in their susceptibility to zearalenone?

- Zearalenone toxins are produced by *Fusarium* spp. In pigs, the major metabolite of Zearalenone is α -zearalenol, which has greater affinity for estrogen receptors than β -zearalenol, which is formed in cattle. Hence, pigs are more susceptible than cattle.

Q.40. Among ruminants, why cattle are more susceptible than sheep for nitrate poisoning?

- The rumen of sheep is effective in converting nitrites to ammonia, which is used for protein synthesis. But in cattle, the rumen is not as effective as sheep. Hence, in cattle high nitrites accumulate resulting in poisoning.

Q.41. Why non-ruminants are not affected by nitrates from plant sources?

- The conversion of nitrates to nitrites does not occur in non-ruminants (lack of rumen micro flora). Hence, non-ruminants are not affected. However, pigs are most sensitive to ingestion of pre-formed nitrites.

Q.42. Why plant accumulate nitrates in toxic proportions?

- Plants absorb nitrates from soil due to physiological requirement. However, any change in environmental conditions that affect the utilization of nitrates leads to nitrate accumulation. For example, lack of rainfall – no leaching of nitrates from soil; low temperature – inhibits nitrate reductase activity; high temperature – excessive absorption from soil; etc.

Q.43. Why chopping, cutting or chewing plants increases cyanide toxicity?

- Cyanogenic glycosides are present in epidermal cells whereas the enzyme β -glycosidase is present in mesenchymal cells. Hence, chopping, cutting or chewing ruptures the cells releasing the enzyme which releases HCN.

Q.44. Why ruminants are more susceptible to cyanogenic glycoside poisoning?

- The pH, water content and micro flora of rumen facilitates the release of cyanide from cyanogenic glycosides. Hence, ruminants are more susceptible to cyanogenic glycoside poisoning.

Q.45. Why non-ruminants are not affected by cyanogenic glycosides?

- Acidic pH destroys β -glycosidase enzyme, which is responsible for the release of HCN. Hence, non-ruminants are not affected by cyanogenic glycosides.

Q.46. What are oxalates?

- Oxalates belong to a group of substances known as anti-nutrients. Anti-nutrients are, as their name would suggest, compounds which prevent the nutritive value of foods from being effective, either by preventing the absorption of nutrients, by being toxic themselves, or by one or more other methods of action.

Q.47. Name some plants and foods that contain oxalates

- There are several plants and food that contain oxalates. For example, Dieffenchia plant, vegetables and fruits such as Spinach, Swiss Chard, Rhubarb, Soy Nuts, Plantains, almonds, Cashews, Sesame Seeds, Yucca

Q.48. Why ruminants are less susceptible for oxalate poisoning?

- Rumen has the ability to convert soluble oxalates into insoluble form. Hence, ruminants are less susceptible for oxalate poisoning. But if the rumen's ability for conversion is exceeded, oxalate poisoning occurs.

Q.49. Why urinary bladder tumors are common in cattle in bracken fern poisoning?

- Ptaquiloside is converted into an active carcinogen dienon in alkaline medium. As the urine in cattle is alkaline, the conversion of ptaquiloside to dienon occurs, leading to development of urinary bladder tumors.

Q.50. Despite the presence of lectins, why barley is non-toxic to animals?

- The structure of lectins contains A and B chains lined by disulfide bond. The presence of both chains is necessary for producing toxicity. But barley is not toxic due to the presence of only A chain.

Q.51. What is photodynamic substance?

- A substance which absorbs UV light and emits energy while coming to ground state is called *photodynamic substance*.

Q.52. What is secondary / hepatogenous photosensitization?

- The type of photosensitivity which is produced due to hepatic damage consequent to ingestion of hepatotoxic substances is called secondary / hepatogenous photosensitization.

Q.53. Name at least three plants that can cause secondary / hepatogenous photosensitization.

- a) Pyrrolizidine alkaloid containing plants- Senecio sp.
- b) Heliotropium sp.; Lantana camara
- c) Mycotoxins- Sporodesmins; Blue green algae – Microcystis sp.)

Q.54. Why lesions in photosensitization are seen only in few areas of the body?

- Melanin pigment protects skin from UV light. Hence, in light pigmented areas or in areas devoid of fur/wool, more UV light is absorbed leading to sun burn lesions. Light pigmented areas and areas devoid of hair/wool like face, eyelids, muzzle, coronary band, udder etc. are more prone for photosensitization.

Q.55. Swallowing of seeds of abrus and castors is not toxic” to animals why?

- Abrus and castor seeds have tough outer coating which resists digestion and hence are passed through GIT without causing any toxicity. However, crushing or chewing prior to swallowing will produce toxicity.

Q.56. Why strychnine is least toxic to chicken and pigeons?

- In chickens and pigeon, strychnine is absorbed very slowly. Hence, strychnine is least toxic to chicken and pigeons. However, other avian species are easily affected.

10.4 Multiple choice questions

(choose the statement, it may be one, two or more or none)

Exercise 1

Q.1. Consumption of milk from goats which have grazed on lupine plants containing the alkaloid, anagrine, may cause ----

- a) birth defects when ingested by women during early pregnancy
- b) severe liver damage characterized by centrilobular necrosis
- c) dizziness, nausea, headaches and hallucinations
- d) numbness of the extremities
- e) aphrodisia and a general increase in sexual awareness

Q.2. During expression of oil from castor seeds, the toxic principle ricin is only present in ---

- a) Oil
- b) Seed Cake
- c) Both
- d) None

Q.3. Intoxication from consumption of wild cherry or apricot pits would best be treated by--

- a) hyperbaric oxygen
- b) artificial respiration
- c) inhalation of amyl nitrite
- d) intravenous sodium nitrite and sodium thiosulfate
- e) oral sodium nitrate

Q.4. The imbalance of following electrolyte is observed in oleander poisoning --

- a) Sodium
- b) Potassium
- c) Magnesium
- d) Calcium

Q.5. The contraindications in strychnine poisoning are ==

- a) Ketamine
- b) Morphine
- c) Emesis
- d) All

Q.6. Toxic part of castor seed is -----

- a) Seeds
- b) Oil
- c) Stem
- d) leaves

Q.7. Active toxic principles of croton plant is ----

- a) Calotoxin
- b) Calotropin
- c) Croton (toxalbumin)
- d) None of the above

Q.8. Which one is toxic part of Calotropis plant?

- a) Stem
- b) branches,
- c) milky white latex
- d) all of the above

Q.9. The toxic principle of Nerium odourum is -----

- a) nerin
- b) Capsaicin
- c) Calotoxin
- d) Gigantin

Q.10. Which one is/are toxic principle(s) of aconite plant?

- a) Aconitine
- b) Misaconitine
- c) Hypaconitine
- d) All of the above.

Q.11. What is the highest plant caused fatalities in the western US?

- a) Kochia weed
- b) Sudan grass
- c) Locoweed
- d) Sorghum
- e) Larkspur

- Q.12. What is the difference between larkspur and monkshood?
- larkspur contains hollow stems and monkshood does not
 - monkshood contains hollow stems and larkspur does not
 - larkspur contains woody stems and monkshood does not
- Q.13. What is the treatment for Larkspur?
- Methylene Blue
 - Acetyl cholinesterase Inhibitor (Physostigmine/neostigmine)
 - Sodium Thiosulfate
 - All of the Above
- Q.14. Low energy diet for ruminants may increase susceptibility to _____ poisoning?
- Nitrite
 - Cardiac glycoside
 - Cyanide
 - diterpenoid alkaloid
 - Phylloerythrin
- Q.15. What is the characteristic clinical sign of cyanide poison?
- abortion
 - circling
 - cherry red blood
 - methemoglobinemia
 - brown mucous membranes
- Q.16. What is the best method of treatment for nitrate poisoning?
- Methylene blue given orally
 - Methylene blue given IM
 - Methylene blue given SC
 - Methylene blue given IV
 - Methylene blue is not a treatment for nitrate poisoning.
- Q.17. Chronic Sudan grass poisoning of horse, sheep and cattle causes _____.
- demyelination
 - Methemoglobinemia
 - bad gas
 - CHF
 - cherry red blood
- Q.18. What plant contains a yellow fluid on cut surfaces that causes violent convulsions by blocking inhibitory pathways to brain?
- Water hemlock
 - Kochia weed
 - Locoweed
 - Monkshood
 - Larkspur
- Q.19. Sorghums and Sudan grasses are associated with which plant poison?
- Nitrate
 - Nitrite
 - Cardiac glycoside
 - Diterpenoid alkaloids
 - Cyanide (prussic acid)

- Q.20. Nitrate causes sudden death in cattle. Nitrate levels are highest on early morning/cloudy days due to the low nitrogen reductase levels. Which one of these plants has highest level of nitrate?
- a) Legumes
 - b) Corn
 - c) Sorghums
 - d) Annual Weeds
 - e) Cereal grains
- Q.21. This plant looks similar to an onion and causes excessive salivation, frothing, sudden death in ewes..... Please choose only one answer:
- a) Water hemlock
 - b) Monkshood
 - c) Larkspur
 - d) Death Camas
- Q.22. Which of the following are not considered cardotoxic?
- a) Yew
 - b) Foxglove
 - c) Avocado
 - d) Tansy Ragwort
- Q.23. What is the treatment for Yew (taxine/taxane) poison?
- a) Atropine Sulfate
 - b) Methylene Blue
 - c) Sodium Thiosulfate
 - d) Charcoal
 - e) There is no treatment
- Q.24. What is the mechanism of action of cardiac glycosides?
- a) inhibit Na/K ATPase
 - b) inhibit cytochrome oxidase
 - c) inhibit acetylcholinesterase
 - d) inhibit protein synthesis
 - e) block Ach receptors
- Q.25. What plant is associated with Grayanotoxins that inhibit voltage gated Na channels?
- a) Locoweed
 - b) Milkweed
 - c) Oleander
 - d) Foxglove
 - e) Rhododendron
- Q.26. St Johns' Wort and buckwheat are associated with.....
- a) Primary Photosensitization
 - b) Secondary Photosensitization
- Q.27. Which organ is MOST severely damaged by pyrrolizidine alkaloids (PA's)?
- a) Heart
 - b) Spleen
 - c) Liver
 - d) lung
 - e) brain

Q.28. Which animal is most susceptible to Plant Alkaloids (PA) toxicity?

- a) horse
- b) cow
- c) chicken
- d) goat
- e) pig

Q.29. Which of the following plants is NOT associated with secondary photosensitization?

- a) Hounds tongue
- b) St Johns' Wort
- c) Fiddle Neck
- d) Tansy ragwort
- e) Rattle pod

Q.30. Which of the following plants is associated with selenium toxicity "Alkali Disease"?

- a) Milk vetch
- b) Black Walnut
- c) Hoary alyssum
- d) Sickie pod
- e) Day blooming Jessamine

Q.31. Lectins are found in castor beans (ricin) and rosary peas. What is the mechanism of action of lectins?

- a) inhibit Na/K ATPase
- b) inhibit Na channels
- c) inhibit Ach receptors
- d) inhibit protein synthesis
- e) inhibit cell enzyme oxidation

Q.32. This plant causes more economic losses to livestock industry than any other plant combined-----

- a) Castor beans
- b) Rosary Peas
- c) Locoweed
- d) Sorghums
- e) Fox glove

Q.33. Yellow star thistle and Russian Knapweed cause which disease?

- a) Sleepy grass disease
- b) Chewing disease
- c) Alkali disease
- d) Heart disease
- e) Liver disease

Q.34. How do you treat bracken fern toxicity?

- a) there is no treatment
- b) acetylcholinesterase inhibitors
- c) Sulfur -IV
- d) Methylene Blue -IV
- e) Thiamine -IV

Q.35. Nightshade contains Solanine toxin (muscarinic Ach receptor antagonism). What clinical sign is associated with this toxin?

- a) Liver necrosis
- b) first and second degree heart block
- c) urinary incontinence
- d) hypertension
- e) dilated pupils

- Q.36. All of the following statements regarding plant toxicity are true EXCEPT:
- Genetic variability plays a role in the toxicity of a plant.
 - Plant toxins are most highly concentrated in the leaves.
 - Young plants may have a higher toxin concentration than older plants.
 - The weather can influence the toxicity of plants.
 - Soil composition can alter a plant's production of toxin.
- Q.37. Contact with which of the following plant species would be LEAST likely to cause an allergic dermatitis?
- Urtica.
 - Philodendron.
 - Rhus.
 - Dendranthema.
 - Hevea.
- Q.38. Which of the following statements regarding lectin toxicity is FALSE?
- Lectins have an affinity for N-acetyl glucosamine on mammalian neurons.
 - Consumption of lectins can cause severe gastrointestinal disturbances.
 - The fatality rate after ingestion of a fatal dose is very high.
 - Some toxic lectins inhibit protein synthesis.
 - A diet high in some lectins has been linked to reduced weight gain.
- Q.39. Colchicine, found in lily bulbs ----
- causes severe dehydration.
 - is sometimes used as a purgative.
 - causes a severe contact dermatitis.
 - inhibits sphingolipid synthesis.
 - blocks microtubule formation.
- Q.40. Activation of a vanilloid receptor is characteristic of which of the following chemicals?
- acetylandromedol.
 - capsaicin.
 - colchicine.
 - ergotamine.
 - linamarin.
- Q.41. Which of the following plant species is known to cause cardiac arrhythmias on ingestion?
- Dieffenbachia.
 - Phytolacca americana.
 - Digitalis purpurea.
 - Pteridium aquilinum.
 - Cicuta maculate.
- Q.42. Which of the following plant toxins does NOT affect the neuromuscular junction?
- nicotine.
 - anabasine.
 - curare.
 - anatoxin A.
 - muscimol.
- Q.43. Which clinicopathologic value is least likely to be abnormal during 2 to 24 hours after a dog is bitten by a rattlesnake?
- Serum amylase activity
 - Serum creatine phosphokinase activity

- c) Serum - γ -glutamyltransferase activity
- d) Platelet count
- e) Prothrombin time

Q.44. Selenium absorption by crop plants is favored by soil that is -----

- a) Acidic, wet and poorly drained
- b) Acidic, semi-arid, and well drained
- c) Alkaline, well aerated and well drained
- d) Alkaline, wet and poorly aerated
- e) Acidic or alkaline, wet and poorly aerated

Q.45. In ruminants, urea toxicosis is characterized by ---

- a) Ruminal alkalosis, systemic acidosis and elevated blood ammonia levels
- b) Ruminal acidosis, systemic alkalosis and elevated blood ammonia levels
- c) Ruminal alkalosis, systemic alkalosis and elevated blood ammonia levels
- d) Ruminal acidosis, systemic alkalosis and decreased blood ammonia levels
- e) Ruminal alkalosis, systemic alkalosis and elevated blood urea nitrogen levels

Q.46. After a period of drought or cloudy weather, the cyanide content in the plant

- a) Increases
- b) Decreases
- c) Does not change
- d) Becomes zero

Q.47. Cyanide has more affinity for the following

- a) Hemoglobin
- b) Cytochrome oxidase
- c) Met-hemoglobin
- d) Myoglobin

Q.48. The oxalate salt of the following element(s) is/are soluble

- a) Sodium
- b) Potassium
- c) Magnesium
- d) Calcium

Q.49. The most appropriate sample to be collected in case of nitrate/ nitrite poisoning is-

- a) Blood
- b) Rumen contents
- c) Fodder
- d) CSF
- e) Aqueous humor
- f) All of above

Q.50. Which of the following leads to deposition of oxalate crystals in the urinary tract?

- a) Dieffenbachia (dumbcane)
- b) propylene glycol
- c) methoxyflurane
- d) philodendron
- e) ethylene glycol

Q.51. Intoxication from consumption of wild cherry or apricot pits would best be treated by

- a) hyperbaric oxygen
- b) artificial respiration
- c) inhalation of amyl nitrite
- d) intravenous sodium nitrite and sodium thiosulfate
- e) oral sodium nitrate

Q.52. The major toxic effect of hydrogen cyanide exposure is:

- a) lung damage
- b) hemoglobin alteration
- c) hemolysis of RBCs
- d) inhibition of mitochondrial respiration
- e) lipid peroxidation

Q.53. The parts of the plant which does not accumulates fluoride is---

- a) Seed
- b) Stem
- c) Leaf
- d) Flower

Q.54. The following plant(s) is/ are nitrate accumulators

- a) Cereal grasses
- b) Maize
- c) Sunflower
- d) Sorghum

Q.55. Which method (s) of storing forage reduces nitrate content?

- a) Hay making
- b) Silage making
- c) Composting
- d) Straw making

Q.56. Maximum accumulation of nitrates is seen in the following part of the plant ---

- a) Tip
- b) Leaves
- c) Upper 1/3 of stem
- d) Lower 1/3 of stem

Q.57. During extraction of oil from castor seeds, the toxic principle ricin is only present in --

- a) Oil
- b) Seed Cake
- c) Both
- d) None

Q.58. Which of the following part of bracken fern is more toxic?

- a) Rhizome
- b) Stem
- c) Leaves
- d) Tips

Q.59. Abrin is a -----

- a) Toxalbumin
- b) Toxglobulin
- c) Polypeptide
- d) Carbohydrate

Q.60. The imbalance of following electrolyte is observed in oleander poisoning--

- a) Sodium
- b) Potassium
- c) Magnesium
- d) Calcium

Q.61. The contraindications in strychnine poisoning are --

- a) Ketamine
- b) Morphine
- c) Emesis
- d) All

Q.62. Convulsion in acute poisoning can be treated by----

- a) Morphine
- b) Barbiturates
- c) d-tubocurare
- d) chloral hydrate

Q.63. Vitamin K is recommended in the treatment of poisoning due to

- a) Sweet clover
- b) Zineb
- c) Prunus sp.
- d) Lotus sp.

Q.64. Liver damage occurs in poisoning with-

- a) Lantana
- b) Pyrrolizidine alkaloids
- c) Copper
- d) All of above
- e) None of above

Q.65. Garlic like odor of rumen content is indicative of

- a) Phenol poisoning
- b) Phosphorus poisoning
- c) Hemlock poisoning
- d) Cyanide poisoning

Q.66. Cyanotic mucous membranes are seen in poisoning with

- a) Nitrate/ nitrite
- b) Chlorates
- c) Carbon monoxide
- d) Only one of above
- e) None of above
- f) All of above

Q.67. The most appropriate sample to be collected in case of nitrate/ nitrite poisoning is

- a) Blood
- b) Rumen contents
- c) Fodder
- d) CSF
- e) Aqueous humor
- f) All of above

Exercise 2

Q.1 Which of the following plants are carcinogenic

- a) American hellebore
- b) bracken fern
- c) buttercup
- d) tung nut

Q.2 All of the following are true of grayano toxins except---

- a) they are present in rhododendron
- b) they can contaminate honey
- c) they cause bradycardia
- d) they block the neuromuscular junction

Q.3. Plant molecules that react as bases and usually contain nitrogen in a heterocyclic structure are known as ---

- a) alkaloids
- b) terpenes
- c) resins
- d) glycosides

Q.4. Plant molecules that are created from isoprene units with varying functional groups are known as ----

- a) terpenes
- b) amines
- c) alkaloids
- d) phenols

Q.5. Plant molecules that are hydrolyzed to a sugar and a nonsugar moiety are known as ----

- a) glycosides
- b) alkaloids
- c) resins
- d) terpene

Q.6. Toxic minerals that may accumulate in plants include all of the following except ---

- a) cadmium
- b) magnesium
- c) copper
- d) selenium

Q.7. Brassica oleracea (kale) contains ---

- a) cardiac glycoside
- b) cyanogenic glycoside
- c) goitrogenic glycoside
- d) steroid glycoside

Q.8. A plant toxin that can be highly transmitted through milk is ----

- a) oxalate
- b) cyanide
- c) nitrate
- d) tremetol

Q.9. An antidote is available for the toxin present in -----

- a) azalea
- b) pigweed
- c) veratrum
- d) apple seeds

Q.10. Which of the following plant toxins is classified as an alcohol?

- a) nicotine
- b) ranunculus
- c) dogbane
- d) tremetol

Q.11 Amygdalin is found in the highest amount in the seeds of -----

- a) bitter almond
- b) tomato
- c) pear
- d) plum

Q.12 Strychnine blocks ---

- a) glycine-gated chloride channel
- b) glutamate receptors
- c) GABA receptors
- d) voltage-gated sodium channels

Q.13. The toxin found in species of Capsicum has been known to be useful in the therapy of ----

- a) skin cancer
- b) depression
- c) chronic pain
- d) decubitus ulcers

Q.14. All of the following are true of curare except ----

- a) it was a south American arrow poison.
- b) it is a neuromuscular blocking agent.
- c) it can be used clinically
- d) it is CNS toxic

Q.15. Swainsonine -----.

- a) is present in vinca species
- b) is a glycoprotein
- c) causes abortions in livestock
- d) none of the above

Q.16. The veratrum and lupine alkaloids are ----

- a) teratogenic
- b) components of marketed pharmaceuticals
- c) used as insecticides
- d) poisons that Socrates drank

10.5 Fill in the blanks

Exercise 3

- Q.1. *Abrus precatorius* is commonly known as ----- or -----.
- Q.2. The toxicity due to seeds of *Abrus precatorius* is commonly referred to as ----- poisoning.
- Q.3. The toxic principle present in the seeds of *Abrus precatorius* is -----.
- Q.4. *Ricinus communis* is commonly referred to as -----.
- Q.5. The toxic principle present in the seeds of *Ricinus communis* is -----.
- Q.6. The toxic principles abrin and ricin belongs to the class of glycoproteins known as -----.
- Q.7. The toxic principle present in castor bean which causes hemagglutination and hemolysis is -----.
- Q.8. The species of animal that is more susceptible to abrin and ricin poisoning is -----.
- Q.9. At the cellular level, lectins (abrin & ricin) acts by inhibiting ----- preventing protein synthesis.
- Q.10. The toxic plant whose flowers are known as 'angel's trumpets' or 'moonflowers' is -----.
- Q.11. The major tropane alkaloids present in *Datura stramonium* are -----and -----.
- Q.12. The toxic principles in *datura* are present in ----- and -----.
- Q.13. The plant that is known as 'deadly night shade' is -----.
- Q.14. The species of animal, which is resistant to *Atropa belladonna* is -----.
- Q.15. Tropane alkaloids (atropine) acts by inhibiting ----- receptors in the body.
- Q.16. The symptoms of *datura* toxicity are termed as -----.
- Q.17. Urine from *datura* intoxicated animals produces ----- in cat, which is used for diagnosis.
- Q.18. The competitive inhibitor of acetyl choline esterase, which is used for treating *datura* (atropine) intoxication is -----.
- Q.19. Active toxic principles of *abrus precatorius* is -----.
- Q.20. Leftover cake after the extraction of oil is also -----highly toxic

Exercise 4

- Q.1. *Ipomoea turpethum* (Indian jalapa or morning glory) contains the toxic principle -----.
- Q.2. The toxic principle present in *Ipomoea orizabensis* is -----.
- Q.3. The main symptom in *ipomoea* plant poisoning is -----.
- Q.4. The toxic principles present in *Nerium oleander* (White oleander) is -----.
- Q.5. The toxic principle present in *Nerium odorum* is -----.
- Q.6. *Cerebra thevetia* contains the toxic glycosides ----- and -----.
- Q.7. The steroidal glycoside present in *Nerium indicum* is -----.
- Q.8. The most toxic part of *Nerium* sp. of plants is -----.
- Q.9. The species of animal most susceptible for oleander glycoside poisoning is -----.
- Q.10. Oleander glycosides act by inhibiting ----- enzyme in cardiac cells.
- Q.11. The toxic principle present in *Strychnos nux-vomica* is -----.
- Q.12. The toxic principle strychnine is present in ----- part of *S. nux vomica*.
- Q.13. Strychnine produces spinal stimulation through inhibition of ----- neurotransmitter.
- Q.14. The major site for action of strychnine in spinal cord is ----- cells.

- Q.15. In strychnine toxicity, the characteristic symptom is ----- appearance.
Q.16. The preferred sedative for strychnine poisoning is -----.
Q.17. The toxic principle present in cotton seeds is -----.
Q.18. Gossypol produces anemia by inhibiting heme synthesis by binding with -----.
Q.19. Inhibition of the testicular enzyme ----- is responsible for development of reproductive toxicity in males.
Q.20. Intake of high amounts of ----- is protective in gossypol toxicity.

Exercise 5

- Q.1. Oxalate poisoning in animals occurs commonly through ----- consumption.
Q.2. The most important oxalate containing plants, which cause oxalate poisoning are ----- and -----.
Q.3. Halogeton species contains -----% of oxalates on dry matter basis.
Q.4. The species of fungus, which is rich in oxalates and can cause oxalate poisoning, is -----.
Q.5. The most commonly affected species for oxalate poisoning is -----.
Q.6. Pastures containing ----- % oxalates is toxic for sheep.
Q.7. The important element with which oxalates interact in the body is -----.
Q.8. The primary clinical sign in oxalate poisoning is -----.
Q.9. The deposition of insoluble calcium oxalate crystals in renal tubules causes -----.
Q.10. The common site of urinary obstruction due to oxalate crystals in bulls and rams is -----.
Q.11. In oxalate poisoning, administration of ----- salts is carried out as a part of treatment.
Q.12. Nitrate is first converted to ----- in rumen by micro flora.
Q.13. The use of ----- fertilizers increases the concentration of nitrates in plants.
Q.14. The herbicide which increases nitrate content in plants is----- .
Q.15. High nitrate content is present in drinking water from ----- source.
Q.16. The species of animals that are more susceptible to nitrate poisoning are-----..
Q.17. The concentration of nitrates in plants, which is toxic to animals is -- % or -----PPM.
Q.18. Drinking water containing more than ----- PPM of nitrates can cause poisoning.
Q.19. The nitrate content in young plants is ----- than mature plants.
Q.20. The presence of ----- bacteria in water increases nitrate toxicity.

Exercise 6

- Q.1. The growth of plants/ algal blooms in ponds causes ----- in nitrate content of water
Q.2. The deficiency of molybdenum/ sulfur / phosphorus in soil causes ----- in nitrate accumulation in plants.
Q.3. The deficiency of copper/ cobalt/ manganese in soil causes ----- in nitrate accumulation in plants.
Q.4. The addition of ----- to feeds improves tolerance to nitrate toxicity.
Q.5. The antibiotic used as feed additive, which enhances conversion of nitrates to nitrites causing poisoning is -----.
Q.6. Watering of animals immediately after consuming on nitrate rich plants ----- the chances of nitrate poisoning.
Q.7. Nitrite ion enters erythrocytes in exchange for ----- ion.

- Q.8. Nitrite combines with hemoglobin (in 1:2 ratio) to form -----.
- Q.9. The color of blood in nitrate poisoning is-----.
- Q.10. Physiologically formed methemoglobin (1 to 2 %) is converted back to hemoglobin in the body by the enzymes-----.
- Q.11. Formation of ----- % of methemoglobin produces symptoms of nitrate poisoning.
- Q.12. Vasodilation and hypotension observed in nitrate poisoning is due to smooth muscle relaxation caused by-----.
- Q.13. The respiration in nitrate poisoning is -----.
- Q.14. Chronic nitrate poisoning leads to the development of ----- in sheep.
- Q.15. The preferred ante-mortem sample to be collected in nitrate poisoning is-----.
- Q.16. The specific treatment for nitrate poisoning is -----.
- Q.17. Methylene blue is oxidized to ----- during the conversion of met-hemoglobin to hemoglobin.
- Q.18. The conversion of methemoglobin to hemoglobin by methylene blue depends on the availability of ----.
- Q.19. The use of ----- is contraindicated in nitrate toxicity to improve blood pressure and heart function.
- Q.20. The use of ----- metal chelates is contraindicated in selenium toxicity.

Exercise 7

- Q.1. Cyanide from plant sources is present in the form of-----.
- Q.2. The accumulation of ----- in plants predisposes to cyanide formation.
- Q.3. The enzyme present in plants, which releases hydrocyanic acid from cyanogenic glycosides is -----.
- Q.4. The species of animals, which are more susceptible to cyanogenic glycoside poisoning are-----.
- Q.5. Among ruminants, the more susceptible species for cyanogenic glycosides is -----.
- Q.6. The cyanogenic glycosides present in bitter almond and wild cherry is-----.
- Q.7. The cyanogenic glycosides present in sorghum and Sudan grass is-----.
- Q.8. The cyanogenic glycosides present in linseed and wild clover is-----.
- Q.9. The part of the plant which contains more cyanogenic glycosides is -----.
- Q.10. The level of HCN in plants, which can cause cyanide poisoning in animals is-----.
- Q.11. Young plants contain ----- cyanogenic glycosides than mature plants.
- Q.12. The use of ----- fertilizers increases cyanide toxicity.
- Q.13. Spraying of the weedicide ----- can increase cyanide content in plants.
- Q.14. The soils which favor cyanide accumulation in plants are high in ----- and low in ----- content.
- Q.15. Watering animals after feeding on cyanogenic plants ----- toxicity.
- Q.16. The metabolite of cyanide, which is excreted through urine is -----;
- Q.17. Cyanide is converted to non-toxic thio-cyanate by the enzyme-----.
- Q.18. Good reserves of ----- in the body reduces the toxic effects of cyanide toxicity.
- Q.19. Cyanide inhibits cellular respiration by binding with-----.
- Q.20. The color of blood in cyanide poisoning is -----.
- Q.21. The characteristic smell of ruminal contents, which can suggest cyanide poisoning is -----smell.

- Q.22. Chronic form of cyanide toxicity observed in humans due to consumption of cassava root is called as -----.
- Q.23. The level of cyanide in rumen contents, which is indicative of cyanide poisoning is-----.
- Q.24. The specific treatment for cyanide toxicity is -----followed by -----.
- Q.25. In selenium toxicity, depleted glutathione levels can be restored by administering ----- during treatment.
- Q.26. In selenium poisoning, the level of selenium detected in blood is ----- PPM and in hooves is ----- PPM.
- Q.27. In cattle, cracked and overgrown hooves are the main symptoms ----- poisoning.
- Q.28. In horses, loss of hair from the mane is the main symptom of ----- poisoning.
- Q.29. The important natural source of selenium apart from plants is -----
- Q.30. The maximum permissible amount of cotton seed cake that can be added to ration of cattle is ----- kg. (total dose)

Exercise 8

- Q 1. The death in zinc phosphide poisoning is due to release of _____.
- Q 2. Cherry red color of mucous membrane is indicative of _____ poisoning.
- Q 3. Deep yellow color of urine is seen in _____ poisoning whereas brown black color is indicative of _____ poisoning.
- Q 4. The toxic principle of Cannabis sativa is _____.
- Q 5. The cyanogenetic glycoside in Sorghum sp. is _____ and that in Prunus sp. is _____.
- Q 6. _____ and _____ are used in the treatment of cyanide poisoning.
- Q 7. Fagopyrin from Fagopyrum esculantum is responsible for causing _____ in cattle.
- Q 8. Chronic copper poisoning in sheep occurs when the grazing pasture contains _____ ppm of copper on dry matter basis.
- Q 9. Ammonia exerts its toxic effect by inhibition of _____.
- Q 10 Cyanide in smaller quantity is detoxified by an enzyme _____.
- Q 11. ----- and ----- are mostly sent to the chemical examiner for confirming chronic arsenic poisoning
- Q 12. In cyanide poisoning ----- and ----- are the organs to be dispatched for chemical analysis
- Q 13. Liebermann test is employed for confirming ----- poisoning
- Q 14. -----and ----- cause anoxia by combining hemoglobin
- Q.15. The species of animal that is more susceptible to secondary photosensitization due to pyrrolizidine alkaloids is -----.
- Q.16. Lantana camara causes ----- photosensitization.
- Q.17. Abnormal sensitivity of un-pigmented or less pigmented parts of skin to sun light due to the presence of photodynamic substances in peripheral circulation is known as -----.
- Q.18. The type of photosensitivity produced due to direct ingestion of photodynamic substances or metabolically activated agents is called ----- photosensitization.

- Q.19. The photodynamic substance, formed due to bacterial break down of chlorophyll, which is responsible for secondary photosensitization is -----.
- Q.20. Secondary photosensitization in Lantana camara is mainly due to -----.
- Q.21. The phyto-constituents of L. camara which cause bile duct occlusion and liver damage are -----.
- Q.22. Hepatic lesions such as -----and ----- are diagnostic in differentiation primary and secondary photosensitization.
- Q.23. The primary visible lesion in photosensitization are -----.
- Q.24. The prognosis is poor in ----- type photosensitization.

Exercise 9

- Q.1. 1 Gossypol induced infertility is due to ----- effect on ovary.
- Q.2. Bracken fern poisoning is caused due to the consumption of the plant -----.
- Q.3. The enzyme present in bracken fern, which breaks down thiamine (vitamin B1) is -----.
- Q.4. Aplasia of bone marrow due to bracken fern toxicity is observed in ----- species of animals.
- Q.5. The aplastic anemia causing and carcinogenic factor present in bracken fern is-----.
- Q.6. In alkaline pH, ptaquiloside is converted in to active carcinogenic form -----.
- Q.7. The co-carcinogen present in bracken fern, which causes malignant tumors in mouth, esophagus and rumen along with papilloma virus is -----.
- Q.8. The most susceptible species for bracken fern poisoning are ----- and -----.
- Q.9. Anemia is absent in bracken fern poisoning in ----- species.
- Q.10. The main symptom of bracken fern poisoning in cattle is -----.
- Q.11. Long term consumption of bracken fern causes ----- tumors in cattle.
- Q.12. Enzootic hematuria due to bracken fern poisoning is seen in ----- species.
- Q.13. Bracken fern produces permanent blindness in ----- species.
- Q.14. The diagnosis of bracken fern poisoning involves estimation of ----- level in blood.
- Q.15. The specific treatment for bracken fern induced thiamine deficiency is -----.

10.6 True or False statements

Exercise 10

- Q.1. The chronic selenium poisoning is also known as blind staggers
- Q.2. Selenium toxicity occurs when the pasture contains more than 5 ppm of selenium.
- Q.3. The toxicity of nitrates is 6-10 times more than nitrite.
- Q.4. Lantadin A & B from Lantana camara causes secondary photosensitization
- Q.5. Aster sp. is an example of Indicator plant which contains high concentration of selenium
- Q.6. Nitrate poisoning can cause abortion in cattle.
- Q.7. There is a treatment for Water hemlock (cicutoxin) poison.

10.7 Match the Statements

Match the column A with column B

Exercise 11

Column A	Column B
----------	----------

Q.1 apricot	A. anticholinergic
Q.1water hemlock	b. nausea, vomiting
Q. lupine	c. soluble oxalate
Q. cactus	d. seizures, tremors
Q.5. poinsettia	e. CNS cognitive
Q.6.oleander	f. photosensitivity-inducing
Q.7. jimsonweed	g. cyanide
Q.8. Saint-John's-Wort	h. contact irritant dermatitis
Q.9.rhubarb	i. hepatotoxic and teratogenic
Q.10marijuana	j. cardiac arrhythmias.

10.8 Answers

10.8.1 Multiple choice questions

Exercise 1

1. a
2. b
3. d
4. b
5. d
6. a
7. c
8. d
9. a
10. d
11. e.
12. c
13. b
14. a
15. c
16. d
17. a
18. a
19. e
20. d
21. d
22. d
23. e.
24. a
25. e.
26. a
27. c
28. e
29. b.
30. a
31. d
32. c
33. b

34. e
35. e
36. b
37. a
38. c
39. e
40. b
41. c
42. e
43. a
44. c
45. a
46. a
47. c
48. a & b
49. d
50. a
51. d.
52. d.
53. a
54. a, b, c, d (all)
55. b
56. d
57. a
58. a.
59. a
60. b
61. d
62. b
63. a
64. d
65. b

66. f

67. d

Exercise 2

1.b.
2.d.
3.a.
4 a.
5.a.
6.b.
7. c.
8.d.

9. d.
10. d.
11. a.
12. a.
13. c.
14. d.
15. c.
16.a.

10.8.2 Fill in the blanks

Exercise 3

1. ROSARY PEA or RATHI
2. SUI/ NEEDLE
3. ABRIN
4. CASTOR BEAN
5. RICIN
6. LECTINS
7. RCA (Ricinus communis agglutinin)
8. HORSE
9. RIBOSOMES
10. DHATURA STRAMONIUM

11. HYOSCINE ATROPINE
12. SEEDS, FLOWERS
13. ATROPA BELLADONNA
14. RABBIT
15. MUSCARINIC
16. ANTICHOLINERGIC DELIRIUM
17. MYDRIASIS
18. PHYSOSTIGMINE
19. ABRIN
20. HIGHLY TOXIC.

Exercise 4

1. TURPETHIN
2. CAMMONIN
3. DIARRHOEA
4. OLEANDRIN
5. NERIN
6. THEVETIN, CEREBRIN
7. ODOROSIDE
8. LEAF
9. HORSE
10. Na⁺ - K⁺ ATPase.

11. STRYCHNINE
12. SEEDS
13. GLYCINE
14. RENSHAW
15. SAW HORSE
16. PENTOBARBITONE
17. GOSSYPOL
18. IRON
19. LACTATE DEHYDROGENASE (LDH)
20. PROTEIN.

Exercise 5

1. PLANTS
2. HALOGETON GLOMERATUS and OXALIS PESCAPRAE
3. 34 %
4. ASPERGILLUS
5. SHEEP
6. 2%
7. CALCIUM
8. HYPOCALCAEMIA
9. OXALATE NEPHROSIS
10. SIGMOID FLEXURE

11. CALCIUM
12. NITRITE
13. NITRATE
14. 2, 4-D
15. DEEP-WELL
16. RUMINANTS
17. 1% or 10,000 PPM
18. 1500 PPM
19. MORE
20. COLIFORM

Exercise 6

1. DECREASE
2. INCREASE
3. DECREASE
4. SOLUBLE CARBOHYDRATES (TDN)
5. MONENSIN
6. DECREASES
7. CHLORIDE
8. METHEMOGLOBIN
9. CHOCOLATE BROWN
10. DIAPHORASE – I & II

11. 20 to 40 %
12. NITRIC OXIDE (NO)
13. RAPID
14. GOITER
15. PLASMA
16. METHYLENE BLUE
17. LEUCOMETHYLENE BLUE
18. NADPH₂
19. ADRENERGIC AGONISTS
20. DIMERCAPROL (BAL).

Exercise 7

1. CYANOGENIC GLYCOSIDES
2. NITRATES
3. β -GLYCOSIDASE.
4. RUMINANTS
5. CATTLE
6. AMYGDALINE
7. DHURRIN
8. LINAMARINE
9. LEAF
10. 200 PPM AND ABOVE.
1. MORE
2. NITRATE
13. 2, 4-D.
14. NITROGEN, PHOSPHORUS

15. INCREASES
16. THIOCYANATE
17. RHODANESE
18. SULFUR
19. CYTOCHROME OXIDASE
20. BRIGHT RED
21. BITTER ALMOND
22. KONZO
23. 10 PPM
24. SODIUM THIOSULPHATE
25. ACETYL CYSTEINE
26. 1-4 PPM, 5-20 PPM
27. SELENIUM
28. SELENIUM
29. VOLCANIC GASES
30. ONE

Exercise 8

1. PHOSPHINE GAS
2. CYANIDE
3. PICRATE, ACORN
4. TETRAHYDRO CANNABINOL

5. DHURRIN, PRUNASIN
6. SODIUM NITRITE AND SODIUM THIOSULPHATE
7. PRIMARY PHOTSENSITIZATION

8. 15-20 PPM
9. CITRIC ACID CYCLE
10. RODONASE.
1. HORN AND HAIR
2. LIVER AND LUNG
3. CARBOLIC ACID (PHENOL)
4. CARBON MONOXIDE AND NITRITE
15. PIG
16. SECONDARY
17. PHOTSENSITIZATION
18. PRIMARY
19. PHYLLERYTHRIN
20. BILE DUCT OCCLUSION
21. LANTADENE A & B
22. FIBROSIS, BILIARY HYPERPLASIA
23. SUN BURNS
24. SECONDARY

Exercise 9

1. LEUTOLYTIC
2. PTERIDIUM AQUILINUM
3. B1, THIAMINASE
4. RUMINANTS
5. PTAQUILOSIDE
6. DIENON
7. QUERCETIN
8. HORSE, CATTLE
9. HORSE
10. APLASTIC ANEMIA.
11. URINARY BLADDER
12. CATTLE
13. SHEEP
14. THIAMINE
15. THIAMINE (VIT B1)

10.7.3 True or False statements

Exercise 10

1. False
2. True
3. False
4. True
5. False
6. True
7. False

.

10.8.3 Match the Statements

Exercise 11

Q.1	g. cyanide
Q.2	d. seizures, tremors
Q.3	i. hepatotoxic and teratogenic
Q.4	h. contact irritant dermatitis
Q.5	b. nausea, vomiting
Q.6	j. cardiac arrhythmias
Q.7	a. anticholinergic
Q.8	f. photosensitivity-inducing
Q.9	c. soluble oxalate
Q.10	e. CNS cognitive

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