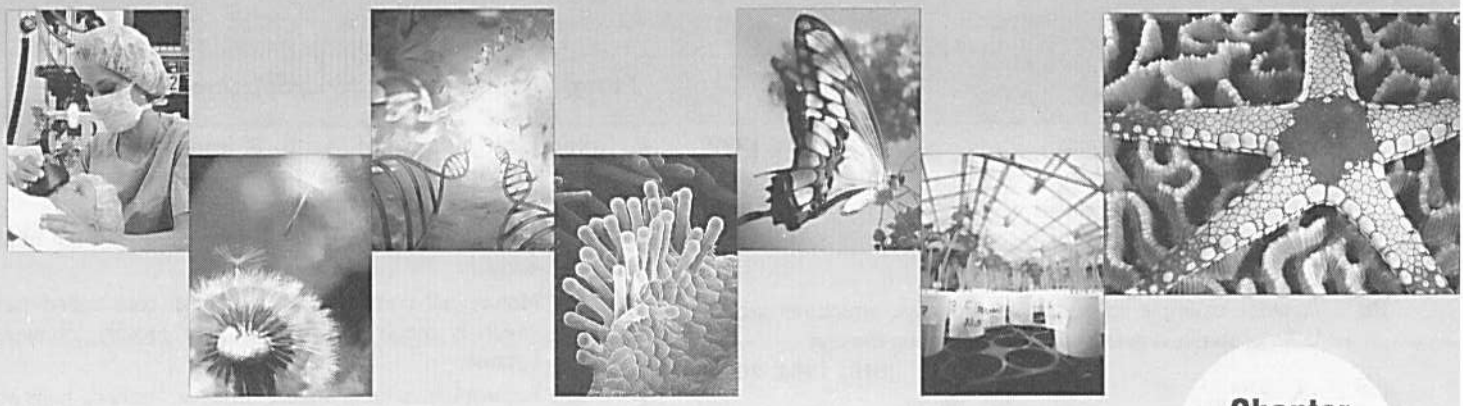


Chapter

1.5

Viruses

The term 'virus' has been derived from Latin, which means poison or venom or viscous fluid. They remain inactive outside a living host but become active inside the host and multiply in it. They represent a transitional form of life between non–living and living world.

Luria (1953) defined virus as "Sub-microscopic entities capable of being introduced into specific living cells and reproducing inside such cells only. "Single virus is called 'Virion', most of the plant virus are RNA virus. Most of the animal virus are DNA virus.

(i) **Important discovery of virus**

Carolous causius (1576) recorded first viral disease in tulips.

A. Mayer (1886) found a disease in tobacco caused by virus and called it tobacco mosaic disease.

D. Ivanowski (1892), a Russian Botanist, discovered the infectious nature of the viruses. He was the person, who discovered the virus.

Beijerinck (1898) Beijerinck called them living infectious fluid or "Cotagium virum fluidum."

W. Twort (1915) and D. Herelle (1917) discovered bacteriophages, a kind of virus which infected bacteria and destroyed them.

W. M. Stanley (1935) first time isolated tobacco mosaic virus (TMV) in crystalline form and showed that crystals were made up of proteins. Nobel prize was awarded to him for this work.

(ii) **Nature of viruses :** Viruses are regarded as intermediate between non-living entities and living organisms. It is very difficult to as certain whether they are living or non-living. Some characters of viruses suggest their non-living nature where as many other characters suggest their living nature. The two views are listed below –

Viruses are non-living : The following characters state that they are non-living.

(a) Viruses have no complete cellular structure. They are not surrounded by cell membrane or cell wall.

(b) They do not show cellular metabolism and lack respiration.

(c) They possess high specific gravity unlike living organisms.

(d) Viruses are active only when they are inside the living host cells. Out side the host, they are good as chemical substances. Thus, they do not have their independent existence.

(e) Postulates of *Robert Koch* are not true for the viruses. Virus cannot grow in "*invitro*" condition in lab.

(f) Absence of growth and division.

Viruses are living organisms : The following characters state that they are living organisms –

(a) They have definite shape and morphology like that of a living organism.

(b) They possess genetic material (DNA or RNA), which determine their structure and development. Genetic material passes from generation to generation in usual manner.

(c) All viruses are intracellular obligate parasite and attack specific hosts. The bacteriophages recognise the real bacterial surface.

(d) They show property of mutation.

(e) They show irritability and respond to environmental conditions such as heat, ultraviolet rays, humidity, drought, alcohol, etc.

(f) They can grow inside the host and multiply enormously showing one of the most important property of living organisms.

(iii) **Chemical composition :** Chemically viruses are nucleoproteins. They are made up of central core of nucleic acid. Nucleic acid is only one, either DNA or RNA. This nucleic acid

(DNA or RNA) represents the genetic characters of virus. TMV has RNA (like most plant viruses have) 10% RNA and 90% protein is present in influenza virus and PSTV (Potato Spindle Tuber Viroid) also has RNA but it does not have capsid (protein coat). Plant viruses contain RNA but in cauliflower mosaic virus contain DNA. Bacteriophages contain DNA and almost half animal viruses contain RNA and half contain DNA. But it is called that often animal viruses contain DNA. Cancer causing viruses reovirus contain both RNA and DNA, Only some enzymes are detected in viruses such as – Lysozyme in bacteriophages, transcriptase in vaccinia virus, reverse transcriptase and DNA or RNA polymerase in retroviruses.

Table : 1.5-1 Nucleic acid in viruses and no. of strands

DNA Viruses	Strands	RNA Viruses	Strands
Adenoviruses	DNA (2)	Avian leukemia virus	RNA (1)
Bacteriophage ϕ X 174	DNA (1)	Bacterial virus F2	RNA (1)
Bacteriophage M13	DNA (1)	Bacteriophage MS–2	RNA (1)
Coliphage lambda (λ)	DNA (2)	Coliphage R17	RNA (1)
Coliphage T2, T4, T6	DNA (2)	Influenza virus	RNA (1)
Coliphage T3, T7	DNA (2)	Poliomyelitis virus	RNA (1)
Pox virus	DNA (2)	Tobacco mosaic virus (TMV)	RNA (1)
Herpes viruses	DNA (2)	Reovirus	RNA (2)
Popilloma virus	DNA (2)	Rice dwarf virus	RNA (2)
Polyoma virus SV 40	DNA (2)	Wound Tumour virus	RNA (2)

(iv) **Shape :** There is variation in shapes of viruses. On the basis of shape of viruses have been placed in the following categories.

(a) Straight, rigid rods with helical architecture, *e.g. TMV, Barley stripe mosaic virus* (BSMV).

(b) Long flexous thread–like rods, *e.g. Potato latent mosaic, Wheat streak mosaic virus.*

(c) Polyhedral virions, *e.g. Turnip yellow mosaic, Tobacco ring spot virus.*

(d) Tadpole like – *Bacteriophages.*

(e) Spherical – *Influenza virus.*

(v) **Size :** Viruses have a long range of size. They range from 10 mμ to more than 300 mμ in size. The virus of foot and mouth disease (FMD) of animals is smaller than the largest protein molecule. Largest virus is smallpox virus – variola (250 mμ).

(vi) **General structure of virus**

Structurally viruses are made up of envelope, capsid, nucleoid and occasionally one or two enzymes.

Envelope : Some viruses possess an outer thin loose covering, called envelope. It is composed of proteins (from virus), lipids and carbohydrates (both from host). It is found in some animal viruses *e.g.*, Herpes virus, HIV. The smaller subunits of envelope are called **peplomers** The viruses, which do not possess envelope, are called naked.

Capsid : It is the protein coat that surrounds the central portion of nucleoid and enzymes (if present). The capsid consists of a specific number and arrangement of small sub-units called capsomeres. These sub-units possess antigenic properties.

Nucleoid : The nucleic acid present in the virus is called nucleoid. It is the infective part of virus which utilizes the metabolic machinery of the host cell for synthesis and assembly of viral components. The genetic material of viruses are of four types :

(a) Double stranded DNA (ds DNA) *e.g.*, Herpes virus, Hep. B virus.

(b) Single stranded DNA (ss DNA) *e.g.*, Coliphage.

(c) Double stranded RNA (ds RNA) *e.g.*, Wound tumour virus.

(d) Single stranded RNA (ss RNA) *e.g.*, Retrovirus, TMV, Polio virus.

(vii) **Life cycle :** The word reproduction is not appropriate in case of viruses because they have no cellular components or cell organelles. They do not reproduce themselves but divide by a special mechanism as follows.

Attachment : The bacteriophage gets attached to bacterial cell wall with the help of caudal fibres.

Penetration : Bacteriophage dissolves the bacterial wall by an enzyme *Lysozyme* and makes a pore in cell wall. Through this pore DNA molecule enters in the cell after contraction of head protein, entire protein coat remains outside.

Latent period : Phage DNA controls hosts cellular machinery. Instead of formation of bacterial protein, phage protein formation begins. Cellular DNA and RNA is broken down and from this cellular DNA, phage DNA is formed. Now protein covers the DNA fragments to form a kid virus.

Maturation : This young virion is changed into an adult virus hence this process is called maturation.

Release : The viruses are mature, cell wall of bacterial cell is weakened by enzyme lysozyme. The release of viruses takes place by bursting of host cell and these are again ready for next infection or attack on other bacteria.

(viii) **Economic importance of viruses**

Uses of viruses

(a) Specific viral strains are cultured and attenuated to be used as vaccines against specific diseases.

(b) The addition of cyanophages LPP-1 and SM-1 are useful in controlling water blooms.

(c) Bacteriophage was used by *Hershey* and *Chase* to prove that DNA is the chemical basis of heredity.

(d) Bacteriophages are of interest to geneticists because these bring about transduction.

(e) Water of river Ganga is believed to have phages which destroy bacteria. That is why its water does not get spoiled.

Tobacco mosaic virus (TMV) : It was discovered by the Russian worker D. Ivanowski. Franklin etal (1957) described the ultrastructure of (TMV) – It is a rod–shaped virus having a central core of RNA surrounded by protein coat (capsid) to form the nucleocapsid. The nucleocapsid may be naked or may be surrounded by a loose membranous envelope. The protein coat (capsid) consists of 2130 identical subunits (capsomeres).

Bacteriophage : The viruses which attack bacteria are called bacteriophages. In outline they look like tadpole or sperm. The body can be divided into a hexagonal head neck and a tail. The hexagonal head has a central core of DNA, which is surrounded by protein coat. The DNA is double helix. The cylindrical tail is hollow and is entirely made up of proteins. At the end of this, there are six long threads called tail fibres or caudal fibres. These fibres help the virus while attaching to bacteria. Bacteriophage contain lysozyme enzyme.

Cyanophages : Generally some of the viruses are found which attack on blue green algae. *Sofferman* and *Morris* (1963) reported 11 filamentous forms of blue green algae (Lyngbya, plectonema and phormidium, hence called LPP-1) which were attacked by viruses. These viruses are usually called cyanophages. Cyanophages contain DNA as their genetic material. These viruses resemble with bacteriophages in morphology and behaviour.

Mycophages : Some fungi such as, *Mushrooms, Penicillium*, etc have also been found to be infected by viruses. These are isometric in shape and contain double stranded RNA.

Phycophages : These are virus which attack on Algae.

Viroids : Diener and **Raymer (1967)** discovered very simple smallest infectious agents called Viroids. Viroids consist of RNA only and capsid is lacking. Viroids contain only very low mol. weight. *Diener* and *Raymer* reported that causal agent of potato spindle tuber disease was a free RNA and no viral nucleoprotein particles were present in the infected tissue. *T.O. Diener* (1971) termed it viroid. Viroids are single–stranded, covalently closed circular as well as linear RNA molecules. Transmission is mechanical. The symptoms on host plants are almost similar to those of viruses. Viroids cause persistent infections. A number of other diseases caused by viroids are – Cadang Cadang of coconut, Cucumber pale fruit, Chrysanthemum stunt, Avacado sunblotch, etc.

Prions : Prusiner (1982) discovered it as a human disease causal agents. ***Stanley B. Prusiner*** discovered infectious agents which were prions. Prions are proteinaceous particles thought to cause a number of diseases including the slow virus diseases, therefore also called as **slow viruses**. They are made of protein molecules only. Genetic material (DNA and RNA) is absent in prions. *Kuru*, a disease of central nervous system found in few canniblastic tribes of *New Guinea* is caused by prions.

Interferons : *G.M. Findley* and ***McCallum*** (1937) reported a phenomenon called viral interference in which the cell infected with one type of virus becomes resistant to super infection by other viruses. Alliac Issacs and Lindeman (1957) gave the term interferons to the chemical substances responsible for viral interference.

(i) Interferons are produced by cells in mammals, rodents, birds, etc., and provide resistance against viruses.

(ii) Interferons are **protein** molecules or polypeptides of low molecular weight which prevent viral multiplication.

Table : 1.5-2 Families of animal viruses, grouped by type of nucleic acid

Family	Virion Structure	Diameter (nm)	Examples (Diseases)
dsDNA			
Papova virus	Naked polyhedral	40–57	Papilloma (human warts, cervical cancer); polyoma (tumors in certain animals).
Adeno virus	Naked polyhedral	70 – 80	Viruses that cause respiratory disease; some that cause tumors in certain animals.
Herpes virus	Enveloped polyhedral	150–250	Herpes simplex I (cold sores); herpes simplex II (genital); varicella zoster (chicken pox, shingles); Epstein–Barr virus (infectious mononucleosis, Burkitt's lymphoma).
Pox virus	Enveloped complex	200–350	Variola (smallpox); vaccinia; cowpox.
ss DNA			
Parvo-virus	Naked polyhedral	18–26	Most depended on co infection with adenoviruses for growth

Table : 1.5-3 ss RNA that can serve as mRNA (+ strand RNA)

Picorna virus	Naked polyhedral	18–38	Poliovirus; rhinovirus (common cold); enteric viruses
Toga virus	Enveloped polyhedral	40–60	Rubella virus; yellow fever virus; encephalitis virus (transmitted by insects).
Retrovirus	Enveloped polyhedral; two copies of genome per virion.	100–120	RNA tumor viruses (solid tumors and leukemia); AIDS

Table : 1.5-4 ss RNA that is a template for mRNA (– strand RNA)

Rhabdovirus	Enveloped helical	70–180	Rabies
Paramyxovirus	Enveloped helical	150–300	Measles, mumps
Orthomyxovirus	Enveloped helical; RNA in eight segments.	80–200	Influenza viruses
ds RNA			
Reovirus	Naked polyhedral; RNA in ten segments.	60–80	Diarrhoea viruses

***ds = double– stranded; ss = single–stranded.**

Table : 1.5-5 Important plant diseases caused by viruses

S.No.	Disease	Causal organism
(1)	Abutilon mosaic	Abutilon mosaic virus
(2)	Bunchy top of banana	Banana bunchy top virus
(3)	Cucumber mosaic	Cucumber mosaic virus
(4)	Little leaf of brinjal	Brinjal little leaf virus
(5)	Little leaf of cotton	Cotton little leaf virus
(6)	Papaya mosaic	Papaya mosaic virus
(7)	Potato leaf roll	Potato leaf roll virus
(8)	Potato mild mosaic	Potato virus X
(9)	Potato rugose mosaic	Potato virus X and Y
(10)	Stunt of S. C.	Ratoon stunt virus
(11)	Rosette of groundnut	Groundnut mosaic virus
(12)	Sugarcane mosaic	Sugarcane virus I
(13)	Tobacco mosaic	Tobacco mosaic virus
(14)	Tomato leaf curl	Tomato curl virus
(15)	Tristeza of citrus	Citrus Tristeza virus

Table : 1.5-6 Important human diseases caused by viruses

S.No.	Disease	Host	Causal organism
(1)	Encephalitis	Man	Encephalitis virus
(2)	Infectious hepatitis	Man	Hepatitis virus
(3)	Herpetic Keratitis	Man	Herpes virus
(4)	Influenza	Man	Influenza virus–a
(5)	Measles	Man	Measles virus
(6)	Viral bronchitis	Man	Parainfluenza virus
(7)	Poliomyelitis	Man (children)	Polio virus
(8)	Small Pox	Man	Pox virus
(9)	Common cold	Man	Rhino virus
(10)	Yellow fever	Man	Yellow fever virus

Tips & Tricks

- Father of Virology W.M. Stanley (American Microbiologist).
- Edward Jenner (1796) developed the first successful vaccine against viral disease small pox.
- D' Herelle (1917) coined the term "bacteriophage" for bacterial virus.
- *Caulimo virus* (cauliflower mosaic virus) are double stranded DNA virus
- Lindemann (1957) did the first successful vaccination against Polio.
- Single virus observed under electron microscope, outside host is called "Virion".
- The first virus to be cultured in human cells was Polio virus.
- Most of the phase are DNA virus.
- Retroviruses and reverse transcription were reported by Temin and Baltimore.
- Viruses can pass through bacteria proof filters. These are the intermediate connection between living and non living.
- Viruses have host specificity. A specific virus infects only a particular host.
- In the world which do not have cell are virus, viroids and prions.
- Substance which can inactivate to viral activities are known as antiviral agents or virucide.
- The synthesis of viral proteins takes place on host ribosomes.
- Viruses lack pigments metabolic activity, they are made up of RNA the only movement and sex organ, but some enzymes are found in them.
- AIDS is caused by HIV. It infects T–lymphocytes. HIV virus remains dormant for about 8 years. Infected person does not suffer a symptoms during this period. AIDS day is 1st December.
- Size of virus is 20nm – 300 nm Largest virus is – *vaccinia* or cow pox-virus (500nm). Smallest virus is – *Alfa-alfa virus* (17 nm).
- Pox virus is also known as vip virus.
- Five genes are present in a simplest virus.

Ordinary Thinking

Objective Questions

Viruses

1. The first to isolate plant virus was **[NCERT; CBSE PMT 1993]**

Or

The *Tobacco mosaic virus* was crystallized for first time by **[MP PMT 1994]**

(a) W.M. Stanley (b) E. C. Stackmann
(c) A. K. Smith (d) Ivanowski

2. The viruses contain **[NCERT; J & K CET 2008]**

(a) Proteins only
(b) DNA only
(c) Nucleic acids only
(d) Proteins, DNA or RNA (nucleic acids)

3. Caulimo virus (Cauliflower mosaic virus) are a group of viruses which have

(a) Double stranded RNA (b) Single stranded RNA
(c) Single stranded DNA (d) Double stranded DNA

4. The rabies virus consists of **[WB JEE 2009]**

(a) Single stranded RNA (b) Double stranded RNA
(c) Single stranded DNA (d) Double stranded DNA

5. A virus containing ssRNA act as a template for DNA synthesis is called as **[MP PMT 2007; DPMT 2007; Odisha JEE 2008]**

(a) Polio virus (b) Retro virus
(c) Pox virus (d) Adeno virus

6. Viruses enter plant cells only through..... **[VITEEE 2008]**

(a) Lenticels (b) Wounds
(c) Stomata (d) Roots

7. Influenza virus has got

(a) Naked capsid (b) Enveloped capsid
(c) Naked polyhedral capsid (d) No capsid at all

8. The genetic material in viruses is **NCERT; CPMT 1994; MP PMT 1995, 98, 2000; CBSE PMT 1997; Pb. PMT 2000; BHU 2005]**

(a) Only RNA
(b) Only DNA
(c) RNA and DNA both
(d) RNA or DNA *i.e.* one nucleic acid in a virus

9. Each capsomere of TMV contain amino acids whose number is

(a) 158 (b) 185
(c) 815 (d) 581

10. Ribovira is a group of viruses which contains

(a) dsDNA (b) ssDNA
(c) RNA (d) None of these

11. Which of the following is the smallest virus

(a) Foot and mouth virus
(b) Tobacco mosaic virus
(c) Coliphage lambda virus
(d) Wound tumour virus

12. Which of the following is the largest virus

(a) *Penicillium virus* (b) Wound tumour virus
(c) Pox virus (d) None of the above

13. Which of the following is false **[CBSE PMT 2005; DUMET 2009]**

(a) Most plant viruses are RNA viruses
(b) Most animal viruses are DNA viruses
(c) TMV has double stranded RNA molecule
(d) T_4 bacteriophage has double stranded DNA molecule

14. Which one is absent in viruses **[AFMC 2008]**

(a) Replication (b) Protein synthesis
(c) Energy liberation (d) Mutation

15. Wound tumour virus has

(a) Double stranded DNA (b) Single stranded DNA
(c) Double stranded RNA (d) Single stranded RNA

16. Which of the following is a DNA containing plant virus **[Pb. PMT 1999, 2000]**

(a) Tobacco mosaic virus (b) Tomato mosaic virus
(c) Cauliflower mosaic virus (d) Potato mosaic virus

17. Algal viruses are known as **[CBSE PMT 1993]**

(a) Binal viruses (b) Cyanophages
(c) Mycophages (d) Phycophages

18. Arthropod borne viruses are

(a) Ribo virus (b) Reo virus
(c) Arbo virus (d) None of these

19. Which one of the following are intracellular obligate parasites **[KCET 1998; DUMET 2009]**

(a) Bacteria (b) Viruses
(c) Slime moulds (d) Blue-green algae

20. Select the wrong statements **[AIPMT 2015]**

(a) W.M. Stanley showed that viruses could be crystallized
(b) The term '*contagium vivum fluidum*' was coined by M.W. beijerinck
(c) Mosaic disease in tobacco and AIDS in human being are caused by viruses
(d) The viroids were discovered by D.J. Ivanowski

21. Helper virus is called

(a) Perfect phage of virus
(b) A defective phage which helps another defective phage
(c) A latent phage
(d) None of these

22. Who discovered interferons

(a) Issacs and Lindmann (b) Holmes and Knight
(c) Harshey and Chase (d) Enders

23. The agents which are known to cause CJD are **[KCET 2009]**
(a) Protein particles (b) A class of bacteria
(c) A class of viruses (d) Fungi

24. Virus was discovered by whom **[WB JEE 2009]**
(a) Stanley (b) Ivanowski
(c) Herelle (d) Beijerinck

25. A virion is a **[Odisha JEE 2009]**
(a) Without protein coat virus
(b) Enucleated virus
(c) Prions
(d) Virus

26. Protein of capsomeres is made up of
(a) Nucleic acids (b) Carbohydrates
(c) Fats (d) Amino acids

27. Who proposed the phanerogram of virus
(a) Lwoff and Tournier (b) W.M. Stanley
(c) Weil *et al* (d) None of these

28. A cryptogram has got how many pairs of information
(a) 1 (b) 2
(c) 3 (d) 4

29. In which virus, DNA is double stranded **[AMU (Med.) 2006]**
(a) Hepatitis A (b) Hepatitis B
(c) Hepatitis C (d) Hepatitis D

30. Viroids differ from viruses in having **[NEET 2017]**
(a) DNA molecules with protein coat
(b) DNA molecules without protein coat
(c) RNA molecules with protein coat
(d) RNA molecules without protein coat

31. Virus was assigned its name by
(a) Dmitri Ivanowski (b) Adolf Mayer
(c) M.W. Beijerinck (d) McKinney

32. The filterable property of tobacco mosaic virus (TMV) was shown by **[NCERT; MP PMT 1996]**
(a) Ivanowsky (b) Beijerinck
(c) Stanley (d) Winogradsky

33. Viruses were called *Contagium vivum fluidum* by **[NCERT]**
(a) de Herelle (b) Bawden and Pirie
(c) Twort (d) Beijerinck

34. The size of TMV is
(a) 17.5 × 300Å (b) 17.5 × 300*nm*
(c) 19.5 × 250Å (d) 19.5 × 250*nm*

35. Which of the following is not concerned with viruses
(a) Viruses are made up of nucleic acid and proteins
(b) Viruses multiply only in living host cell
(c) Viruses can not use oxygen for respiration
(d) Viruses can be grown in sugary liquid

36. The viruses are known as
(a) Unicellular (b) Acellular
(c) Multicellular (d) Free genes

37. A substance (low molecular weight protein) produced by host cells in response to viral infection and protect other cells against further viral infection is
(a) Phytotoxin (b) Antibody
(c) Interferon (d) Hormone

38. Which is not true for viruses
(a) Double stranded DNA (b) Double stranded RNA
(c) Both DNA and RNA (d) Single stranded DNA

39. Single stranded nucleic acid is found in **[BVP 2004]**
(a) *E. coli* (b) $\phi \times 174$
(c) λ (d) T_4

40. Temin worked on which virus **[BHU 2000]**
(a) Herpesvirus (b) Rhinovirus
(c) Retrovirus (d) Denguvirus

41. The capsid of tobacco mosaic virus (TMV) has capsomeres numbering **[KCET 2000]**
(a) 1230 (b) 2130
(c) 2310 (d) 3120

42. Genetic material of reovirus is **[Kerala CET 2001; Odisha JEE 2004, 11]**
(a) *ds* DNA (b) *ss* DNA
(c) *ds* RNA (d) *ss* RNA

43. Viruses multiply
(a) In *vivo* (b) In *vitro*
(c) Both (a) and (b) (d) None of the above

44. The viruses responsible for causing polio and hydrophobia are
(a) Neurotropic (b) Visrotropic
(c) Dermotropic (d) Neumotropic

45. The part of the virus which gives to it the hereditary feature, is **[BHU 1994; BVP 2003]**
(a) Capsid (b) Capsomere
(c) Nucleic acid (d) Nucleotide

46. Influenza is caused by **[NCERT; BVP 2001]**
(a) Bacterium (b) Virus
(c) Fungus (d) Cyanobacterium

47. Vertical transmission of virus in human is through
(a) Placenta of mother (b) Sperms of the father
(c) Both (a) and (b) (d) None of these

48. The causative agent of mad-cow diesase is a **[CBSE PMT 2006]**
(a) Worm (b) Virus
(c) Bacterium (d) Prion

49. Viruses multiply in **[EAMCET 1995; BVP 2001; BHU 2004]**
(a) Bacteria only (b) All living cells
(c) Specific living cells (d) Rotten food

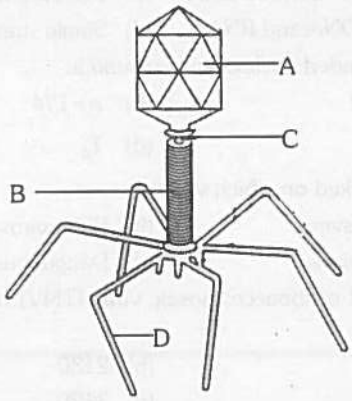
50. Which of the following is true for viruses
(a) They invariably contain DNA
(b) They multiply only in host cell
(c) They occur only inside bacteria
(d) Their genetic material is RNA

51. HIV is classified as a retrovirus because its genetic information is carried in **[DUMET 2009,10]**

(a) DNA instead of RNA (b) DNA

(c) RNA instead of DNA (d) Protein coat

52. Given below is the diagram of a bacteriophage. In which one of the options all the four parts A, B, C and D are correct



Options: **[NCERT; CBSE PMT (Mains) 2010]**

	A	B	C	D
(a)	Tail fibres	Head	Sheath	Collar
(b)	Sheath	Collar	Head	Tail fibres
(c)	Head	Sheath	Collar	Tail fibres
(d)	Collar	Tail fibres	Head	Sheath

53. Viruses usually infect the whole plant except the **[CBSE PMT 1993; MH CET 2000]**

(a) Stem apex (b) Cortex

(c) Pith (d) Phloem

54. Potato tuber spindle disease is caused by **[MP PMT 2007; DUMET 2009; BHU 2012]**

(a) Virus (b) Viroid

(c) Plasmid (d) None of these

55. Which one the following viruse contains both *DNA* and RNA **[WB JEE 2010]**

(a) Cyanophage (b) Herpes virus

(c) Leuko virus (d) Polio virus

56. Grey matter of brain is affected by

(a) Measel virus (b) Varicella virus

(c) Dengue fever virus (d) Encephalitis virus

57. X-bodies are formed during infection of

(a) Bacteria (b) Mycoplasma

(c) Virus (d) All the above

58. Infectious proteins are presents in **[MP PMT 2007; CBSE PMT (Pre.) 2010]**

(a) Satellite viruses (b) Gemini viruses

(c) Prions (d) Viroids

59. Our crops suffer from many diseases. Indicate the disease caused by virus

(a) Potato mosaic (b) Citrus canker

(c) Brown rot of potato (d) Leaf spot of cotton

60. Banana bunchy top is caused by **[KCET 2011]**

(a) *Mycoplasma*

(b) *Deutromycetes*

(c) *Xanthomonas*

(d) *Pentalonia nigronervosa* (Virus)

61. Interferon suppresses the pathogenic activity of **[CMC Vellore 1994; MP PMT 1998; MHCET 2000; BVP 2000, 04]**

(a) Bacteria (b) Viruses

(c) Protozoans (d) Helminths

62. Tobacco mosaic Virus (TMV) has **[EAMCET 1993, MHCET 2001; MP PMT 2001; BVP 2002; AIEEE Pharmacy 2004; J & K CET 2008]**

(a) A single stranded RNA molecule

(b) A double stranded RNA molecule

(c) A single stranded DNA molecule

(d) A double stranded DNA molecule

63. Viruses that infect bacteria, multiply and cause their lysis, are called **[CBSE PMT 2004; AIIMS 2009]**

(a) Lytic (b) Lysogenic

(c) Lysozymes (d) Lipolytic

64. Phages that show lysogenic cycle are called **[MP PMT 1997; VITEEE 2008]**

(a) Temperate phages (b) Virulent phages

(c) Avirulent phages (d) Lytic phages

65. A bacteriophage is **[MP PMT 1995, 98, 2002, 10, 12; MHCET 2000; Odisha JEE 2009; WB JEE 2010]**

(a) A virus attacking a bacterium

(b) A bacterium attacking a virus

(c) A stage in the life-cycle of bacterium

(d) A virus attacking another virus

66. Tailed bacteriophages are **[CBSE PMT 1995]**

(a) Motile on surface of bacteria

(b) Non-motile

(c) Actively motile in water

(d) Motile on surface of plant leaves

67. Which of the following is a pandemic disease

(a) Amoebic dysentry (b) Hepatitis

(c) Filariasis (d) Influenza

68. Sometimes when a virus attacks a bacterium, neither the virus multiplies nor the bacterium dies. This phenomenon is called as **[MP PMT 1998]**

(a) Adsorption (b) Assimilation

(c) Lysogeny (d) Viral stability

69. On the basis of host attacked viruses are classified into **[MP PMT 1995]**

(a) Two types (b) Three types

(c) Four types (d) Five types

70. The spread of AIDS disease is promoted by **[MP PMT 1995]**
(a) Homosexuality
(b) Immoral way of life
(c) Use of infected needles in blood transfusion
(d) All the above

71. Find out the correct statement **[MP PMT 1996; Kerala PMT 2011]**
(a) In lichens, the algal component is called phycobiont and fungal component is known as mycobiont, which are heterotrophic and autotrophic respectively
(b) Viroid contains *RNA* of low molecular weight and protein coat
(c) A virus contains both *RNA* and *DNA*
(d) Viruses are obligatory parasites
(e) Viruses that infect plants have double stranded *RNA*

72. Dog distemper is a disease carried by a **[KCET 2011]**
(a) Bacterium (b) Viroid
(c) Prion (d) Virus

73. Influenza virus has **[CBSE PMT 1996]**
(a) RNA (b) DNA
(c) Neither RNA nor DNA (d) Both DNA and RNA

74. Which is not found in bacteriophage **[Bihar CECE 2006]**
(a) RNA (b) DNA
(c) Coat (d) Protein

75. Viral genome incoporated host DNA is called **[BHU 2006; Odisha JEE 2010; WB-JEE 2016]**
(a) Prophase (b) Prophage
(c) Bacteriophage (d) None of these

76. Potato leaf-roll disease is caused by **[MP PMT 1993, 99, 2002]**
(a) Mycoplasma (b) Virus
(c) Microspores (d) Bacterium

77. A provirus is
(a) Precursor of a viral particle
(b) Prolonged viral infection
(c) A symbiotic viral nucleic acid within the host genome
(d) A dormant viral protein

78. Bacteriophage is made up of **[CPMT 1994; Pb. PMT 2000]**
(a) Carbon and nitrogen
(b) DNA
(c) Nucleoprotein (Nucleic acid + protein)
(d) Protein only

79. Which one is the smallest among the following
(a) Bacteriophage (b) TMV
(c) *E. coli* (d) *Neurospora*

80. Plant virus was first crystallized by **[MP PMT 1994; CPMT 1996]**
(a) Pirie (b) Bawden
(c) Stanley (d) Beijerinck

81. Which of the bacteriophage is a virulent
(a) Coliphage M_{12} (b) λ phage
(c) T_4 phage (d) None of these

82. The enzymes formed by bacteriophage which ruptures the bacterial wall is
(a) Proenzymes (b) Phage–lysozymes
(c) Endolysins (d) Phagoproteins

83. Which of the following sequence is found in *Rous sarcoma virus*
(a) DNA → RNA → Protein
(b) RNA → RNA →Protein
(c) RNA → DNA → RNA → Protein
(d) DNA → DNA → Protein

84. Which of the following shows coiled RNA strand and capsomeres **[CBSE PMT 2014]**
(a) Measles virus (b) Retrovirus
(c) Polio virus (d) Tobacco mosaic virus

85. The protein coat of virus is called **[NCERT; BHU 1999; WB JEE 2009; MP PMT 2009; CBSE PMT (Pre.) 2010]**
(a) Capsid (b) Cosmid
(c) Capsomere (d) Chromophore

86. The phage which does not destroy the host cell but infects it, is called

Or

The virus responsible for lysogenic growth cycle is
(a) Cyanophage (b) T_2 phage
(c) Virulent phage (d) λ phage

87. Which of the following was used by *Hershey* and *Chase* to prove that DNA is the chemical basis of heredity **[AIIMS 1993; BVP 2003]**
(a) TMV (b) Cauliflower mosaic virus
(c) Dahlia mosaic virus (d) T_2 bacteriophage

88. Genetic mapping of bacteriophage $\phi \times 174$ has been done by
(a) Pirie and Bawden (b) F. Sanger
(c) R.L. Sinsheimer (d) Salk and Sabin

89. Coliphage T_2 has **[AFMC 1997]**
(a) *ss*RNA (b) *ss*DNA
(c) *ds*RNA (d) *ds*DNA

90. Which of the following viruses is devoid of protein coat with their body constituted by only RNA
(a) Tobacco mosaic virus (TMV)
(b) Potato spindle tuber virus (PSTV)
(c) Polyoma virus
(d) Mumps virus

91. Zymophage remains parasite on
(a) Bacteria (b) Algae
(c) Yeast (d) None of these

92. The virus of *deoxyvira* (sub-phylum) contains
(a) mRNA (b) tRNA
(c) DNA (d) rRNA

93. An extreme example of latency in which DNA of the phage is integrated with the DNA of host cell chromosome is **[DPMT 1993]**
(a) Lysis (b) Lysogeny
(c) Attenuated virus (d) Prophage

94. In cyanophage, the genetic material is
(a) RNA (b) DNA
(c) RNA and DNA (d) Protein

95. Satellite virus is a
(a) Independent virus
(b) Associated with an activator virus
(c) Both (a) and (b)
(d) None of these

96. Ultrastructure of bacteriophage–T was studied by
(a) R.L. Sinsheimer (b) S. Brenner
(c) M. Schlesinger (d) None of the above

97. The water of Holy Ganga, river is pure due to the presence of **[MP PMT 1998]**
(a) Cyanophages (b) Hydrophytes
(c) Bacteria (d) Bacteriophages

98. Viroids have **[MHCET 2001; AIEEE Pharmacy 2004; J & K CET 2012]**
(a) Double stranded RNA enclosed by protein coat
(b) Double stranded DNA enclosed by protein coat
(c) Single stranded DNA not enclosed by protein coat
(d) Single stranded RNA not enclosed by protein coat

99. Which statement is wrong for viruses **[CBSE PMT (Pre.) 2012]**
(a) All are parasites
(b) All of them have helical symmetry
(c) They have ability of synthesize nucleic acids and proteins
(d) Antibiotics have no effect on them

100. The genome of transducing phages is **[JIPMER 2001]**
(a) Single stranded RNA (b) Double stranded RNA
(c) Single stranded DNA (d) Double stranded DNA

101. A single stranded DNA molecule is the genetic material of bacteriophage **[BHU 1995, 2000; MHCET 2000; DPMT 2003, 04]**
(a) T_2 (b) T_4
(c) $\phi \times 174$ (d) λ

102. Which of the following diseases are known to be caused by viruses (In this item one or more of the answers given may be correct. Decide which are correct and mark the answer sheet according to the code)
1. Burkitt's lymphoma
2. Adult T–cell leukemia
3. Phenyl ketonuria

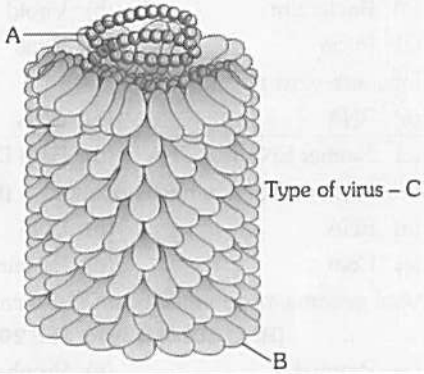
Code
(a) 1, 2 and 3 are correct (b) Only 1 and 2 are correct
(c) Only 2 and 3 are correct (d) Only 1 and 3 are correct

103. Which of the following statements is not true for retroviruses **[CBSE PMT 2004]**
(a) The gentic material in mature retroviruses in RNA
(b) Retroviruses are causative agents or certain kinds of cancer in man
(c) DNA is not present at any stage in the life cycle of retroviruses
(d) Retroviruses carry gene for RNA-dependent DNA polymerase

104. In phage (plaque) culture **[CMC Vellore 1993]**
(a) Only protein of virus enters and multiplies
(b) Only DNA of virus enters the bacterium and multiplies
(c) Whole virus enters the bacterium and multiplies
(d) None of these

105. Satellite RNA are present in some **[NEET (Karnataka) 2013]**
(a) Viroids (b) Prions
(c) Bacteriophages (d) Plant viruses

106. The diagram of a virus is given below. In which of the options A, B and C are correct **[NCERT]**



	A	B	C
(a)	RNA	Protein	HIV
(b)	RNA	Lipid	Tobacco Mosaic Virus
(c)	DNA	Capsid	Tobacco Mosaic Virus
(d)	RNA	Capsid	Tobacco Mosaic Virus

107. Which of the following statements is **wrong** for viroids **[NEET (Phase-I) 2016]**
(a) They lack a protein coat
(b) They are smaller than viruses
(c) They cause infections
(d) Their RNA is of high molecular weight

108. The genome of Influenza virus is a **[WB JEE 2016]**
(a) Single-stranded RNA (-) (b) Single-stranded RNA (+)
(c) Double-stranded RNA (d) Single-stranded DNA

Critical Thinking

Objective Questions

1. Viruses are non-cellular organisms but replicate themselves once they infect the host cell. To which of the following kingdom do viruses belong to **[NCERT]**
(a) Monera (b) Protista
(c) Fungi (d) None of the above

2. What is the purest form of matter that cannot be separated into different substances by chemical means
(a) Electrons (b) Molecules
(c) Elements (d) Compounds

3. Bacteriophage is similar to fungus **[CMC Vellore 1993]**
(a) In having DNA as genetic material
(b) In having RNA as genetic material
(c) In mode of reproduction
(d) In having cell wall

4. Interferon is a **[MP PMT 1996, 2006; Pb PMT 2000; CBSE PMT 2000, 01; AFMC 2002; DPMT 2003; BHU 2003; MHCET 2003; KCET 2007; VITEEE 2008]**
(a) Low molecular weight protein which inhibits viral multiplication
(b) RNA used for DNA synthesis
(c) Protein used for the transportation of oxygen
(d) Protein inhibits DNA synthesis

5. Which one of the following enzymes is present in the bacteriophage **[MP PMT 1996]**
(a) Protease (b) Lysozyme
(c) Succinic dehydrogenase (d) Urease

6. AIDS virus contains **or** Human immuno deficiency (HIV) virus has protein coat and genetic material which is **[MP PMT 1994, 99, 2003, 09; CBSE PMT 1998; AIIMS 2000, 13]**
(a) Single stranded RNA with protein
(b) Double stranded RNA
(c) Single stranded DNA with protein
(d) Double stranded DNA

7. Viruses have **[CBSE PMT 2014]**
(a) Single chromosome
(b) Both DNA and RNA
(c) DNA enclosed in a protein coat
(d) Prokaryotic nucleus

8. Difference between Virus and Viroid is **[NCERT]**
(a) Absence of protein coat in viroid but present in virus
(b) Presence of low molecular weight RNA in virus but absent in viroid
(c) Both a and b
(d) None of the above

AR Assertion & Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
(b) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
(c) If the assertion is true but the reason is false
(d) If both the assertion and reason are false
(e) If the assertion is false but reason is true

1. Assertion : Interferons are a type of antibodies produced by body cells infected by bacteria.
Reason : Interferons stimulate inflammation at the site of injury. **[AIIMS 2008]**

2. Assertion : DNA serves as hereditary material.
Reason : DNA functions as blue-print for building and running cellular machinery.

3. Assertion : Primitive atmosphere was formed by the lightest atoms.
Reason : The primitive atmosphere was reducing in nature.

Answers

Viruses

1	a	2	d	3	d	4	a	5	b
6	b	7	b	8	d	9	a	10	c
11	a	12	c	13	c	14	c	15	c
16	c	17	d	18	c	19	b	20	d
21	b	22	a	23	a	24	b	25	d
26	d	27	a	28	d	29	b	30	d
31	c	32	a	33	d	34	b	35	d
36	d	37	c	38	c	39	b	40	c
41	b	42	c	43	a	44	a	45	c
46	b	47	a	48	d	49	b	50	b
51	b	52	c	53	a	54	b	55	c
56	d	57	c	58	c	59	a	60	d
61	b	62	a	63	a	64	a	65	a
66	b	67	d	68	c	69	b	70	d
71	d	72	d	73	a	74	a	75	b
76	b	77	c	78	c	79	a	80	c
81	d	82	c	83	c	84	d	85	a
86	d	87	d	88	b	89	d	90	b
91	c	92	c	93	b	94	b	95	b
96	b	97	d	98	d	99	b	100	d
101	c	102	b	103	c	104	b	105	d
106	d	107	d	108	a				

Critical Thinking Questions

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

Assertion and Reason

1	d	2	a	3	b				

AS Answers and Solutions

Viruses

19. (b) Viruses are non-cellular, infectious, obligate, intracellular parasites. These are genetic elements (DNA or RNA) wrapped in a protein coat and are not considered to be organisms, as they can not reproduced independently.

21. (b) Helper virus needs another virus to be active.

30. (d) Viruses are made up of proteins and nucleic acids while viroids are naked RNA molecules.

39. (b) Single stranded DNA found in e.g. ϕ×174, S–13, F–1, M–13, R_{17} (*Parvo* viruses) etc.

40. (c) Temin and Baltimore (1975) discovered the process of reverse transcription. It is found in retrovirus.

41. (b) The protein coat (capsid) consists of 2130 identical subunits (capsomeres) in TMV.

43. (a) Because viruses are obligate parasites, so that they can only survive in living cells not in non-livings.

46. (b) Influenza is caused by virus. It is a RNA virus with a helical capsid surrounded by an envelope with spike.

51. (b) Retrovirus is an RNA containing virus that converts its RNA into DNA by means of the enzyme reverse transcriptase ; this enables it to become integrated into its host's DNA. The best known retrovirus is HIV, responsible for AIDS in humans.

52. (c) A – Head; B – Sheath; C – Collar; D – Tail fibre

53. (a) Because in apical tips of shoot apex, a few growth hormones like auxins are formed which check infection of viruses.

55. (c) Leuko virus (a Retro virus) posses both *DNA* and *RNA* in their life cycle.

56. (d) Encephalitis virus infects the grey matter of brain and cause swelling in brain known as brain fever.

61. (b) *Interferon* : In 1957 Issac and Lindeman called interferon to that protein, which is synthesized in human cells during viral infections. This protein provide immunity to the same virus or the others also.

75. (b) Viral genome incorporated into host DNA is called prophage. Most of the prohage genes are repressed by two repressor proteins that are the product of phage genes.

78. (c) Bacteriophage is a virus which infect bacteria. In its tadpole like structure, DNA is found inside the proteinous head.

83. (c) *Rous sarcoma virus* : This virus related to retro group of viruses is having genetical material RNA. But this RNA on reaching in host cell synthesize DNA by the process of reverse transcription, which form *m*RNA and then protein. So the sequence in this is [RNA → DNA → mRNA → Protein]

84. (d) RNA is single stranded helically coiled with 6400 ribonucleotides.

86. (d) Lysogenic cycle is the reproductive cycle of a temperate, nonvirulent phage (like λ phage) which has the potential to lyse the host cell but normally involves integration of viral genome with host DNA and multiplication of the same alongwith the host cell.

93. (b) *Lysogeny* : The process in which bacteriophage attacking on host bacteria, after transduction burst the bacterial cell is called as lysogeny.

95. (b) *Satellite virus* : This virus carry some other viruses on his body and behaves like carrier *e.g.* tobacco mottle virus.

101. (c) $\phi \times 174$ *Bacteriophage* : In this bacteriophage, DNA is rounded, closed and bangle shaped, the duplication pattern is different type in this bacteriophage.

Critical Thinking Questions

2. (c) An element is the simplest form of matter which cannot be split into two or more simpler substances by ordinary chemical methods because an element is formed of only one type of atom.

4. (a) *Interferon* : During infection of viruses on human cells, a protein having 270 amino acids is synthesized known as interferon. This protein helps in developing defence mechanism against the same virus or others also.

5. (b) In bacteriophage, enzyme lysozyme helps at the time of dissolving host wall.

6. (a) *HIV* virus is a retrovirus which contains single stranded RNA surrounded by protein coat (core shell) as genetic material. It causes AIDS.

7. (c) Nucleoprotein particles.

Assertion and Reason

1. (d)

2. (a) DNA is the genetic material in most of living organism except the plant viruses and some bacteriophages. It is the only molecule which can replicate itself or can form its own carbon copy. The phenomenon is called molecular reproduction. All the information required for growth, differentiation, running cellular machinery and reproduction is contained in DNA molecules. These genetic information of DNA are like the blue print. During cell division (which involve DNA replication) the daughter cell receive the same blue print or genetic material as in the parental cell.

3. (b) The lightest atoms of nitrogen, hydrogen, carbon etc. formed the primitive atmosphere. Hydrogen atoms were most numerous and most reactive in primitive atmosphere. First hydrogen atoms combined with all oxygen atoms to form water and leaving no free oxygen. Thus primitive atmosphere was reducing atmosphere (without free oxygen) unlike the present oxidising atmosphere (with free oxygen). Presence of huge amount of free hydrogen in primitive atmosphere also proves its reducing nature.

Viruses

SET Self Evaluation Test

1. Identify the correct sequence of events in the viral replication process.

I. Eclipse II. Maturation
III. Adsorption IV. Assembly
V. Penetration VI. Lysis

[WB JEE 2012]

(a) $I \rightarrow II \rightarrow III \rightarrow IV \rightarrow V \rightarrow VI$
(b) $II \rightarrow I \rightarrow III \rightarrow IV \rightarrow V \rightarrow VI$
(c) $III \rightarrow V \rightarrow I \rightarrow II \rightarrow IV \rightarrow VI$
(d) $III \rightarrow V \rightarrow I \rightarrow IV \rightarrow II \rightarrow VI$

2. The genetic material of Papaya Mosaic Virus is **[Odisha JEE 2012]**

(a) *ssDNA*
(b) *dsDNA*
(c) *dsRNA*
(d) *ssRNA*

3. Who discovered synthesis of DNA from RNA in *Rous sarcoma virus*

(a) Smith
(b) Temin
(c) Twort
(d) Meyer

4. Bacteriophage which infects colon bacterium is

(a) Biophage
(b) Cyanophage
(c) Coliphage
(d) None of these

5. Most of the plant viruses are characterized in having **[AFMC 1993; DPMT 1993]**

(a) DNA
(b) RNA
(c) DNA and RNA
(d) Lipids

6. Cyanophages attack **[MP PMT 1996, 2004]**

(a) Cyanobacteria
(b) Bacteria
(c) Fungi
(d) Lichens

Answers

1	c	2	d	3	b	4	c	5	b
6	a								

* * *