

CSS 2022
General Science & Ability
Question no. 3

Answer: Vaccination (A)

Vaccination is a process that is carried out to make people immune to viral or bacterial diseases, or epidemics, such as polio, measles, pneumonia, etc.

Vaccine: Vaccines are weakened or dead microorganisms or toxins that are used to provide immunity against a disease, or may prevent infections. They protect us from both bacterial and viral diseases. For example, MMR (measles, mumps, rubella), HPV/human papilloma virus vaccines, and polio vaccines.

Types of Vaccines: Vaccines are of different types - live and attenuated (vaccines against chickenpox, BCG vaccine), subunit (Hepatitis C), toxoid, conjugate, DNA, recombinant, vectors vaccines, and other experimental vaccines.

***Inactivated Vaccines:** These are the vaccines that usually do not provide immunity strongly as live vaccines, but their booster shots over time may be needed to acquire ongoing/continuous immunity against a disease. For example, Flu, Polio, Hepatitis A, and

Rabies vaccines are inactivated vaccines.

* Live-Attenuated Vaccines:

Live vaccines are the vaccines in which a weakened form of the disease causing germ is used to prevent a natural infection, and they create long lasting immunity. Moreover, these vaccines are strong enough that 1 or 2 doses give lifetime protection to an individual against a disease causing germ. Live vaccines give immunity against some famous diseases, like smallpox, measles, yellow fever, retrovirus, mumps, and rubella.

* mRNA Vaccines:

mRNA vaccines are the vaccines that form protein in the body which is used to trigger an immune response. The immune response triggered by the protein formed by the vaccine in the body helps an individual to fight against infection. Moreover, mRNA vaccines have many benefits, including easy handling, manufacturing, and no risk of causing disease in the vaccinated person. COVID-19 vaccine is the best example of mRNA vaccine.

*** Subunit, recombinant, polysaccharide, and Conjugate Vaccines:** Specific pieces of germs body, such as capsid, protein contents, and sugars are used in the formation of subunits, recombinant, polysaccharides, and conjugate vaccines. These vaccines are used to protect against some common diseases, such as Hepatitis B, Pneumococcal disease, Meningococcal disease, etc. Lastly, these vaccines need booster shots in order to get continuous protection against diseases.

*** Toxoid Vaccines:** Toxoid vaccines have targeted immune responses and create immunity or resistance against the disease causing part of a germ instead of its whole body. In toxoid vaccines, an individual may need booster shots to acquire continuous immunity. Tetanus and diphtheria vaccines are toxoid vaccines.

Side Effects: Side effects of vaccines are not severe, so mild soreness, redness and swellings are observed at the injection site. Moreover, some vaccines are correlated with pyrexia, rash, and mild pain, but

severe side effects, such as allergic reactions or life threatening seizures are rare. So, see the possible side effects, the smallpox vaccine is a best example in this regard.

Normal or Mild Side Effects:

* Fever ($100-102^{\circ}\text{F}$) and rash (mild) that usually lasts for 3-4 days.

* Soreness or swelling of lymph nodes that usually lasts for 3-4 days.

Temperate to Severe Side Effects:

* Loss of vision or acute eye infection if vaccine virus spreads to the eyes.

* Full body rash, Eczema, and severe infection at the vaccinated sites.

* Brain infection (encephalitis) or death (in rare cases).

Effectiveness of Vaccines:

Vaccines have significantly contributed to improving health and also to increase the longevity of humans. Moreover, vaccines strengthen our immune system so infections can not get started, and act against both bacteria and viruses. Vaccines enhance natural immunity. Furthermore, by vaccination, polio cases have declined by 95% and smallpox has been eradicated worldwide. Therefore, by seeing

the effectiveness of vaccines, a large number of vaccines are produced, such as mumps, measles, typhoid, cholera, yellow fever, hepatitis A, B, and fever, etc. Lastly, some vaccines are not 100% effective, but these vaccines are used for that population that is at higher disease risk. For example, COVID-19 is not good, because new variants of COVID-19 are appearing worldwide.

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(B)

Answer: Polio: Poliomyelitis or polio virus mostly occurs in childhood, and it is found all over the world. This is the smallest known virus that contains RNA in a spherical capsid and mostly occurs in children younger than 5 years.

Symptoms:

- * Muscle pain and stiffness (especially back, neck, arms and legs),
- * Headache and sore throat,
- * Fever, fatigue, nausea or vomiting.

Causes of Spread: It may spread through

- (i) Stool,
- (ii) Contaminated water or food,
- (iii) saliva.

Prevention and Vaccine: Currently, two types of polio vaccines are available. Four shots of vaccines at specific intervals (at the age of 2, 4, 6, and 18 months, booster shots at the age of 4-6 years) may prevent a child from polio.

Types of vaccines include:

- * Inactivated poliovirus vaccine (IPV),
- * Live attenuated oral polio vaccine (OPV).

Answer: Nucleic (C) Acids: Nucleic acids are polymers of nucleotides. They were first isolated from nuclei of "pus" cells in 1869 by a German chemist, Friedrich Miescher. Nucleic acids were named due to their isolation from nuclei and their acidic nature.

Nucleic acids are complex substances and they are the polymers of nucleotide units. There are three units in each nucleotide:

1. A pentose sugar (5-carbon monosaccharide),
2. A nitrogen-containing base,