Class 11
SAMPLE QUESTION PAPER (MEDICAL)

National Science Olympiad™

Syllabus

Section – I (Biology) : Living world, Diversity of life, Cell & cell division, Genetics, Morphology of plants & animals.

Section – II (Physics-Chemistry) : *Chemistry:* Basic concepts of chemistry, States of matter, Atomic structure & chemical bonding, Classification of element & periodicity, Equilibrium, Extraction of elements, Hydrogen, s & p block elements, carbon & its compounds, Hydrocarbons, Haloalkanes & Haloarenes. *Physics:* Units & measurements, Mechanics, Properties of matter, Heat & thermodynamics, Oscillation, Waves.

Comprehensively covers syllabus from CBSE Board, ICSE, Maharashtra Board, Andhra Pradesh Board, Tamilnadu Board & Other state boards

BIOLOGY

1. Which of the following statements are true for photosynthetic bacteria (PB) and chemosynthetic bacteria (CB)?
(a) obtain energy from the oxidation of inorganic molecule such as ammonium salt
(b) obtain energy from sunlight
(c) contain photosynthetic pigments
(d) are autotrophs.
(A) PB - b, c, d ; CB - a, d
(B) PB - a, c ; CB - b, d
(C) PB - b, d ; CB - a, b
(D) PB - a, b, c ; CB - b, c, d.

2. Anaerobic respiration release less energy than aerobic respiration because
(A) energy from oxygen is not made available
(B) ethyl alcohol is a source of energy
(C) carbon dioxide is released
(D) less energy is required by fermenting organisms.

3. The best definition of an ecosystem is
(A) the inter-relationship between producers, consumers and decomposers of an environment
(B) a stable co-existence of dominant species in an environment
(C) a natural unit including plants, animals and non-living constituent of the environment
(D) a number of population of organisms of different species.

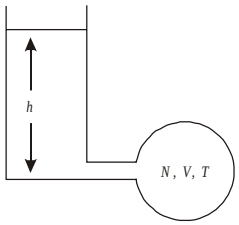
4. In the life cycle of a fern the meiosis occurs during the
(A) formation of spores
(B) formation of gametes
(C) germination of a spore
(D) development of a zygote.

5. The relationship between ants and acacia plants in the tropics is a coevolved mutualism because
(A) the plants provide important resources (nectar and protein bodies) that the ants cannot get elsewhere
(B) the ants are well-suited to living in the swollen red thorns of the acacia
(C) the ants are immune to the chemical secondary defences of the acacia
(D) both the plants and the ants benefit from the interaction.

6. Hydrogen sulphide (H_2S) contains 94.11% sulphur, water (H_2) contains 11.11% hydrogen and sulphur dioxide (SO_2) contains 50% oxygen. Find the ratio of all given elements. After your calculations which law has been verified?
(A) law of multiple proportion (B) law of reciprocal proportion
(C) law of constant components (D) law of combining volumes.

7. An astronaut in the space shuttle orbiting the earth performs a trick for a television audience. She inflates a helium filled balloon within the shuttle's controlled atmosphere and lets go of it. To the astonishment of all watching, the balloon
(A) hovers in place where it was released.
(B) rises noticeably away from the earth.
(C) falls noticeably towards the earth.
(D) drifts backwards opposite to the direction of the shuttle's velocity.

8. The bulb on the right has volume V contains N molecules (or equivalently n moles) of an ideal gas at temperature T. On the left hand side we have a cylindrical vessel containing a liquid of density ρ (volume mass density) in contact with the atmosphere at pressure p_0. What is the condition that h must obey in order for the piston not to move? You may assume that the cross sectional area of the cylinder is A. Also, the tube connecting the cylindrical vessel with the bulb is small compared to the cylindrical vessel and the bulb. The piston inside the tube is in black. ($Nk \equiv nR$)



(A) $\rho gh - p_0 = NkT/V$ (B) $p_0 + \rho hg = NkT/V$
(C) $p_0 + \rho gh = \frac{3}{2}NkT/V$ (D) none of the above

9. A weight is attached to the free end of a sonometer wire. It gives resonance at a length 40 cm when it is resonanced with a tuning fork of frequency 512. The weight is then immersed wholly in water, the resonant length is reduced to 30 cm. The relative density in which weight suspended is
(A) 16/9 (B) 16/7 (C) 16/5 (D) 16/3..

10. A tank of water has a pinhole leak in the side, 1 m below the water line. If the tank is open to the atmosphere (air pressure = 1.013×10^5 pa), how fast is the water leaving the pinhole?
(A) $\sqrt{g/4}$ (B) $\sqrt{g/0.1}$
(C) $\sqrt{2g}$ (D) $\sqrt{g}$

11. Find the correct statement from among the following.
(A) In planetary motion, total energy remains constant but total angular momentum may vary
(B) Both total energy and total angular momentum are constant in planetary motion and the total energy is negative
(C) Motion of a planet about the Sun and motion of an electron about an attracting nuclear centre are governed by identical relations and the total energy is always positive in both cases
(D) Both total energy and total angular momentum are constant in planetary motion and the total energy is positive.

12. 12 gm gas occupy a volume 4×10^3 m^3 at a temperature of 70°C. After the gas is heated at constant pressure its density becomes equal to 6×10^{-4} gm/cc. What is the temperature to which the gas was heated?
(A) 107°C (B) 1127°C
(C) 1000 K (D) 1200 K

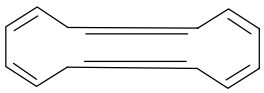
13. A projectile is thrown such that its range should be 1000 metres, but at highest point it breaks into two equal masses, one of whom falls vertically downwards. The other mass will fall at a distance
(A) 1500 metres from launching point
(B) 2000 metres from launching point
(C) 3000 metres from launching point (D) none

14. The element which have largest number of isotopes is
(A) silver-46 (B) nickel-48
(C) thorium-238 (D) radium-228.

15. The fourth state of matter is
(A) super fluid
(B) plasma
(C) liquid crystals
(D) small particles suspended in the gas.

16. The use of ^{12}C scale has suspended the older scale at atomic mass based on ^{16}O isotope, one important advantage of the former being
(A) the atomic masses on ^{12}C scale became whole number
(B) ^{12}C is more abundant in earth crust than ^{16}C
(C) the difference between the physical and chemical atomic masses got narrowed down significantly
(D) ^{12}C is situated midway between metals and non-metals in the periodic table.

17. Electric cookers have a coating that protects them against fire. The coating is made of
(A) magnesium oxide (B) heavy lead
(C) chromium oxide (D) nickel.

18.  is

(A) aromatic compound (B) annulene
(C) heterocyclic compound (D) polycyclic compound.

19. If the sun were suddenly replaced by a black hole of one solar mass, what would happen to the earth's orbit immediately after the replacement ?
(A) The earth would spiral into the black hole
(B) The earth would spiral out away from the black hole
(C) The radius of the earth's orbit would be unchanged, but the period of the earth's motion would increase.
(D) Neither the radius of the orbit nor the period would change

20. The chemistry of lithium is very much similar to that of magnesium even though they are placed in different groups. The reason is
(A) both have nearly the same size
(B) the ratio of their charge to size is nearly the same
(C) both have similar electronic configuration
(D) both are found together in nature.

21. Units and conversion factor errors are frequently the cause of engineering design failures (and wrong answers on tests and assignments in the case of engineering and science students!). One also encounters them in the popular press. For example, in the most recent edition of a book, a hectare is defined as 10000 m^2 or 2.5 acres or 15 soccer fields. The first two definitions are correct but not the third. Estimate the number of soccer fields in a hectare.
Remember that soccer field fit within a standard running track. Also soccer fields are about the same size as a football field.
(A) less than 1 (B) between 1 and 3
(C) between 3 and 5 (D) none of the above

22. A star initially has 10^{40} deuterons. It produces energy via the process
$_1H^2 + {}_1H^2 \rightarrow {}_1H^3 + p$ and $_1H^2 + {}_1H^3 \rightarrow {}_2He^4 + {}^1_0n$
If the average power radiated by the star is 10^{16} W, the deuteron supply of the star is exhausted in a time of the order of
(A) 10^6 second (B) 10^8 sec (C) 10^{12} sec (D) 10^{16} sec.

23. A double star consist of two stars having masses m and $2m$ seperated by a distance r, which of the following statement is correct ?

(A) Radius of circular path of star of mass $2m$ is $2r/3$

(B) Kinetic energy of $2m$ mass star is double that of lighter star

(C) Time period of revolution of both are not same

(D) Angular momentum of lighter star is more.

24. Atom may be regarded as comprising of protons, neutrons and electrons. If the mass attributed to a neutron were halved and that attributed to the electron were doubled, the atomic mass of ${}_6C^{12}$ would

(A) remain approximately the same

(B) be approximately doubled

(C) be approximately halved

(D) be reduced approximately by 25%.

25. A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends, the white ammonium chloride ring first formed will be

(A) at the centre of the tube

(B) near the hydrogen chloride bottle

(C) near the ammonium bottle

(D) throughout the length of the tube.

ANSWERS

Biology :	1.	(A)	2.	(B)	3.	(C)	4.	(A)	5.	(D)										
Physics – Chemistry :	6.	(B)	7.	(A)	8.	(B)	9.	(B)	10.	(C)	11.	(B)	12.	(B)	13.	(D)				
	14.	(B)	15.	(B)	16.	(C)	17.	(A)	18.	(B)	19.	(D)	20.	(B)	21.	(A)				
	22.	(C)	23.	(A)	24.	(D)	25.	(B)												