



UNIFIED COUNCIL

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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 12 (PCB)

Question Paper Code : UN449

KEY

1. C	2. B	3. D	4. C	5. D	6. D	7. B	8. D	9. D	10. Del
11. B	12. D	13. A	14. C	15. C	16. B	17. D	18. B	19. A	20. A
21. B	22. C	23. B	24. D	25. C	26. D	27. B	28. D	29. C	30. D
31. C	32. A	33. B	34. C	35. C	36. A	37. C	38. B	39. D	40. D
41. D	42. A	43. D	44. C	45. A	46. C	47. A	48. A	49. C	50. C
51. A	52. B	53. B	54. A	55. D	56. D	57. D	58. B	59. D	60. Del

SOLUTIONS

BIOLOGY

- (C)** Mitosis ends with two genetically identical diploid cells.
- (B)** Clostridium sps respire by anaerobic respiration.
- (D)** The main purpose of DNA replication is to copy genetic information
- (C)** Insects (such as bees and butterflies) and wind help in pollination

Earthworms are unable to help in pollination. They help to loosen and aerate the soil and speed up decomposition. Their droppings enrich the soil

- (D)** Due to non disjunction of extrachromosome result in down and klinefilter syndrome.
- (D)** Proteins are made up of amino acids.
- (B)** A rise in the levels of estrogen towards the end of the follicular phase caused a surge in level of L + 1 and FSH to release oocytes to be released from ovary.
- (D)** When excess fertilisers containing nitrates and phosphates are washed into a river, the concentration of these nutrients will increase by the growth of algae and aquatic plants. Eventually, an algal bloom develops on the surface but it will deprive submerged plants of

sunlight. When the submerged plants die, they will be decomposed by bacterial cells, which use up oxygen in the river. Eventually, other organisms such as fish and aquatic animals will die.

9. **(D)** The pollen grains from the male parts of the flower land on the stigma. Each pollen grain produces a tube. Pollen tubes grow downwards through the style to reach the ovule in the ovary. The male reproductive cells are inside the tips of the pollen tubes.

There is an egg cell inside each ovule. When a male reproductive cell in a pollen tube enters the ovule and fuses with the egg cell, fertilization takes place.

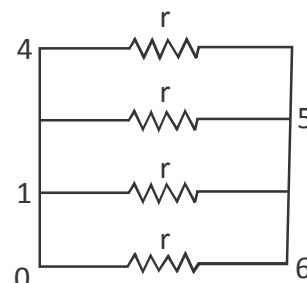
10. **(Delete)**
11. **(B)** During photosynthesis green plants use carbon dioxide to synthesise food.
12. **(D)** As DDT is insoluble in water, it will be stored in the fatty tissues of organisms that have consumed DDT. Hence the accumulation of DDT occurs in the bodies of the consumers and it will be passed down along the food chain, increasing the concentration along the trophic levels.
13. **(A)** The rat poison acts as a selection pressure and rats which are resistant to the poison will be selected for by natural selection. Overtime, the allelic frequency for resistant genes against the rat poison will increase in the population.
14. **(C)** Since bacterial cell are used, yeast cells are not required.
15. **(C)** ADH and Oxytocin are released from the posterior lobe of the pituitary gland.
16. **(B)** Homologous chromosomes behave independently during mitosis.
17. **(D)** Wind- Pollinated flowers are well adapted for pollination by having feathery stigma (to increase the surface area for capturing pollen a grains),

small and winged pollen grains (which increases their buoyancy in the air) and a pendulous filament (that allows the pollen grains to be dispersed by the air currents).

18. **(B)** Fact. During puberty, the hormone testosterone causes development of pubic and facial hair in males.
19. **(A)** Wings of a bird and wings of an insect are analogous organs.
20. **(A)** Varicella virus causes chicken pox
21. **(B)** Changes in heritable characteristics of population over successive generations support evolution.
22. **(C)** In the ovary of a chicken, special cells undergo mitosis producing identical cells. The daughter cells then start to divide by Meiosis. In leaf cell of a plant and in a human cheek cell, mitosis cell division takes place.
23. **(B)** Amniotic fluid acts as a shock absorber and helps to protect the foetus from mechanical injury.
24. **(D)** Chromosomes have DNA, Histone, Protein and Centromere.
25. **(C)** The fusion of a male gamete with the ovum in the embryo sac to form a diploid zygote is considered fertilisation.

PHYSICS

26. **(D)** The points 0, 1 and 4 have same potential and the points 5 and 6 have same potential. Therefore, the circuit may be reduced as shown below.



$$\text{Thus, } R_{16} = \frac{r}{4}$$

27. (B) Magnitude of the other field

$$= \frac{1.2 \times 10^{-2} \times \sin 15^\circ}{\sin 45^\circ} = 4.4 \times 10^{-3} \text{ T}$$

28. (D) Speed of infrared radiation in vacuum = $3 \times 10^8 \text{ m s}^{-1}$

$$v = \lambda f$$

$$3 \times 10^8 \text{ f}(2 \times 10^{-5})$$

$$f = 1.5 \times 10^{13} \text{ Hz}$$

29. (C) Intensity at the centre of bright fringe,

$$I_0 = I + I + 2\sqrt{I}I \cos 0^\circ$$

$$I_0 = 2I + 2I$$

$$I_0 = 4I$$

Intensity at a point distant $b/4$ (with a phase difference = $2p/4 = p/2$) is

$$I' = I + I + 2\sqrt{I}I \cos \frac{\pi}{2}$$

$$I' = 2I + 2\sqrt{I}I \times 0$$

$$I' = 2I$$

$$\therefore \frac{I_0}{I'} = \frac{4I}{2I} = 2$$

30. (D) The energy of the incident photons is

$$E = hf = (4.14 \times 10^{-15} \text{ eV} \cdot \text{s}) (7.2 \times 10^{15} \text{ Hz}) = 30 \text{ eV}$$

Since $E > f$, photoelectrons will be produced, with maximum kinetic energy

$$K_{\text{max}} = E - f = 30 \text{ eV} - 6 \text{ eV} = 24 \text{ eV}$$

31. (C) No. emf is induced in the parallel horizontal wires. Equal emf of same polarity is induced in the two parallel vertical wires. Hence, induced current is zero as two equal and opposite emf's are present in the loop.

32. (A) $R_1 = 30 \text{ W}$, $R_2 = 70 \text{ W}$

$$E_0 = 20 \text{ V},$$

$$E_{\text{rms}} = \frac{E_0}{\sqrt{2}} = \frac{20}{\sqrt{2}} = 14.14 \text{ V}$$

$$I_{\text{rms}} = \frac{E_{\text{rms}}}{\text{Total resistance}}$$

$$= \frac{14.14}{30 + 70} = 0.1414 \text{ A}$$

Power developed across R_2

$$= I_{\text{rms}}^2 \times R_2 = (0.1414)^2 \times 70 = 1.4 \text{ W.}$$

33. (B) Magnetic field due to ADB is

$$B_1 = \left(\frac{\theta}{2\pi} \right) \frac{\mu_0 i}{2a}$$

(Perpendicular to paper outwards)

and magnetic field due to ACB is

$$B_2 = \left(\frac{2\pi - \theta}{2\pi} \right) \frac{\mu_0 i}{2a}$$

(Perpendicular to paper inwards)

$$\therefore B_{\text{net}} = B_2 - B_1 = \left(\frac{\pi - \theta}{\pi} \right) \frac{\mu_0 i}{2a}$$

(Perpendicular to paper in wards)

34. (C) $F = \frac{1}{4\pi \epsilon_0} \cdot \frac{q_1 q_2}{r^2}$ or $q_1 q_2 = 4\pi \epsilon_0 F r^2$

Setting $F = 0.075 \text{ N}$ and $r = 3 \text{ m}$, we get $q_1 q_2 = 7.5 \times 10^{-11}$ (i)

Also, $q_1 + q_2 = 20 \text{ mC} = 20 \times 10^{-6} \text{ C}$..(ii)

From the equations (i) and (ii), it can be obtained that

$$q_1 = 15 \times 10^{-6} \text{ C} \text{ and } q_2 = 5 \times 10^{-6} \text{ C}$$

35. (C) $m = 0.254 \text{ kg}$, $I = 100 \text{ A}$, $t = ?$

$$t = \frac{m}{z \cdot I}, \quad z = \frac{E}{F} = \frac{M}{pF}$$

Atomic mass of copper = $M = 63.5 \times 10^{-3} \text{ kg}$

Valency = $p = 2$

1 Faraday = $F = 96500 \text{ C}$

$$z = \frac{M}{pF} = \frac{63.5 \times 10^{-3}}{2 \times 96500} = 3.29 \times 10^{-7} \text{ kg C}^{-1}$$

$$t = \frac{m}{z \cdot I} = \frac{0.254}{3.29 \times 10^{-7} \times 100} = 7720.3 \text{ second.}$$

36. (A) $R = \rho(4l / \pi d^2)$

Therefore, $R \propto l/d^2$

Hence, $R_1 : R_2 : R_3$

$$= \frac{2}{3^2} : \frac{3}{4^2} : \frac{4}{5^2} = \frac{2}{9} : \frac{3}{16} : \frac{4}{25}$$

Currents are in the inverse ratio of resistances.

$$i_1 : i_2 : i_3 = \frac{9}{2} : \frac{16}{3} : \frac{25}{4} = 54 : 64 : 75$$

or $i_1 = 54k$, $i_2 = 64k$ and $i_3 = 75k$

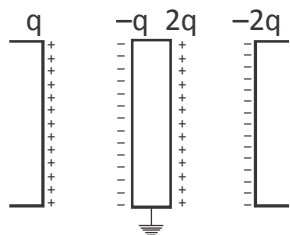
Where k is the common ratio.

$$\text{But } i_1 + i_2 + i_3 = 5$$

$$54k + 64k + 75k = 5 \text{ or } k = 5/193$$

$$i_1 = \frac{270}{193} \text{ A}, i_2 = \frac{320}{193} \text{ A}, i_3 = \frac{375}{193} \text{ A}$$

37. (C) In steady state the following charges will appear on different faces of the plates.



Net charge on central plate is $+q$. Thus, $+q$ charge will flow through the switch.

38. (B) The distance of closest approach is

$$\text{given by } r_0 = \frac{1}{4\pi \epsilon_0} \cdot \frac{2Ze^2}{\frac{1}{2}m u^2}$$

$$\text{Here, } Z = 79; \frac{1}{2}m u^2 = 5 \text{ MeV} = 5 \times 1.6 \times 10^{-13} \text{ J}$$

$$\text{We know, } e = 1.6 \times 10^{-19} \text{ C}$$

$$\therefore r_0 = 9 \times 10^9 \times \frac{2 \times 79 \times (1.6 \times 10^{-19})^2}{5 \times 1.6 \times 10^{-13}}$$

$$= 4.55 \times 10^{-14} \text{ m}$$

39. (D) The lens maker's formula is :

$$\frac{1}{f} \left(\frac{n_L}{n_m} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

Where n_L = Refractive index of lens and

n_m = Refractive index of medium.

In case of double concave lens, R_1 is negative and R_2 is positive. Therefore,

$$\left(\frac{1}{R_1} - \frac{1}{R_2} \right) \text{ will be negative.}$$

For the lens to be diverging in nature, focal length 'f' should be negative or

$$\left(\frac{n_L}{n_m} - 1 \right) \text{ should be positive or } n_L > n_m$$

but since $n_2 > n_1$ (given), therefore the lens should be filled with L_2 and immersed in L_1 .

40. (D) Series $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$

Effective capacitance

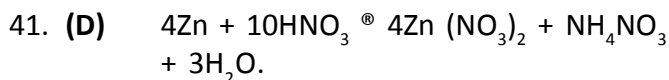
$$= C_s = \frac{C}{n} = \frac{5\mu\text{F}}{5} = 1 \mu\text{F}$$

$$\text{Parallel } C_p = C_1 + C_2 + \dots$$

$$\text{Effective capacitance} = C_p = nC$$

$$= 5 \times 5 \text{ mF} = 25 \text{ mF.}$$

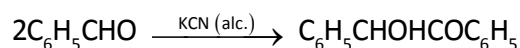
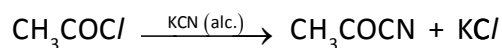
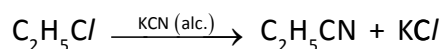
CHEMISTRY



42. (A) Here, Mn is in +7 state. The atomic number of Mn is 25. So, the electronic configuration of Mn^{7+} is $1s^2 2s^2 3s^2 3p^6$. Thus, there is no electron in its d orbital.

43. (D) Difluoroacetic acid is the strongest acid out of the given acids. Hence, it ionizes maximum and therefore, has highest electrical conductivity.

44. (C) Ethyl chloride and acetyl chloride react with alc. KCN by nucleophilic substitution reaction while benzaldehyde undergoes benzoin condensation.



Thus, only chlorobenzene does not react.

45. (A) NaCl changes into CsCl type (6:6 to 8:8) on applying pressure.

46. (C) Addition of an electron to a negatively charged species is not a favourable process. So, energy is absorbed in such a step.

47. (A) Only Na reacts with both ethanol and phenol. In contrast, NaOH/I₂ reacts only with ethanol while neutral FeCl₃ and Br₂/H₂O react in the presence of conc. H₂SO₄ with phenol only.

48. (A) Number of moles of acetic acid

$$= \frac{0.6 \text{ mL} \times 1.06 \text{ g mL}^{-1}}{60 \text{ g mol}^{-1}}$$

$$= 0.0106 \text{ mol} = n$$

$$\text{Molality} = \frac{0.0106 \text{ mol}}{1000 \text{ mL} \times 1 \text{ g mL}^{-1}}$$

$$= 0.0106 \text{ mol kg}^{-1}$$

$$\text{DT}_f = 1.86 \text{ K kg mol}^{-1} \times 0.0106 \text{ mol kg}^{-1}$$

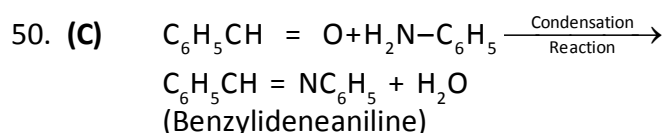
$$= 0.0197 \text{ K}$$

van't Hoff factor (i)

$$= \frac{\text{Observed freezing point}}{\text{Calculated freezing point}} = \frac{0.0205 \text{ K}}{0.0197 \text{ K}}$$

$$= 1.041$$

49. (C) Heats of adsorption in physisorption lie in the range 10 – 40 kJ mol⁻¹.



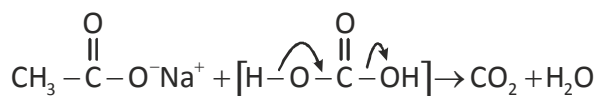
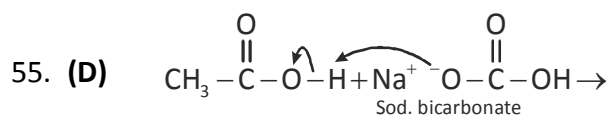
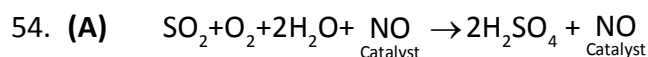
51. (A) Both Zn and Hg react with air (oxygen) on heating to form ZnO and HgO. All other properties are shown by Zn but not Hg.

52. (B) S_N1 reaction leads to racemisation.

53. (B) Rate = rate of disappearance of A per mole.

$$= -\frac{1}{2} \frac{\Delta[A]}{\Delta t} = -\frac{1}{2} \frac{(0.5 - 0.4)}{10} = -0.005$$

The negative sign simply indicates the fall in concentration of A. Thus ignoring the negative sign, the rate of the reaction is 0.005 mole/litre/minute.



Thus, C of CO₂ comes from bicarbonate.

CRITICAL THINKING

56. (D)

57. (D) If Geetha is older than Manish and Rohan is older than Geetha, then Manish has to be the youngest of the three. Choice b is clearly wrong because Rohan is the oldest. There is no information in the paragraph to support either choice a or choice c.

58. (B) Clearly, damage to crops due to high temperature may have resulted in a short supply of vegetables and hence an increase in their prices.

59. (D) The woman is the mother of Sharikh's granddaughter. Hence, the woman is the daughter-in-law of Sharukh.

60. (Delete)