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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION - UN412

Solutions for Class : 10

Mathematics

1. **(A)** $p^2 - q^2 = 4\cos\theta \cot\theta = 4\cos^2\theta/\sin\theta$

$\Rightarrow (p^2 - q^2)^2 = 16\cos^4\theta/\sin^2\theta$

$pq = \cot^2\theta - \cos^2\theta$

$$= \cos^2\theta\left(\frac{1-\sin^2\theta}{\sin^2\theta}\right) = \frac{\cos^4\theta}{\sin^2\theta}$$

$\therefore\ (p^2 - q^2)^2 = \mathbf{16\ pq}$

2. **(C)** Probability of drawing green ball

$= 3 \times$ probability of drawing red ball

$$\Rightarrow \frac{n}{5+n} = \frac{3\times 5}{5+n}$$

$\Rightarrow n = 15$

$\therefore$ Total no. of balls = 5 + 15 = **20**

3. **(B)** $\Delta CDE \sim BAE$

$$\therefore \frac{CD}{AB} = \frac{ED}{AE}$$

$$\Rightarrow \frac{9}{3} = \frac{ED}{AE}$$

$$\Rightarrow 3 + 1 = \frac{ED}{AE} + 1$$

$$\Rightarrow 4 = \frac{ED + AE}{AE}$$

$$\Rightarrow 4 = \frac{AD}{AE}$$

$$\Rightarrow AE = \frac{4}{4} = 1\text{ cm}$$

$$\therefore \text{Area of } \Delta\ AEC = \frac{1}{2}\times AE \times CD$$

$$= \frac{1}{2}\times 1\times 9$$

$= \mathbf{4.5\ cm^2}$

4. **(C)** The required ratio

$$= \frac{2(8\times4+4\times2+8\times2)}{(8\times4\times2).2(1\times1+1\times1+1\times1)} = \mathbf{7:24}$$

5. **(D)** $xy = 96050$ .... (i)

$xz = 95625$ .... (ii)

$\Rightarrow \dfrac{y}{z} = \dfrac{3842}{3825}$ [Dividing (i) by (ii)] .... (iii)

and $y - z = 1$

$\Rightarrow y = z + 1$ .... (iv)

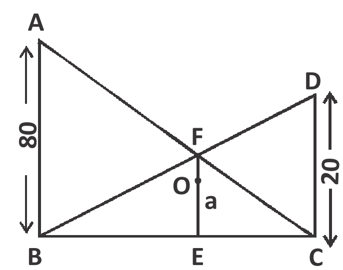
from eq. (iii) and (iv), we get z = 225

6. **(B)** As 'c' is factor of ab and 'a' is factor of ab as c and a are coprime, so ca is factor of ab then, if ab = (ca) x for $x \in$ N, then b = cx.

$\therefore$ c is a factor of b.

7. **(C)** $\Delta ABC \cong \Delta DCB$,

$$\therefore \frac{AF}{CF} = \frac{AB}{CD} = \frac{80}{20} = \frac{4}{1}$$



$$\Rightarrow \frac{AF}{CF} = \frac{4}{1}$$

$$\Rightarrow \frac{AF+FC}{FC} = \frac{4+1}{1} = \frac{5}{1}$$

$\Delta ABC \sim \Delta FEC$ [Since AB and FE are parallel]

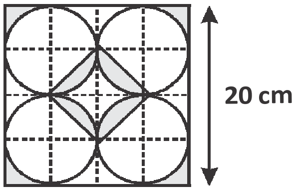
$$\Rightarrow \frac{AB}{FE} = \frac{AC}{FC}$$

$$\Rightarrow \frac{80}{FE} = \frac{5}{1}$$

FE = 16

Hence, the value of a = **16 m**

8. **(D)**



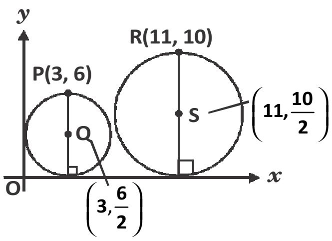
Area of square = 20 cm $\times$ 20 cm = 400 cm^2

Out of 16 parts, 2 are shaded.

$\therefore$ Area of unshaded region = $\frac{14}{16} \times 400\,\text{cm}^2$

= **350 cm²**

9. **(B)**



$\therefore$ Slope of QS = $\frac{5-3}{11-3} = \frac{2}{8} = \mathbf{\frac{1}{4}}$

10. **(A)** Let a be the first term and d be the common difference of A.P.

Since $a_9 = 99$

$\therefore\ a + 8d = 99$ ..... (i)

Also, $a_{99} = 9$

$\therefore\ a + 98d = 9$ ..... (ii)

Subtracting (ii) from (i)

$\Rightarrow -90\,d = 90$

$\therefore\ d = -1$

Substituting this value of d in (i)

$a + 8(-1) = 99$

$\Rightarrow\ a = 99 + 8 = 107$

$\therefore\ a_{108} = a + (108 - 1)\,d$

$= 107 + 107\,(-1) = \mathbf{0}$

11. (Del) Correct answer is 3.

12. **(B)** The whole surface area of the remaining solid = $\pi RL + \pi r l + \pi[R^2 - r^2]$

$= \pi[6 \times \sqrt{36+28} + 3 \times \sqrt{9+7} + (36-9)]$

$= \pi[6 \times 8 + 3 \times 4 + 27] = \mathbf{87\,\pi\,cm^2}$

13. **(A)** $360^\circ - 25^\circ - 25^\circ = 310^\circ$

Radius of circle = 20 cm $\div$ 2 = 10 cm

Area of circle $= \pi r^2$
$= 3.14 \times 10\,\text{cm} \times 10\,\text{cm} = 314\,\text{cm}^2$

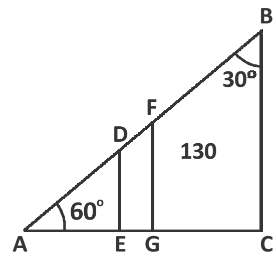
Area of shaded part

$= \frac{310^\circ}{360^\circ} \times 314\,\text{cm}^2 = \mathbf{270\frac{7}{18}\ cm^2}$

14. **(C)** Median of the slopes of

$\overline{OA}, \overline{OB}, \overline{OC}, \overline{OD}, \overline{OE}$ = slope of $\overline{\mathbf{OC}} = \mathbf{\frac{3}{4}}$

15. **(C)** Let AB be the ladder inclined at an angle of 30° with the wall BC.



After one second the man will be at D such that AD = 2 m.

$\therefore$ AE = AD cos 60° = $2 \times \frac{1}{2} = 1\text{m}$

Similarly after 2 seconds, the man will be at F such that AF = 4 m.

$\therefore$ AG = 2 m

Thus after every second, the man is approaching the wall a distance equal to 1 m, i.e., at **1 m/sec.**

16. **(A)** Given parabolic equation is $y = 3x^2 + 12x - 2$

$\frac{-b}{2a} = \frac{-12}{6} = -2$

$y = f(2) = 12 - 24 - 2 = -14$

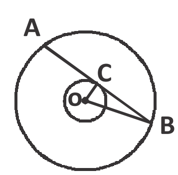
$\therefore$ Vertex of the parabola = (–2, –14)

$\therefore$ The axis of symmetry is $\boldsymbol{x = -2}$

17. **(C)** Product of 'm' numbers = (H.C.F. of pairs)$^{m-1}$ $\times$ L.C.M. of 'm' numbers.

Hence, product of 4 numbers = $(3)^{4-1} \times 126$
= **3402**

18. **(B)** Given AB = 6 m $\Rightarrow$ AC = CB = 3 m



Since, the radius of two circles are integers, then for OC = 4 m and OB = 5 m, the value of CB is 3 m

$\therefore$ The radius of inner circle is 4 m.

19. **(B)** $ax^2 + bx + 1 = 0$ has real roots if

$b^2 - 4a \geq 0$

Value of a	Corresponding value of b for which $b^2 - 4a \geq 0$	no. of ways
1	2, 3, 4	3
2	3, 4	2
3	4	1
4	4	1

Total number of ways = **7**

20. **(C)** $\tan(\alpha+\beta) = \dfrac{m/m+1+1/2m+1}{1-(m/m+1))(1/2m+1)}$

$$= \frac{2m^2+m+m+1}{2m^2+2m+m+1-m}$$

$$= \frac{2m^2+2m+1}{2m^2+2m+1} = 1$$

$\therefore$ $\boldsymbol{\alpha+\beta = \pi/4}$

21. **(D)** In option (D), the slope is negative and y-interept is positive.

22. **(C)** In ΔABC, $\angle$ACE = $\angle$ABC + $\angle$BAC

Similarly in

ΔBCD, $\angle$BDC = $\angle$DCE $-$ $\angle$DBC

[Ext. angle prop. of a Δ]

But $\angle DCE = \dfrac{1}{2}\angle ACE$ and

$\angle DBC = \dfrac{1}{2}\angle ABC$

Now, $\angle$BDC = $\angle$DCE $-$ $\angle$DBC

$= \dfrac{1}{2}\angle ACE - \dfrac{1}{2}\angle ABC$

$= \dfrac{1}{2}(\angle ACE - \angle ABC)$

$= \dfrac{1}{2}(\angle ACE + \angle BAC - \angle ACE)$

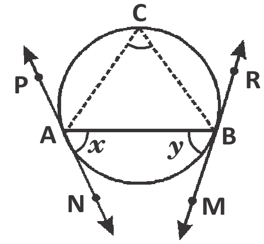
$\therefore \angle BDC = \boldsymbol{\dfrac{1}{2}\angle BAC}$

23. **(C)**

a	b	c	d	a + b + c + d	(a + 1) (b + 1) (c + 1) (d + 1)
1	1	1	1	4	(2) (2) (2) (2) = 16
2	1	1	0	4	(3) (2) (2) (1) = 12
3	1	0	0	4	(4) (2) (1) (1) = 8

Hence, maximum value of (a + 1) (b + 1) (c + 1) (d + c) is **16**.

24. **(D)** Take any point C on circle and join C to A and B.



Now $\angle$ACB = x (angle in alternate segment)

$\angle$ACB = y (angle is in alternate segment)

$\Rightarrow$ $\boldsymbol{x = y}$

25. **(A)** Let p(x) = $x^4 - a^2x^2 + 3x - a$.

Since x + a, i.e. x – (–a) is a factor of p(x), we must have p(–a) = 0

$\Rightarrow$ $(-a)^4 - a^2(-a)^2 + 3(-a) - a = 0$

$\Rightarrow$ $a^4 - a^4 - 3a - a = 0$

$\Rightarrow$ $-4a = 0$

$\Rightarrow$ **a = 0**

Physics

26. **(C)** If two resistors (a and b) are connected in series, the value of the total resistance will be a + b.

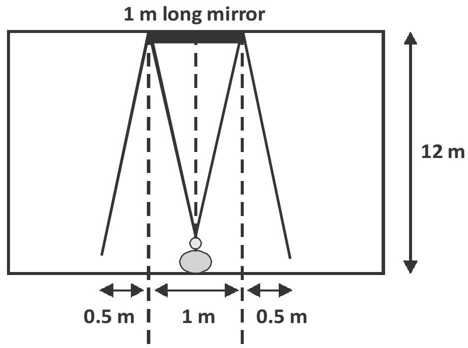
If two resistors (a and b) are connected in parallel, the value of the total resistance will be $\dfrac{a \times b}{a+b}$.

Using different combinations of 3, 4 and 6 ohm resistors, we can make new resistors with the following values:

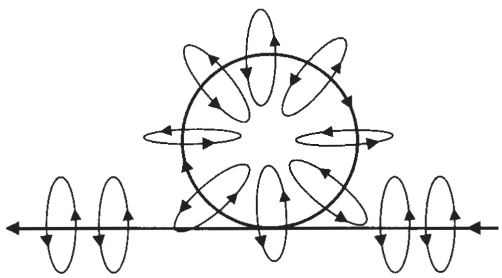
- 9 ohms : 3 ohms and 6 ohms in series, $3+6=9$
- 2.4 ohms : 4 ohms and 6 ohms in parallel, $\dfrac{4\times6}{4+6} = \dfrac{24}{10} = 2.4$
- 2 ohms : 3 ohms and 6 ohms in parallel, $\dfrac{3\times6}{3+6} = \dfrac{18}{9} = 2$

There is no combination that can produce a total resistance of 8 ohms.

27. **(B)** Assume that the painter is facing the centre of the mirror. To see the maximum range, he has to look at the two extreme ends of the mirror. By applying the laws of reflection, angle of incidence = angle of reflection as per the figure given below, the maximum length of painted wall, the painter can see is 2 m.



28. **(A)** When the current-carrying wire is being coiled up, the circular magnetic field produced by portion on the straight wire is being concentrated in the core of the coil. This will produce a stronger magnetic field strength.



29. **(C)** (i) The light coming from the objects enters the human eye through cornea (X). Just behind the cornea is the iris. There is a hole in the middle of the iris called pupil.

(ii) The lens lies behind the pupil (Y). It is convex, transparent, soft and flexible. It is held in proper position with the help of suspensory ligaments at one end and ciliary muscles at the other end.

(iii) The space between the cornea and the lens is filled with aqueous humour.

(iv) The focal length of the convex lens present inside the eye can be changed (made thicker / thinner) by the action of ciliary muscles.

(v) The space between the lens and the retina is filled with vitreous humour.

(vi) Behind the lens is the natural screen called retina (Z) on which the image is formed. It is conveyed to the brain through the optic nerve in the form of electrical signals.

30. **(A)** Statements (B), (C) and (D) are the best ways to increase the efficient use of various sources of energy.

31. **(C)** Only image projector emits light rays on a screen and forms real images.

The image formed in the plane mirror is virtual and erect.

The image formed by a magnifying glass (convex lens) is also virtual and erect.

32. **(C)** Using Ohm's law, $\frac{V}{I} = R$

$$\therefore\ V = I \times R = \frac{Q}{t} \times R$$

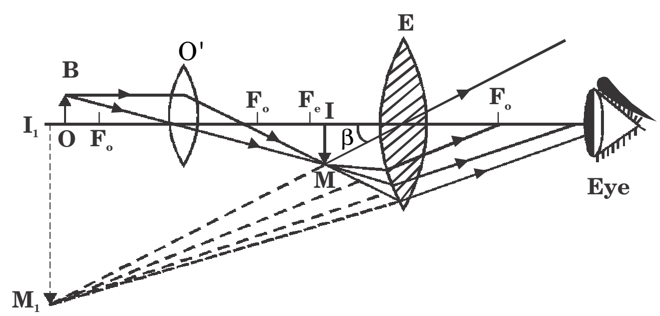
$$\therefore\ V = \frac{200}{25} \times 20 = 160\ V$$

33. **(D)** All the statements are true.

34. **(B)** The slip rings are used to prevent entanglement of the wires in the external circuit.

35. **(C)** Two convex lenses of focal lengths 5 cm and 7 cm respectively are used to construct a compound microscope.

A compound microscope consists of two converging lenses, (i) the objective O', and (ii) the eyepiece E. The lens facing the object is called the objective and the lens close to the eye is called the eyepiece. The objective is of very short focal length and has a smaller aperture than the eyepiece. The eyepiece is also of short focal length but of large aperture. The objective is a combination of two lenses, which acts as a converging lens. The eyepiece is a combination of two lenses separated by a small distance. The focal length of the eyepiece is slightly greater than that of the objective. The two lenses are placed coaxially at the ends of an adjustable tube. The distance between the two lenses can be adjusted.



The object OB is placed just beyond the focus of the objective, which forms a real, inverted and magnified image. This image is formed within the focus of the eyepiece, which produces a virtual, erect and magnified image. The final image I_1M_1 is adjusted to be formed at the least distance of distinct vision. The eyepiece acts as a magnifier.

36. **(C)** Renewable sources of energy are sunlight, tidal waves, ethanol fuel, wood and wind while non-renewable sources of energy are coal, natural gas and petroleum.

37. **(D)** The human eye ball is almost spherical and has a thick, tough coating called sclerotic on the external side. About 5/6th of this

portion is opaque and the remaining part is in front of the eye which is a transparent structure called the cornea. The coating within the sclerotic is called choroid which consists of black pigment cells. Choroid absorbs light and prevents the reflection of light within the eyeball.

38. **(B)** One of the factors that determines the strength of the electromagnet is the number of coils per unit length. The more concentrated the coils are being packed, the stronger will be the magnetic field strength.

39. **(D)** To reproduce a similar print, the real image must be the same size as the object. It can only be achieved when u = 2f. This implies that u = 12 cm.

40. **(C)** $I = V \div R$

$= 1200 \div 240 = 5\ A$

The operating current of the heater is 5 A. The fuse should be slightly higher than the operating current. The function of the fuse is to allow operating current to flow through but melts when the current becomes too high so as to protect the equipment from being damaged by the undesirably high current.

The next higher rate of fuse is the 10 A fuse.

41. **(A)** Statements (i) and (ii) are true for carnivores.

(i) Human beings and all the predators like tiger, lion, cheetah etc. have their eyes in front of the head.

(ii) The two eyes are a few centimetres apart from each other. Due to this reason, the two eyes see the same object from two slightly different angles and send two slightly different images of the same object to the brain.

(iii) The brain combines these two slightly different images to build a three dimensional picture of the object which enables us and animals to judge the distance of the object more accurately.

(iv) Most of the animals have a large field of view to see around due to binocular vision but not monocular vision.

42. **(D)** Earth wire connects the conducting casing of the appliance to the ground. It is used to conduct any leaked charges from the conducting casing of the appliance to the ground. This prevents people from getting an electric shock should there be a leakage of charges.

43. **(C)** When light travels through optical fibre, total internal reflection takes place and not refraction.

44. **(C)** Doubling the length of the wire will double the resistance. ($R \propto L$).

Doubling the cross-sectional area of the wire will have the resistance. $\left(R \propto \frac{1}{A}\right)$.

Resistance of the wire which is 4 m and has 2 mm^2 cross-sectional area.

$$16 \times 2 \times \frac{1}{2} = 16\ \Omega$$

45. **(C)** (i) The distance between the optical centre (O) of the convex lens and object placed at 'X' is the object distance OX.

(ii) The distance between the optical centre (O) and principal focus 'Y' of the convex lens is the focal length - OY.

(iii) A ray of light parallel to the principal axis of a convex lens passes through its focus after refraction through the lens. The distance between the optical centre (O) of the convex lens to the point where the image 'Z' is formed is the image distance - OZ.

46. **(A)** Iron is a soft magnetic material which can be easily magnetised and demagnetised. It is used as an electromagnet.

Steel is a hard magnetic material which cannot be easily magnetised nor demagnetised. It is used as a permanent magnet.

47. **(A)** Tungsten has a melting point higher than 3000 °C.

When the filament is so hot that it produces white light, its temperature must be greater than 2500 °C. The material of the filament must have a melting point higher than 2500 °C.

Option (B): Tungsten has high resistance to allow high current to pass through.

When a material has high resistance, the current flowing through it is low (with other factors held constant).

Option (C): Tungsten has high mass so that more thermal energy can be stored in the filament.

When a material has high mass, more thermal energy is required to increase its temperature. The filament would need more energy to produce the same brightness.

Option (D): Tungsten has high specific heat capacity so that small amount of heat can increase the temperature to a large extent.

When a material has high specific heat capacity, it requires more energy to increase its temperature.

48. **(A)** Focal length f is 15 cm.

Object distance u is 31 cm.

For u > 2f, the image formed will be real, inverted and diminished.

49. **(B)** The safest method to dispose radioactive wastes is given below.

The radioactive wastes must be kept in a thick, lead containers with narrow mouth and plugged with thick lead corks. These containers can be buried under the sea.

50. **(B)** Resistance of the appliance

$= V \div I = 240\text{ V} \div 2\text{A} = 120\ \Omega$

Current flowing through the appliance at 120 V supply = $V \div R$

$= 120\text{ V} \div 120\ \Omega = 1\text{ A}$

Power of appliance = I^2R

$= (1)^2 \times (120) = 120\text{ W}$

<u>Chemistry</u>

51. **(C)** Noble gases are elements of Group 18. They exist as monoatomic gases because their outermost shells are filled with two or eight electrons as shown below.

Element	Atomic Number	Electron Arrangement
Helium	2	2
Neon	10	2, 8
Argon	18	2, 8, 8
Krypton	36	2, 8, 18, 8
Xenon	54	2, 8, 18, 18, 8
Radon	86	2, 8, 18, 18, 32, 8

52. **(A)** Metals react with dilute hydrochloric acid to give metal chlorides and hydrogen gas is released. Based on the reactivity series of metals, sodium is the most reactive metal followed by magnesium and zinc.

(i) Sodium metal is very reactive. It reacts violently with dilute hydrochloric acid to form sodium chloride and hydrogen.

(ii) Magnesium metal is less reactive than sodium. It reacts quite rapidly with dilute hydrochloric acid to form magnesium chloride and hydrogen.

(iii) Zinc metal is less reactive than magnesium and aluminium. It reacts less rapidly with dilute hydrochloric acid to form zinc chloride and hydrogen.

As the reactivity of metals decreases from sodium to zinc, sodium metal releases hydrogen gas faster followed by magnesium and zinc.

53. **(A)** Chemical reaction between aluminium and iron (III) oxide is balanced. Both being metals are solids as reactants.

When iron (III) oxide is heated with aluminium powder, then aluminium oxide and iron metal (molten) is formed.

In this displacement reaction, a more reactive metal, aluminium, is displacing a less reactive metal, iron, from its oxide, iron (III) oxide. So much heat is produced in this reaction that iron is obtained in the molten state (liquid state).

(B) Chemical reaction is balanced but iron being a metal is shown as (g) gas, which is not correct.

(C) Chemical reaction is not balanced on the reactants side (Aluminium) and aluminium oxide being a metallic oxide is represented as gas, which is not correct.

(D) Chemical reaction is not balanced as less number of iron atoms are shown on products side.

54. **(C)** (i) Hydrochloric acid is a strong acid and the pH of this acid lies between 0 to 3 on the pH scale. Strong acids completely ionise in water to form a large number of H^+ ions.

(ii) Ethanoic acid is a weak acid and its pH is above 3 on the pH scale. Weak acids do not ionise completely in water and produce a small number of H^+ ions

(iii) HCl is a strong acid and it ionises completely to form H^+ and Cl^- ions respectively. CH_3COOH is a weak acid because it does not ionise completely. It forms CH_3COO^- (Acetate ion) and H^+ (ion respectively. The difference in pH value between the two acids is ionisation. So, the degree of ionisation is less in ethanoic acid than that of hydrochloric acid.

55. **(C)** Hydrocarbon 'X' must be an unsaturated hydrocarbon with a C=C bond i.e. an alkene C_5H_{10} (pentene). C_2H_6, C_3H_8 and C_7H_{16} are saturated hydrocarbons in the homologous series of alkanes.

56. **(C)** To prevent oxidation of fried foods, the following methods must be adopted.

(i) Adding antioxidants like butylated hydroxy-anisole or butylated hydroxy toluene to food substances before frying them in oil.

(ii) Storing fried foods in air-tight containers prevents the contact of food with oxygen. Absence of light slows down the oxidation of oil and fats in fried foods.

(iii) Filling the huge bags / containers in which the fried foods would be stored with nitrogen gas.

57. **(C)** The ore from which manganese is extracted is pyrolusite.

Haematite - Iron

Bauxite - Aluminium

Calamine - Zinc

58. **(C)** The given chemical reaction is used in the manufacture/preparation of soap.

Vegetable oil (Castor, cotton, linseed or soyabean oil) + Alkali (Sodium hydroxide) $\xrightarrow{\Delta}$ Soap (Sodium salt of fatty acid) + Glycerol (P) (An alcohol)

So, 'P' is glycerol.

59. **(D)** Acidic oxide : SO_2, CO_2

Amphoteric oxide : Al_2O_3

Basic oxide : Na_2O , MgO

60. **(D)** Chemical equation for complete combustion of methanol is given in option (D).

Chemical equations given in options (A), (B) and (C) show incomplete combustion of methanol.

61. **(A)** From Li to C, the elements use 1 to 4 electrons for bonding respectively. However, from C to F, the number of electrons used declines from 4 to 1. Ne does not form any compound readily since it is a noble gas.

62. **(A)** Option (A) gives the correct balanced equation as per the numbers given under (i), (ii), (iii) and (iv) respectively as shown below.

(i) PbS + (ii) $4H_2O_2 \rightarrow$ (iii) $PbSO_4$ + (iv) $4H_2O$

63. **(D)** Reactive metal oxides form more stable oxides. Zinc is the most reactive metal and lead the least reactive of the three metals given.

64. **(D)** $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

The white solid is Na_2CO_3.

65. **(C)** Combustion of ethanol :

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

Manufacture of ethanol:

$C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(l)$

Fermentation of glucose :

$$C_6H_{12}O_6 \xrightarrow{\text{Yeast, absence of air}} 2CO_2 + 2C_2H_5OH$$

Oxidation of ethanol:

$C_2H_5OH + 2[O] \rightarrow CH_3COOH + H_2O$

66. **(D)** The bond formed between two oppositely charged ions is ionic or electrovalent bond, Mg^{+2} and O^{-2} .

Two chlorine atoms and two hydrogen atoms separately form a single covalent bond as shown below.

$Cl + Cl \rightarrow Cl_2$ $\quad$ $Cl - Cl$

$H + H \rightarrow H_2$ $\quad$ $H - H$

Carbon dioxide forms a double covalent bond O = C = O.

Transfer of electrons

Mg : (Magnesium atom, 2, 8, 2) + $\ddot{\underset{..}{O}}$: (Oxygen atom, 2,6) $\longrightarrow$

Mg^{2+} (Magnesium ion, 2, 8) $[:\ddot{\underset{..}{O}}:]^{2-}$ (Oxide ion, 2,8) or MgO

$\underbrace{\hspace{6em}}_{\text{Magnesium oxide}}$

We find that the magnesium ion has 2 units of positive charge whereas the oxide ion has 2 units of negative charge. The oppositely charged magnesium ions, Mg^{2+}, and oxide ions O^{2-}, are held together by a strong force of electrostatic attraction to form magnesium oxide compound $Mg^{2+}O^{2-}$ or MgO. Thus, magnesium oxide contains ionic bonds.

67. **(B)**

	First liquid pH	Second liquid pH
(A)	5	2
(B)	5	12
(C)	6	1
(D)	14	7

In options (A) and (C), the solutions are acidic (pH < 7). When mixed, the pH of the resulting solution will also be acidic. In option (D), the first solution is alkaline while the second one is neutral. When they are mixed, the resulting solution will be alkaline.

68. **(D)** Metals tend to form basic oxides while non-metals tend to form acidic oxides. Hence, Y is a metal and X is a non-metal. Z would be between the 2 elements since the oxide is amphoteric.

69. **(D)** The given structural formula is of a detergent. A detergent has a large non-ionic hydrocarbon group and an ionic group like sulphonate group SO_3^- Na^+, or sulphate group. SO_4^- Na^+. The structure

$CH_3 - (CH_2)_{10} - CH_2 - SO_4^-$ Na^+ is of sodium n-dodecyl sulphate.

70. **(A)** X : Oxidation reaction

The conversion of C_2H_5OH to CH_3CO_2H involves the removal of H and addition of O.

$C_2H_5OH + 2[O] \rightarrow CH_3CO_2H + H_2O$

Y : Acid/base reaction

$CH_3CO_2H + NaOH \rightarrow CH_3CO_2^-Na^+ + H_2O$

Z : Esterification

$CH_3CO_2H + C_2H_5OH \rightarrow CH_3CO_2C_2H_5 + H_2O$

Biology

71. **(D)** Photosynthesis takes place in green plants by the absorption of water and carbon dioxide in the presence of sunlight and chlorophyll pigment by the liberation of oxygen and produce carbohydrates.

72. **(C)** Some of the energy in each level of food chain is lost as heat. Hence, not all the energy from living things is transfered to living thing C.

73. **(A)** Peripheral nervous system consists of cranial and spinal nerves.

74. **(A)** The arrows (showing) labelled as P and Q blood vessels carries oxygen rich blood.

75. **(B)** The sex of a baby is determined by the X and Y chromosomes. Females have two X chromosomes. Males have one X and one Y chromosome.

Each parent gives one copy of their chromosome to the baby.

Female \ Male	X	Y
X	XX	XY
X	XX	XY

50% Male, 50% Female

76. **(B)** The swollen part above the girdle is due to the accumulation of food in phloem.

77. **(B)** **Rice plant ⟶ Grasshopper ⟶ Frog ⟶ Snake ⟶ Eagle**

78. **(D)** Earthworm is a hermaphrodite.

79. **(A)** F is the adrenal gland. It releases adrenline which responds to stress, for example , sugar is released studdenly to enable us to run fast and escape when there is danger.

80. **(C)** In the given flowchart E represents Fertilisation and F Mitosis

81. **(A)** The genetic material found in a sperm can be 22 + X or 22 + Y

82. **(B)** Heat energy that is lost from the body cannot be returned to the ecosystems and recycled.

83. **(B)** Medulla oblongata controls breathing rate and regulates blood pressure.

84. **(A)** In human beings fertilisation occurs in fallopian tubes and implantation in uterus.

85. **(D)** Under the sun plants perform photosynthesis and releases oxygen hence the limewater remains colourless.

86. **(C)** Oxygen is helpful to oxidised or burn the food in our body to release energy.

87. **(C)** The arrow labelled 'X' is pulmonary artery. It carries impure blood rich in carbon dioxide from heart to lungs.

88. **(A)** Movement of the plant in response to external stimulus is called nastic movements.

89. **(D)** The potato plant reproduces by stem tubers.

90. **(A)** The air at the top of the mountains has less amount of oxygen hence people who live on mountain top produce more RBC to absorb more oxygen as compared to land level.