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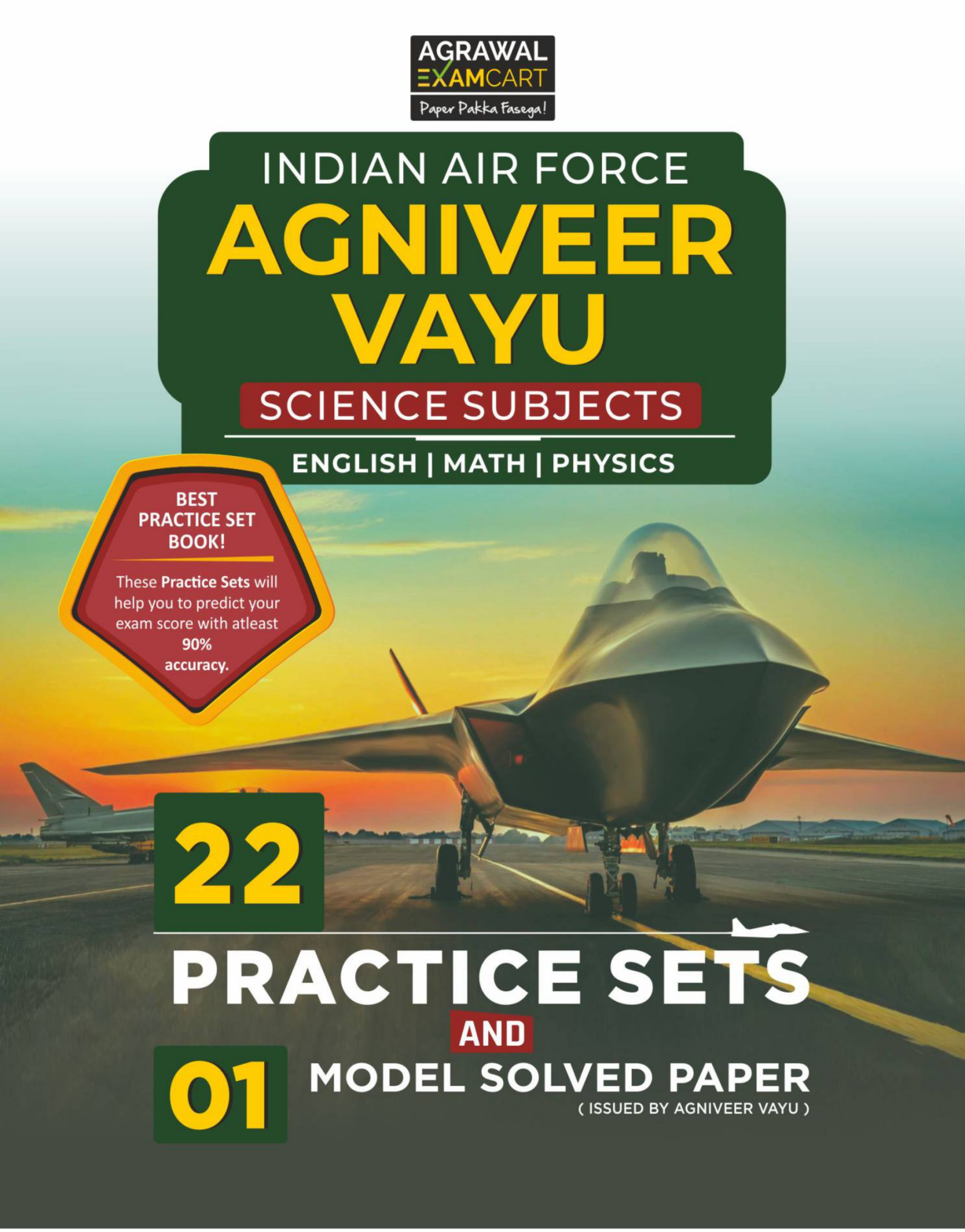

22 PRACTICE SETS

AND

01 MODEL SOLVED PAPER

(ISSUED BY AGNIVEER VAYU)

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विषय-सूची

Practice Set – 1

Part-I

English

Direction (Q. No. 1 to 5)

Read the passage carefully and choose the best answer to each question out of the four alternatives.

Earth is the only planet so far known with the suitable environment for sustaining life. Land, water, air, plants and animals are the major components of the global environment. Population, food and energy are the three fundamental problems facing mankind. Unemployment, inflation, crowding, dwindling resources and pollution are all due to the factors like increasing population, high standard of living, deforestation, etc.

Man has been tampering with the Ecosphere for a very long time and is forced to recognize that environmental resources are scarce. Environmental problems are really social problems. They begin with people as cause and end with people as victims. Unplanned use of resources has resulted in the depletion of fossils, fuels, pollution of air and water, deforestation, which has resulted in ecological imbalance and draining away of national wealth through heavy expenditure on oil and power generation.

1. Increasing population causes :
(A) unemployment and crowding
(B) inflation and pollution
(C) dwindling resources
(D) unemployment, inflation, crowding, dwindling resources and pollution

2. National wealth is drained away by spending heavily on :
(A) power generation
(B) fuels
(C) water and power generation
(D) oil and power generation

3. The three major components of the global environment are :
(A) food, energy and population
(B) high standard of living, crowding and inflation
(C) land, water and air
(D) plants, animals and mankind

4. Depletion of fossils and fuels, pollution of air and water and deforestation will never occur in case of :
(A) improper use of resources
(B) planned use of resources
(C) unplanned use of resources
(D) over use of resources

5. We face the three fundamental problems that are :
(A) inflation, deforestation and unemployment
(B) population, deforestation and energy
(C) population, inflation and food
(D) population, food and energy

6. Select correct preposition from the choice to fill in blank.
Kareena is totally satisfied.....her salary.
(A) for (B) with
(C) of (D) at

7. Rearrange the parts of the sentence in correct order.
It requires :
P : a voluntary effort and
Q : participation of one and all
R : struggle involving the
(A) PQR (B) RQP
(C) RPQ (D) QPR

8. Select the alternative which is the best substitute of the phrase/given words.
Loss of sleep :
(A) Hypertonia
(B) Insomnia
(C) Urania
(D) Dipsomania

9. Select the synonym of the given word.
Imprudent :
(A) Cautious (B) Careless
(C) Wise (D) Discreet

10. Select the one which is opposite in meaning of the given word.
Premium :
(A) Superior (B) Inferior
(C) Choice (D) Excellent

Direction (Q. No. 11 to 15)

Choose the correct alternative and fill in the blanks in the following sentence.

11. ..... is my favourite subject.
(A) Physique (B) Physic
(C) Physics (D) A Physics

12. The members of a community should love ..... .
(A) Each other
(B) Each one
(C) One another
(D) Each another

13. He is the friend ..... I trust most.
(A) him (B) whom
(C) which (D) who

14. During winter evenings, a cup of coffee is ..... to mug of tea.
(A) prefer
(B) more prefer
(C) preferable
(D) more preferable

15. The priest was innocent ..... he could not prove it.
(A) and (B) but
(C) for (D) so

16. She is too weak to walk (Choose without too)
(A) She is so weak that she cannot walk
(B) She is weak but can walk
(C) She is not weak to walk
(D) None of the above

Direction (Q. No. 17 and 18)

Find the error in each of the following sentences. If there is no error, your answer is 'D'

17. If you will work hard (A)/you will always (B)/succeed. (C)/No error (D).

18. Coward dies (A)/ several times (B)/ the braves die but once. (C)/ No Error (D).

19. Change the following sentence into indirect narration.
Socrates said, "Virtue has its own reward."
(A) Socrates said that virtue had its own reward.
(B) Socrates say that virtue is its own reward.

(C) Socrates said that virtue has its own reward.
(D) Socrates said that virtue was its own reward.

20. Change the following sentence into passive voice.
I did not trust anybody.
(A) Nobody was trusted by me.
(B) Nobody had been trusted by me.
(C) Nobody would be trusted by me.
(D) Nobody has been trusted by me.

Part–II

Mathematics

Direction (Q. No. 21 to 45)

Find the appropriate option/answer for the following questions.

21. If p = He is intelligent.
q = He is strong.
Then symbolic form of statement
"It is wrong that he is intelligent or strong," is
(A) $\sim p \vee \sim q$ (B) $\sim (p \wedge p)$
(C) $\sim (p \vee q)$ (D) $p \vee \sim q$

22. Probability that a card drawn from a pack of 52 cards will be a diamond or king is :
(A) $\frac{4}{52}$ (B) $\frac{4}{13}$
(C) $\frac{1}{52}$ (D) $\frac{2}{13}$

23. Mean of 100 items is 49. It was discovered that three items which should have been 60, 70, 80 were wrongly read as 40, 20, 50 respectively. The correct mean is :
(A) 48 (B) 82
(C) 50 (D) 80

24. Differential Equation belonging to the family of curve $y^2 = (x - c)^3$ is :
(A) $8\left(\frac{dy}{dx}\right)^3 = 27y + x$
(B) $8\left(\frac{dy}{dx}\right)^3 = 27y$
(C) $27\left(\frac{dy}{dx}\right)^3 = 8y$
(D) $27\left(\frac{dy}{dx}\right)^2 = 8y$

25. $\lim\limits_{x\to\infty}\left(\frac{n+1}{n^2+1^2}+\frac{n+2}{n^2+2^2}+...+\frac{1}{n}\right) = ?$
(A) $\frac{\pi}{4} - \log 2$ (B) $\frac{\pi}{4} + \frac{1}{2}\log 2$
(C) $\frac{\pi}{4} + \log 2$ (D) $\frac{\pi}{4} - \frac{1}{2}\log 2$

26. The value of $\int \sin^3 x\,dx$ is :
(A) $-\frac{1}{12}[9\cos x - \cos 3x] + c$
(B) $\frac{1}{12}[9\cos x + \cos 3x] + c$
(C) $-\frac{1}{12}[9\cos 3x + 3\cos x] + c$
(D) $\frac{1}{12}[9\cos x - 3\cos x] + c$

27. The value of $\int \sin^2 \frac{x}{2}dx$ is :
(A) $x + \sin x + c$ (B) $-\frac{x}{2} - \frac{\sin x}{2} + c$
(C) $\frac{x}{2} - \frac{\sin x}{2} + c$ (D) $\frac{x}{2} + \frac{1}{2}\sin x + c$

28. The length of the subtangent to the curve $x^2 + xy + y^2 = 7$ at $(1, -3)$ is :
(A) 3 (B) 5
(C) 3/5 (D) 15

29. The derivative of $\sin^{-1}x$ w.r.t. $\cos^{-1}\sqrt{(1-x^2)}$ is :
(A) $1/(1-x^2)$ (B) $\cos^{-1} x$
(C) 1 (D) None of these

30. $\lim\limits_{x\to\pi/2}\frac{2x-\pi}{\cos x}$ is equal to :
(A) 1 (B) 2
(C) -2 (D) 0

31. The value of $\tan 75° - \cot 75°$ is equal to :
(A) $2\sqrt{3}$ (B) $2+\sqrt{3}$
(C) $2-\sqrt{3}$ (D) None of these

32. If $\sin x + \sin^2 x = 1$, then the value of $\cos^2 x + \cos^4 x$ is :
(A) 1 (B) 2
(C) 1.5 (D) None of these

33. The equation of the directrix of the parabola $y^2 + 4y + 4x + 2 = 0$ is :
(A) $x = -1$ (B) $x = 1$
(C) $x = -\frac{3}{2}$ (D) $x = \frac{3}{2}$

34. Locus of the centre of the circle which always passes through the fixed points $(a, 0)$ and $(-a, 0)$ is :
(A) $x = 1$ (B) $x + y = 6$
(C) $x + y = 2a$ (D) $x = 0$

35. ABC is an isosceles triangle. If the coordinates of the base are $B(1, 3)$ and $C(-2, 7)$, the coordinates of vertex A can be :
(A) (1, 6) (B) $\left(-\frac{1}{2}, 5\right)$
(C) $\left(\frac{5}{6}, 6\right)$ (D) $\left(7, -\frac{1}{8}\right)$

36. Value of $\frac{\sin\theta}{1!} + \frac{\sin^3\theta}{3!} + \frac{\sin^5\theta}{5!} + ...$ is :
(A) $e^{-\sin\theta} - e^{\sin\theta}$ (B) $e^{\sin\theta} - e^{\sin\theta}$
(C) $\frac{e^{\sin\theta} - e^{-\sin\theta}}{2}$ (D) $\frac{e^{-\sin\theta} - e^{\sin\theta}}{2}$

37. If $A + B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $A - 2B = \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix}$, then A is equal to :
(A) $\begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 2/3 & 1/3 \\ 1/3 & 2/3 \end{bmatrix}$
(C) $\begin{bmatrix} 1/3 & 1/3 \\ 2/3 & 1/3 \end{bmatrix}$ (D) None of these

38. The system of equations $x + 3y = 2$ and $2x + 6y = 7$ is :
(A) inconsistent (B) not defined
(C) consistent (D) None of these

39. The number of ways in which 8 different beads can be arranged to form a necklace, is :
(A) 25 (B) 252
(C) 2520 (D) None of these

40. The value of $(7.995)^{1/3}$ correct to four decimal places is :
(A) 1.9998 (B) 1.9996
(C) 1.9990 (D) 1.9991

41. The identity
$\log_a n \log_b n + \log_b n \log_c n + \log_c n \log_a n$ is :
(A) $\frac{\log_a n \log_b n \log_c n}{\log_{abc} n}$
(B) $\frac{\log_{abc} n}{\log_a n}$
(C) $\frac{\log_b n}{\log_{abc} n}$
(D) None of these

42. The solution of $\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = \frac{13}{6}$ is :
(A) $\left\{\frac{9}{13}, \frac{5}{13}\right\}$ (B) $\left\{\frac{6}{13}, \frac{5}{14}\right\}$
(C) $\left\{\frac{9}{13}, \frac{4}{13}\right\}$ (D) $\left\{\frac{5}{4}, \frac{3}{2}\right\}$

43. Two numbers are such that whose arithmetic mean is 34 and the geometric mean is 16. Then, the number are :

(A) 64, 4 (B) 30, 25

(C) 12, 13 (D) 12, 14

44. The modulus of $\frac{1-i}{1+i}$ is :

(A) 0 (B) 1

(C) 4 (D) 2

45. Let R be the relation from a set $A = \{2, 3, 4, 5\}$ to another set $B = \{3, 6, 7, 10\}$ defined by x divides y, then R^{-1} is equal to :

(A) $\{(6, 2), (3, 3)\}$

(B) $\{(6, 2), (10, 2), (3, 3), (6, 3), (10, 5)\}$

(C) $\{(6, 2), (10, 2), (3, 3), (6, 3)\}$

(D) None of the above

Part–III

Physics

Direction (Q. No. 46 to 70)

Find the appropriate option/answer for the following given questions.

46. A raft of wood having mass 120 kg floats in water. How much weight can be put on the raft to make it just sink ? (density of wood = 600 kg/m^3)

(A) 80 kg (B) 40 kg

(C) 20 kg (D) 10 kg

47. A body weighs 320 g in air and 260 g in water and 272 g in an oil. Specific gravity of oil will be :

(A) 2.6 (B) 1.8

(C) 0.4 (D) 0.8

48. The time period of a simple pendulum in a lift descending with constant acceleration g is :

(A) $T = 2\pi\sqrt{\frac{l}{g}}$ (B) $T = 2\pi\sqrt{\frac{l}{2g}}$

(C) Zero (D) infinite

49. The mass and diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet will be (if it is a second's pendulum on earth) :

(A) $\frac{1}{\sqrt{2}}s$ (B) $2\sqrt{2}s$

(C) $2s$ (D) $\frac{1}{2}s$

50. If the energy, $E = G^x h^y c^z$, where G is the universal gravitational constant, h is the Planck's constant and c is the velocity of light, then the values of x, y and z are, respectively.

(A) –1/2, 1/2 and 5/2

(B) 1/2, – 1/2 and – 5/2

(C) – 1/2, 1/2 and 3/2

(D) 1/2, – 1/2 and – 3/2

51. The number of particles (n) crossing a unit area perpendicular to the x-axis per unit time is given by, $n = D\left(\frac{n_2 - n_1}{x_2 - x_1}\right)$ where n_1 and n_2 are the number of particles per unit volume for x equal to x_1 and x_2 respectively. Find dimensions of D (called definition constant)

(A) $[M°L^2T^{-2}]$ (B) $[M°L^2T^{-1}]$

(C) $[M°L\ T^2]$ (D) $[M°\ L^2\ T^{-4}]$

52. Calculate the refractive index of glass with respect to water. It is given that refractive indices of glass and water with respect to air are $\frac{3}{2}$ and $\frac{4}{3}$ respectively

(A) $\frac{8}{9}$ (B) $\frac{9}{8}$

(C) $\frac{7}{6}$ (D) None of these

53. If a full wave rectifier is operating from 50 Hz mains, the fundamental frequency in the ripple will be :

(A) 50 Hz (B) 70.7 Hz

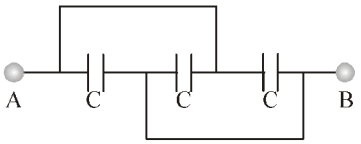
(C) 100 Hz (D) 25 Hz

54. In a Young's double slit experiment, the separation between slits is doubled. To keep the same-spacing of fringes, the distance D of the screen from the slits should be made :

(A) $\frac{D}{2}$ (B) $\frac{D}{\sqrt{2}}$

(C) $2D$ (D) $4D$

55. Three equal capacitors each with capacitance C are connected as shown in figure. The equivalent capacitance between point A and B is :



(A) C (B) $3C$

(C) $\frac{C}{3}$ (D) $\frac{3C}{2}$

56. A frog can be levitated in a magnetic field produced by a current in a vertical solenoid placed below the frog. This is possible because the body of the frog behaves as :

(A) paramagnetic

(B) diamagnetic

(C) ferromagnetic

(D) anti-ferromagnetic

57. A small bar magnet has a magnetic moment 1.2 A-m^2. The magnetic field at a distance 0.1 m on its axis will be : ($\mu_0 = 4\pi \times 10^{-7}$ T-m/A)

(A) 1.0×10^{-4} T (B) 2.4×10^{-4} T

(C) 2×10^4 T (D) 1.2×10^4 T

58. The electromagnetic waves used in the telecommunication are :

(A) Ultra-violet (B) infra-red

(C) visible (D) microwave

59. The minimum energy required to remove an electron from the metal surface is called :

(A) work function

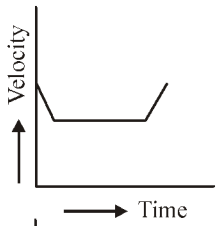
(B) kinetic energy

(C) stopping potential

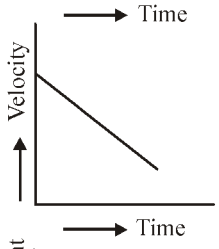
(D) potential energy

60. Which one of the following graphs represents uniform motion ?

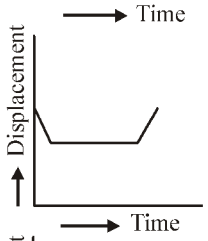
(A)



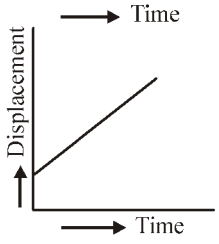
(B)



(C)



(D)



61. The energy of a photon of wavelength l is :

(A) hcl (B) hc/l

(C) l/hc (D) hl/c

62. Calculate the radius of the third Bohr orbit for hydrogen atom and the energy of electron in that orbit.

(A) 3.8Å, -2.43×10^{19} J

(B) 4.775Å, -2.43×10^{-19} J

(C) 5.4Å, 2.43×10^{-19} J

(D) 6.66Å, 2.43×10^{19} J

63. The nuclei $_7N^{14}$ and $_6C^{13}$ are :
(A) isomers (B) isotones
(C) isobars (D) isotopes

64. Two radiations containing photons of energy twice and five times the work function of a metal are incident successively on the metal surface. The ratio of maximum velocity of the emitted electrons in the two cases is :
(A) 1 : 1 (B) 1 : 2
(C) 1 : 4 (D) 1 : 3

65. If R is the Rydberg constant for hydrogen, then the wave number of the first line in the Lyman series is :
(A) $\frac{3R}{4}$ (B) $\frac{R}{4}$
(C) $2R$ (D) $\frac{R}{2}$

66. The energy that should be added to an electron to reduce its de-Broglie wavelength from 10^{-10} m to 0.5×10^{-10} M will be :
(A) thrice the initial energy
(B) twice the initial energy
(C) equal to the initial velocity
(D) four items the initial energy

67. When visible light is incident on a metal surface no photoelectrons are emitted. If a second beam is to be selected it must be :
(A) UV radiation
(B) radiowaves
(C) microwave
(D) infrared radiation

68. In a pressure cooker, cooking is faster because the increase in vapour pressure :
(A) increases the specific heat
(B) decreases the specific heat
(C) decreases the boiling point
(D) increases the boiling point

69. The resistance of a wire is 10Ω. If it is stretched ten times, then its resistance will become :
(A) 1Ω (B) 10Ω
(C) 100Ω (D) 1000Ω

70. The sun is constantly radiating energy and yet its surface temperature is nearly constant at 6000°C. The constancy of solar temperature is due to :
(A) fission
(B) radioactivity
(C) fusion
(D) black hole evaporation

Solutions

English

1. (D) Unemployment, inflation, crowding dwindling resources and pollution are the main clause ab increasing population.

2. (D) Oil and power generation.

3. (C) Land, water and air are the major components of the global environment.

4. (B) Planned use of resources.

5. (D) We face the three fundamental problems that are—population, food and energy.

6. (B) 'With' is correct.

7. (C) RPQ is the correct sequence.

8. (B) Insomnia (N) means—the condition of being unable to sleep, over a period of time' is the best substitute for the given phrase.

9. (B) Careless is the best synonym of 'imprudent' means—rash/ irresponsible.

10. (B) Inferior (Adj.) is the opposite word of 'Premium' means having or reflecting superior quality or value.

11. (C) Physics.

12. (C) One another is used when more than two persons are involved while 'each other' is used when the idea is of two persons.

13. (B) 'Whom' will be used in the blank space.

14. (C) Preferable means more desirable or suitable.

15. (B) 'But' conjunction is correct for the blank.

16. (A) She is so weak that she cannot walk.

17. (A) Replace 'will work' with 'work' because if clause begins with present indefinite tense.

18. (C) Replace 'the braves' with 'the brave' means—brave people.

19. (C) The tense of Reported Speech may not change if the statement is a universal truth.

20. (A) The sentence is in Active voice. Its passive voice's, structure will be as follow-
Sub + was + V_3 + by + Agent
Nobody was trusted by me.

Mathematics

21. (C) The symbolic form of given statement is $\sim (p \vee q)$.

22. (B) Clearly, $n(S) = 52$
There are 13 cards of diamond and 4 kings and one of them is a king or diamond.
So, $n(E) = (13 + 4 - 1) = 16$
$$P(E) = \frac{13+3}{52} = \frac{16}{52} = \frac{4}{13}$$

23. (C) The sum of items
$= 49 \times 100 - (40 + 20 + 50) + (60 + 70 + 80)$
$= 5000$
$\therefore$ Correct Mean of 100 items
$$= \frac{\text{Sum of all items}}{\text{Total no. of items}}$$
$$= \frac{5000}{100} = 50$$

24. (B) We have $y^2 = (x-c)^3$
differentiating w.r.t. x,
$$\Rightarrow \quad 2y\frac{dy}{dx} = 3(x-c)^2$$
On cubing both sides,
$$\left(2y\frac{dy}{dx}\right)^3 = 27(x-c)^6$$
$$\Rightarrow 8y^3\left(\frac{dy}{dx}\right)^3 = 27(y^2)^2$$
$$\Rightarrow \quad 8\left(\frac{dy}{dx}\right)^3 = 27y$$

25. (B) Using limit as sum
$$\lim_{x\to\infty}\left(\frac{n^2+n}{n^2+1} + \frac{n^2+2n}{n^2+2^2} + \ldots\ldots + \frac{n^2+n^2}{n^2+x^2}\right)$$
$$= \lim_{x\to\infty}\frac{1}{n}\sum\frac{1+\left(\frac{r}{n}\right)}{1+\left(\frac{r}{n}\right)^2}$$
$$= \int_0^1 \frac{1+x}{1+x^2}dx$$
$$= \tan^{-1}x + \left|\frac{1}{2}\log(1+x^2)\right|_0^1$$
$$= \frac{\pi}{4} + \frac{1}{2}[\log 2]$$

26. (A) We know that,
$$\sin 3x = 3\sin x - 4\sin^3 x$$
$$\Rightarrow \quad \sin^3 x = \frac{3\sin x - \sin 3x}{4}$$
$$\therefore \int \sin^3 x\,dx$$
$$= \int\frac{1}{4}(3\sin x - \sin 3x)dx$$
$$= \frac{1}{4}\left[-3\cos x + \frac{\cos 3x}{3}\right] + c$$
$$= -\frac{1}{12}[9\cos x - \cos 3x] + c$$

27. (C) $\int \sin^2\frac{x}{2}dx = \frac{1}{2}\int(1-\cos x)dx$
$\left(\because \cos x = 1 - 2\sin^2\frac{x}{2}\right)$
$$\therefore \frac{1}{2}\int(1-\cos x)dx = \frac{1}{2}(x - \sin x) + c$$

28. (D) Given curve, $x^2 + xy + y^2 = 7$
On differentiating w.r.t. x,
$$2x + x\frac{dy}{dx} + y + 2y\frac{dy}{dx} = 0$$

$$\Rightarrow (x+2y)\frac{dy}{dx} = -(2x+y)$$

$$\frac{dy}{dx} = \frac{-2x-y}{(x+2y)}$$

$$\frac{dy}{dx} \text{ at } (1,-3) = \frac{-2+3}{1-6}$$

$$\frac{dy}{dx} \text{ at } (1,-3) = \frac{-1}{5}$$

$\therefore$ Length of subtangent

$$= \frac{y}{dy/dx}$$

$$= \frac{-3}{-1/5} = 15$$

29. (C) Let $y = \sin^{-1} x$

and $z = \cos^{-1}\sqrt{(1-x^2)}$

$$z = \cos^{-1}\sqrt{1-\sin^2 y}$$

$$\left(\because y = \sin^{-1} x \atop x = \sin y\right)$$

$$= \cos^{-1}\sqrt{\cos^2 y}$$

$$= \cos^{-1}(\cos y)$$

$$= y$$

$\therefore \quad y = z$

Differential w.r.t. z

$$\Rightarrow \frac{dy}{dz} = 1$$

30. (C) $\lim\limits_{x\to\pi/2} \dfrac{2x-\pi}{\cos x} = \dfrac{2}{-\sin x}$

[Using 1 Hospital rules]

After putting limit $= -2$

31. (A) $\tan 75° - \cot 75°$

$= \tan 75° - \cot(90° - 15°)$

$[\because \cot(90-\theta) = \tan\theta]$

$= \tan(45° + 30°) - \tan(45° - 30°)$

$$= \frac{1+\frac{1}{\sqrt{3}}}{1-\frac{1}{\sqrt{3}}} - \frac{1-\frac{1}{\sqrt{3}}}{1+\frac{1}{\sqrt{3}}}$$

$$= \frac{\sqrt{3}+1}{\sqrt{3}-1} - \frac{\sqrt{3}-1}{\sqrt{3}+1}$$

$$= \frac{3+1+2\sqrt{3}-3-1+2\sqrt{3}}{3-1}$$

$$= 2\sqrt{3}$$

32. (A) Since, $\sin^2 x + \cos^2 x = 1$

$\sin x + \sin^2 x = 1$

$\Rightarrow \quad \sin x = 1 - \sin^2 x$

$\Rightarrow \quad \sin x = \cos^2 x$

$\therefore \cos^2 x + \cos^4 x = \sin x + \sin^2 x = 1$

33. (D) Given equation can be written as

General form

$y^2 + 4y + 4x + 2 = 0$

$$(y+2)^2 = -4\left(x - \frac{1}{2}\right)$$

It is the form of $Y^2 = -4AX$

Equation of directrix is $X = A = 1$

i.e., $\quad x = -\dfrac{1}{2} = 1$

$$\Rightarrow \quad x = \frac{3}{2}$$

34. (D) Let $C(h, k)$ be the centre of circle and given points are $A(a, 0)$ and $B(-a, 0)$

then, $(CA)^2 = (CB)^2$

$\Rightarrow (h-a)^2 + (k-0)^2$

$= (h+a)^2 + (k-0)^2$

$\Rightarrow h^2 + a^2 - 2ah + k^2$

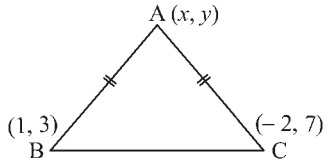
$= h^2 + a^2 + 2ah + k^2$

$\Rightarrow \quad 4ah = 0$

$\Rightarrow \quad h = 0$

$\therefore$ The locus of point (h, k) is $x = 0$.

35. (C) Let (x, y) be the coordinate of vertex A, then



$$AB = \sqrt{(1-x)^2 + (3-y)^2}$$

and $AC = \sqrt{(-2-x)^2 + (7-y)^2}$

$\therefore \angle ABC$ is isosceles triangle.

$\therefore \quad AB = AC$

$\Rightarrow (1-x)^2 + (3-y)^2$

$= (-2-x)^2 + (7-y)^2$

$\Rightarrow 1 + x^2 - 2x + 9 + y^2 - 6y$

$= 4 + x^2 + 4x + 49 + y^2 - 14y$

$\Rightarrow 10 - 2x - 6y = 53 + 4x - 14y$

$\Rightarrow -6x + 8y = 43$

In the given option, only $\left(\dfrac{5}{6}, 6\right)$ satisfies the above equation. Therefore, $\left(\dfrac{5}{6}, 6\right)$ is the vertex of A.

36. (C) We know that,

$$\frac{e^x - e^{-x}}{2!} = \frac{x}{1!} + \frac{x^3}{3!} + \frac{x^5}{5!} + \ldots$$

Putting, $x = \sin\theta$, we get

$$\frac{e^{\sin\theta} - e^{-\sin\theta}}{2!}$$

$$= \frac{\sin\theta}{1!} + \frac{\sin^3\theta}{3!} + \frac{\sin^5\theta}{5!} + \ldots$$

37. (C) $A + B = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and

$$A - 2B = \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix}$$

$$\therefore \; 2A + 2B = \begin{bmatrix} 2 & 0 \\ 2 & 2 \end{bmatrix}$$

Hence $(2A + 2B + A - 2B)$

$$3A = \begin{bmatrix} 2 & 0 \\ 2 & 2 \end{bmatrix} + \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}$$

$$\Rightarrow \quad A = \begin{bmatrix} \frac{1}{3} & \frac{1}{3} \\ \frac{2}{3} & \frac{1}{3} \end{bmatrix}$$

38. (A) Using Cramer's rule for linear equations.

here, $D = \begin{vmatrix} 1 & 3 \\ 2 & 6 \end{vmatrix} = 6 - 6 = 0$

and $D_1 = \begin{vmatrix} 2 & 3 \\ 7 & 6 \end{vmatrix}$

$= 12 - 21 = -9$

$D_1 \neq 0$

So, the system of equations is inconsistent.

39. (C) Lets fix now the beads can be arranged in 7! ways. But, there is no distinction between the clockwise and anti-clockwise arrangements, so the required number of arrangements

$$\frac{\lfloor n-1}{2} = \frac{7!}{2} = 2520$$

40. (B) $(7.995)^{1/3} = (8 - 0.005)^{1/3}$

as $(7.995 = 8 - 0.005)$

$$= 2\left[1 - \frac{0.005}{8}\right]^{1/3}$$

On expanding using binomial expansion

$$= 2\left(1 + \frac{1}{3}\left(-\frac{0.005}{8}\right) + \frac{\frac{1}{3}\left(\frac{1}{3}-1\right)}{2!}\left(-\frac{0.005}{8}\right)^2 + \ldots\right)$$

$$= 2\left(1 - \frac{1}{24}(0.005) - \frac{1}{9} \times \frac{(0.000025)}{64} + \ldots\right)$$

$= 2(1 - 0.000208)$

(neglecting other items)

$= 1.999584 = 1.9996$ (rounding off the decimal point)

41. (A) $\log_a n \log_b n + \log_b n \log_c n + \log_c n \log_a n$

$$= \frac{1}{\log_n a \log_n b} + \frac{1}{\log_n b \log_n c} + \frac{1}{\log_n c \log_n a}$$

$$\left[\because \log_m n = \frac{1}{\log_n m}\right]$$

$$= \frac{\log_n c + \log_n a + \log_n b}{\log_n a \log_n b \log_n c}$$

$$= \frac{\log_n (abc)}{lon_n a \log_n b \log_n c}$$

$[\because \log a + \log b + \log c = \log (abc)]$

$$= \frac{\log_a n \log_b n \log_c n}{\log_{abc} n}$$

42. (C) The given equation is

$$\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = \frac{13}{6}$$

Replacing $\sqrt{\frac{x}{1-x}} = y$, we get

$$y + \frac{1}{y} = \frac{13}{6}$$

$\Rightarrow \quad 6y^2 - 13y + 6 = 0$

$\Rightarrow \quad 6y^2 - 9y - 4y + 6 = 0$

$\Rightarrow \quad (2y - 3)(3y - 2) = 0$

$\Rightarrow \quad y = \frac{3}{2}$ or $y = \frac{2}{3}$

Putting, $y = \frac{3}{2}$

$\Rightarrow \quad \sqrt{\frac{x}{1-x}} = \frac{3}{2}$

Squaring on both sides

$$\frac{x}{1-x} = \frac{9}{4}$$

$\Rightarrow \quad 4x = 9 - 9x$

$\Rightarrow \quad x = \frac{9}{13}$

When, $y = \frac{2}{3}$

$\Rightarrow \quad \sqrt{\frac{x}{1-x}} = \frac{2}{3}$

On squaring on both sides,

$$\frac{x}{1-x} = \frac{4}{9}$$

$\Rightarrow \quad 9x = 4 - 4x$

$\Rightarrow \quad x = \frac{4}{13}$

$\therefore$ So, the roots are $\left\{\frac{9}{13}, \frac{4}{13}\right\}$.

43. (A) Let two numbers be a and b.

Then, AM $= \frac{a+b}{2} = 34$

and GM $= \sqrt{ab} = 16$

$\Rightarrow \quad a + b = 68$ ... (i)

and $ab = 256$ ... (ii)

$\therefore \quad (a-b)^2 = (a+b)^2 - 4ab$

$= (68)^2 - 4 \times 256$

$= 4624 - 1024$

$\Rightarrow \quad (a-b)^2 = 3600$

$\therefore \quad (a-b) = 60$ ... (iii)

On solving Eqs. (i) and (iii), we get

$a = 64, b = 4$

44. (B) Let $z = \frac{1-i}{1+i}$

Rationalising the denominator and numerator,

$$= \frac{1-i}{1+i} \times \frac{1-i}{1-i} = \frac{(1-i)^2}{1^2 - i^2}$$

$$= \frac{1}{2}(1-i)^2 \quad [\because i^2 = -1]$$

$$= \frac{1}{2}(1 + i^2 - 2i)$$

$$= \frac{1}{2} \times (-2i) = 0 - i$$

$\therefore \quad |z| = \sqrt{0^2 + (-1)^2}$

$= \sqrt{0+1} = 1$

45. (B) Since, $A = \{2, 3, 4, 5\}$,

$B = \{3, 6, 7, 10\}$

Now, R is such that 'x divides y'

i.e., $R = \{(2, 6), (2, 10), (3, 3), (3, 6), (5, 10)\}$

R^{-1} is {'y divides x' so $\frac{x}{y}$ }

Now, $R^{-1} = \{(6, 2), (10, 2), (3, 3), (6, 3), (10, 5)\}$

Physics

46. (A) $V = \frac{m}{\rho} = \frac{120}{600} = 0.2 \text{ m}^3$

When raft is fully immersed in water, the weight of water displaced

$= V \times r$

$= 0.2 \times 10^3$ kg

$= 200$ kg

Now, additional weight supported by raft

$= 200 \text{ kg} - 120 \text{ kg}$

$= 80$ kg

47. (D) Specific gravity of liquid

$$= \frac{\text{apparent loss of weight in liquid}}{\text{apparent loss of weight in water}}$$

$$= \frac{320 - 272}{320 - 260} = 0.8$$

48. (D) In a lift descending with constant acceleration $a = g$, the time period will be

$$T = 2\pi\sqrt{\frac{l}{(g-a)}}$$

$$= 2\pi\sqrt{\frac{l}{(g-g)}} = \infty$$

49. (B) As $M_p = 2M_e$ and $D_p = 2D_e$

or $R_p = 2R_e$

Hence, $g_p = \frac{GM_p}{(R_p)^2} = \frac{g_e}{2}$

$\therefore \quad Tp = 2\pi\sqrt{\frac{l}{g_p}} = 2\pi\sqrt{\frac{2l}{g_e}}$

$= \sqrt{2} \times 2\pi\sqrt{\frac{l}{g_e}}$

$= \sqrt{2} \times 2 = 2\sqrt{2}$s

50. (A) $E = G^x h^y C^z$

$\Rightarrow \quad [ML^2T^{-2}] = [M^{-1}L^3T^{-2}]^x [ML^2T^{-1}]^y [LT^{-1}]^z$

$= [M^{-x+y} \; L^{3x+2y+z} \; T^{-2x-y-z}]$

Applying principle of homogeneity of dimensions,

$-x + y = 1$ ... (i)

$3x + 2y + z = 2$ ... (ii)

and $-2x - y - z = -2$ ... (iii)

On solving Eqs. (i), (ii) and (iii), we get

$x = -1/2$

$y = 1/2$

and $z = -5/2$

51. (B) From the given equation,

$$D = \frac{n(x_2 - x_1)}{(n_2 - n_1)}$$

Now, the dimensions of n

$= [M^0L^{-2}T^{-1}]$

The dimensions of $[x_2 - x_1]$

$= [M^0LT^0]$

and $[n_2 - n_1] = [M^0L^{-3}T^0]$

Thus, $[D] = \left[\frac{M^0L^{-2}T^{-1}L}{M^0L^{-3}T^0}\right]$

$\therefore \quad [D] = [M^0L^2T^{-1}]$

52. (B) $_w\mu_g = \frac{_a\mu_g}{_a\mu_w}$

$= \frac{3/2}{4/3} = \frac{9}{8}$

53. (C) In a full wave rectifier, frequency of ripple factor

= twice the frequency of input (AC)

$= 2n = 2 \times 50 = 100$ Hz

54. (C) If new value of distance of screen from double slit be D', then

$$\beta = \frac{\lambda D'}{d'}$$

$$= \frac{\lambda D'}{(2d)}$$

$$= \frac{\lambda D}{d} = \beta$$

$$D' = 2D$$

55. (B) In the given arrangement, all the three capacitors are joined in parallel. Hence, resultant capacitance = $C + C + C = 3C$

56. (B) A frog can be levitated in a magnetic field produced by a current in a vertical solenoid placed below the frog. This is possible because the body of a frog behaves as diamagnetic.

57. (B) $$B = \frac{\mu_0}{4\pi} \cdot \frac{2M}{r^3}$$

$$= \frac{10^{-7} \times 2 \times 1.2}{(0.1)^3}$$

$$= 2.4 \times 10^{-4} \text{ T}$$

58. (D) The electromagnetic waves used in the telecommunication are micro waves.

59. (A) The minimum energy required to remove an electron from the metal surface is called work energy.

60. (D) For uniform motion, displacement-time graph is a straight line as in option (D). Also, the velocity-time graph is a straight line but parallel to time axis.

61. (B) The energy of a photon of wavelength l is hc/l.

62. (B) Here, $r = ?$, $n = 3$, $E = ?$

As $$r = \frac{n^2h^2}{4\pi^2 mke^2}$$

$$r = \frac{9(6.6 \times 10^{-34})^2 \times 9 \times 10^9}{4 \times \frac{22}{7} \times \frac{22}{7} \times 9.1 \times 10^{-31}(1.6 \times 10^{-19})^2}$$

$$= 4.775 \times 10^{-10} \text{ m}$$

$$= 4.775\text{A}^\circ$$

$$E = \frac{-2\pi^2 mk^2 e^4}{n^2 h^2}$$

On putting the standard values, we get

$$E = -2.43 \times 10^{-19} \text{ J}$$

63. (B) They have identical number of neutrons

64. (B) Photoelectric equation is

K.E = E – W

In first case

$$\frac{1}{2}mu_1^2 = 2\text{W} - \text{W}$$

$$\frac{1}{2}mu_1^2 = \text{W} \quad \text{.....(1)}$$

In second case

$$\frac{1}{2}mu_2^2 = 5\text{W} - \text{W}$$

$$\frac{1}{2}mu_2^2 = 4\text{W} \quad \text{.....(2)}$$

From eqn. (1) and (2)

$$\frac{\frac{1}{2}mu_1^2 = \text{W}}{\frac{1}{2}mu_2^2 = 4\text{W}} = \frac{u_1^2}{u_2^2} = \frac{\text{W}}{4\text{W}}$$

$$= \frac{u_1}{u_2} = \sqrt{\frac{1}{4}} = \frac{1}{2} = 1:2$$

65. (A) For lyman series $n_1 = 1$ and $n_2 = 2, 3, 4$ .....

first lyman series

$$\nu = \frac{1}{\lambda} = \text{R}\left[\frac{1}{1^2} - \frac{1}{2^2}\right]$$

Sience

$$\nu = \frac{1}{\lambda} = \text{R}\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

$$\nu = \text{R}\left[1 - \frac{1}{4}\right] = \frac{3\text{R}}{4}$$

66. (A) Because of same number of neutrons.

$$\lambda = \frac{h}{\sqrt{2mE}}$$

or $$10^{-10} = \frac{h}{\sqrt{2mE_1}} \quad \text{...(i)}$$

and $$0.5 \times 10^{-10} = \frac{h}{\sqrt{2mE_2}} \quad \text{...(ii)}$$

From Eqs. (i) and (ii), we get

$$\sqrt{\left(\frac{E_2}{E_1}\right)} = 2$$

or $$\frac{E_2}{E_1} = 4$$

$$\therefore \quad E_2 = 4E_1$$

Then energy added is $4E_1 - E_1 = 3E_1$

67. (A) More the frequency of wave more are the chances to eject electron.

68. (D) Boiling point increases with increase of pressure. In a pressure cooker, the increase in vapour pressure increases the boiling point, and hence cooking becomes faster.

69. (D) Resistance = $10^3 = 1000\Omega$

$$\boxed{\text{R}_2 = n^2\text{R}_1}$$

70. (C) The solar temperature of sun is due to proton-proton chain reaction taking place inside the sun. The constancy of solar temperature is due to fusion.

❑❑

विषय-सूची