Hall Ticket Number

Q.B.No. 4 4 4 3 2 1

Booklet Code : A

Marks : 100
Time : 120 minutes

3PP1S

Signature of the Candidate | **Signature of the Invigilator**

INSTRUCTIONS TO THE CANDIDATE

(Read the Instructions carefully before Answering)

1. Separate Optical Mark Reader (OMR) Answer Sheet is supplied to you along with Question Paper Booklet. Please read and follow the instructions on the OMR Answer Sheet for marking the responses and the required data.
2. The candidate should ensure that the Booklet Code printed on OMR Answer Sheet and Booklet Code supplied are same.
3. **Immediately on opening the Question Paper Booklet by tearing off the paper seal, please check for (i) The same booklet code (A/B/C/D) on each page, (ii) Serial Number of the questions (1-100), (iii) The number of pages and (iv) Correct Printing.** In case of any defect, please report to the invigilator and ask for replacement of booklet with same code within five minutes from the commencement of the test.
4. Electronic gadgets like Cell Phone, Calculator, Watches and Mathematical/Log Tables are not permitted into the examination hall.
5. **There will be ¼ negative mark for every wrong answer.** If the response to the question is left blank without answering, there will be no penalty of negative mark for that question.
6. Using Blue/Black ball point pen to darken the appropriate circles of (1), (2), (3) or (4) in the OMR Answer Sheet corresponding to correct or the most appropriate answer to the concerned question number in the sheet. Darkening of more than one circle against any question automatically gets invalidated and will be treated as wrong answer.
7. Change of an answer is NOT allowed.
8. Rough work should be done only in the space provided in the Question Paper Booklet.
9. Return the OMR Answer Sheet and Question Paper Booklet to the invigilator before leaving the examination hall. Failure to return the OMR sheet and Question Paper Booklet is liable for criminal action.

This Booklet consists of 20 Pages for 100 Questions + 3 Pages of Rough Work + 1 Title Page i.e. Total 24 Pages.

SPACE FOR ROUGH WORK

3PP1S **Booklet Code A**

Time : 2 Hours **Marks : 100**

Instructions :

i) Each question carries ***one*** mark and ¼ negative mark for every wrong answer.

ii) Choose the correct or most appropriate answer from the given options to the following questions and darken, with Blue/Black Ball Point Pen, the corresponding digit **1, 2, 3** or **4** in the circle pertaining to the question number concerned in the OMR Answer Sheet, separately supplied to you.

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1. Assertion (A): A dimensionless quantity may have an unit.

   Reason (R) : An unit less quantity may have a non zero dimension

   (1) Both (A) and (R) are true and (R) is correct explanation for (A)

   (2) (A) is true, but (R) is false

   (3) Both (A) and (R) are false

   (4) Both (A) and ((R) are true but (R) is not the correct explanation for (A)

---

2. In an experiment four quantities a, b, c and d are measured with percentage error 2%, 1%, 5% and 4% respectively. Quantity P is calculated as follows:

   $P = \frac{a^3 b^2}{cd}$. The % error of P is

   (1) 14% (2) 12%

   (3) 17% (4) 13%

---

3. In a certain system of units, 1 unit of time is 5 sec, 1 unit of mass is 20 kg and 1 unit of length is 5 m. In this system, one unit of power will correspond to

   (1) 4 W (2) 2 W

   (3) 8 W (4) 5 W

---

4. A doctor checks the heart beat rate of a person by counting the number of beats in 30 s. If 40 ± 1 beats are counted in 30 ± 0.5 s, what is the heart rate and its uncertainity in beats per minute

   (1) 80 ± 3 beats/min. (2) 100 ± 4 beats/min.

   (3) 80 ± 4 beats/min. (4) 80 ± 2 beats/min.

---

5. Choose the correct True (T) - False (F) sequence of the following statements

A) Fine organic and inorganic particles suspended in air is called aerosol

B) SO_2 is a secondary pollutant

C) SO_3 air pollution cause corrosion of building

D) The percentage of nitrogen in air is 68

(1) T, T, F, F (2) F, F, T, T (3) T, F, F, F, (4) F, F, F, T

---

6. Which of the following elements have been recognized as inorganic contaminants in drinking water on a worldwide basis

(1) Chlorine and Magnesium (2) Calcium and Magnesium

(3) Arsenic and Fluoride (4) Arsenic and Iron

---

7. Choose the sequence containing all in-correct statements

A) A tropical cyclone has a low pressure centre.

B) Study of earthquakes is called meteorology.

C) As the degree of natural calamities increases their frequency of occurrence increases.

D) Powerful tsunami are most frequently produced by earthquakes.

E) The four phases of disaster management planning are mitigation, preparedness, recovery and reconstruction.

(1) A, B and D (2) C and D (3) A, B and E (4) B, C and E

---

8. Choose the correct match between the left and right panels

	Left		Right
A)	The planet known as 'Red planet'	i)	Earth
B)	The planet takes minimum time for one orbit around the Sun	ii)	Jupiter
C)	The planet has maximum number of Moons	iii)	Mars
D)	The planet known as 'Blue planet'	iv)	Venus
E)	The planet takes maximum time for one spin on its axis	v)	Mercury

(1) A-ii, B-v, C-iii, D-i, E-iv

(2) A-v, B-iv, C-ii, D-iii, E-i

(3) A-iii, B-v, C-ii, D-i, E-iv

(4) A-iv, B-iii, C-ii, D-v, E-i

---

9. Which of the following is false for a geostationary satellite is

(1) Has orbital period equal to earth's rotational period

(2) Used as communication and weather satellites

(3) Is usually placed right over north pole

(4) Has a special type of geosynchronous orbit

---

10. For 10 W lamp emitting photons of wavelength 0.5×10^{-6}m, the number of photons emitted per second is ($h = 6.63 \times 10^{-34}$ Js)

(1) 2.5×10^{19} (2) 4×10^{19}

(3) 2.5×10^{20} (4) 4×10^{21}

---

11. Which of the following is mirror formula, when *u*-is distance of the object from mirror, v is distance of the image from mirror, *f* is focal length and R is radius of curvature?

(1) $\frac{(u - v)}{uv} = \frac{2}{R}$ (2) $\frac{(u + v)}{uv} = \frac{2}{R}$

(3) $\frac{(v - u)}{uv} = \frac{1}{f}$ (4) $\frac{(u + v)}{uv} = \frac{R}{2}$

---

12. The main constituents of air are 80% of nitrogen molecules of molar mass 28 kg/k mol and 20% oxygen molecules of molar mass 32 kg/k mol. The mass of air in 50 cm^3 volume at 9.3×10^4 Pa pressure at room temperature (20°C) is

[use ideal gas law] ($R = 8.314 \times 10^3$ J/k mol/K)

(1) 5.5 kg (2) 55×10^{-3} kg

(3) 55 kg (4) 5.5×10^{-5} kg

---

13. Two identical loud speakers are placed facing each other, horizontally separated by a distance of 2 m. Each of them emit sound waves of wavelength 80 cm, driven by the same oscillator. If a listener standing midway between the two speakers walks a distance '*x*' towards one of the speakers, when the first minimum in the sound intensity is listened, the distance '*x*' is

(1) 20 cm (2) 10 cm

(3) –10 cm (4) 15 cm

---

14. Specific heat capacity of an ideal gas at a constant volume (C_v) and at constant pressure (C_p) are related as [R is universal gas constant]

(1) $C_p + C_v = R$ (2) $C_p - C_v = 2R$

(3) $C_p - C_v = R$ (4) $\left(C_p / C_v\right) - 1 = 2R$

---

15. 30 g of ice at 0 °C is mixed with 50 g of water at 80 °C. The temperature of mixture will be (Latent heat of ice = 80 cal/g and specific heat of water is 1 cal/g)

(1) 0 °C (2) 20 °C (3) 40 °C (4) 32 °C

---

16. Choose the correct statement

When sound travels through air, the air particles

(1) Vibrate but not in any fixed direction

(2) Vibrate along the direction of wave propagation

(3) Vibrate perpendicular to the direction of wave propagation

(4) Do not vibrate

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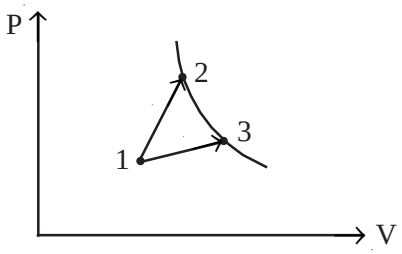
17. A gas takes part in two thermal processes 1-2 and 1-3 as shown in the figure below, in which it is heated from the same initial state temperature to the same final temperature.



The comparison between the amount of heat ΔQ received by the gas and the work done (A) by the gas during the two processes 1-2 and 1-3 are

(1) $\Delta Q_{13} > \Delta Q_{12}$ and $A_{13} < A_{12}$ (2) $\Delta Q_{13} < \Delta Q_{12}$ and $A_{13} > A_{12}$

(3) $\Delta Q_{13} > \Delta Q_{12}$ and $A_{13} > A_{12}$ (4) $\Delta Q_{13} < \Delta Q_{12}$ and $A_{13} < A_{12}$

---

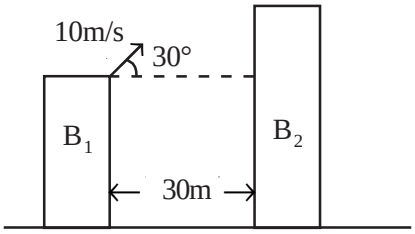
18. A train travelling at 50 m/s sounds its horn at a frequency of 900 Hz and it approaches a tunnel in a cliff. The sound from the horn reflects off the cliff back to the train driver. What will be the frequency of the reflected sound the driver hears. (sound speed $\simeq 350$ m/sec)

(1) 300 Hz (2) 1050 Hz (3) 1200 Hz (4) 150 Hz

---

19. Consider a ball thrown from the top of a building B of height 100 m towards another tall building B_2 (taller than B_1) 30 m away with initial velocity of 10 m/s as shown in the figure. Approximately how far above or below its original level will the ball strike the opposite wall

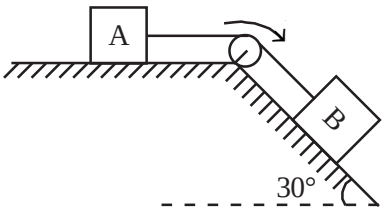
[Assume g = 10 m/s^2]



(1) 25 m above the original level (2) 95 m above the original level
(3) 95 m below the original level (4) 43 m below the original level

---

20. Two boxes of same mass 10 kg are held by a massless cord as shown in the figure. Both boxes experience a sliding friction force with $\mu_k = 0.2$. What is the tension in the cord. (g = 10 m/sec^2)



(1) 12.3 N (2) 6.3 N
(3) 26.3 N (4) 32.3 N

---

21. A mass '*m*' is moving in a circular orbit of radius '*r*' having angular momentum '*j*' about its center. The kinetic energy in terms of *j*, *m* and *r* is

(1) $\frac{j^2}{2mr^2}$ (2) $\frac{2j}{3mr^2}$ (3) $\frac{j}{mr}$ (4) $\frac{3}{4}\frac{j^2}{mr}$

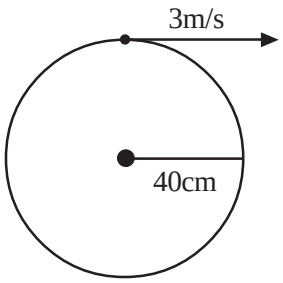
---

22. A snow ball of 40 kg travelling at 4 m/s collides with another snow ball of mass 60 kg travelling at 2 m/s in the same direction. If the two snow balls join together and moves in same direction after the collision, determine how much kinetic energy is lost by the joint-snow ball

(1) 480 J (2) 48 J (3) 392 J (4) 88 J

---

23. A boy whirls a ball vertically at constant energy tying it to the end of a 40 cm string. If the ball's speed at the top of the circle is 3 m/s, what is its speed at the bottom of the circle. (Use g = 10 m/s^2)



(1) 4.1 m/s (2) $2\sqrt{2}$ m/s (3) 5 m/s (4) 6 m/s

---

24. Two planets A and B have the same material density. If the radius of A is thrice that of B, then the ratio of escape velocity of A to escape velocity of B is

(1) 27 (2) 3 (3) 12 (4) 9

---

25. When a charged particle moves perpendicular to the magnetic field, the variable quantity is

(1) Speed (2) Momentum
(3) Moment of inertia (4) Energy

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26. Choose the sequence showing the correct statements

A) Magnetic field lines move from South to North
B) Stationary charges are not affected by the magnetic field
C) The direction of current in a conductor is perpendicular to the direction of magnetic field produced
D) With increase in the temperature magnetic susceptibility of antiferromagnetic material first decreases and then increases

(1) B and D (2) B and C (3) A and C (4) A, B and D

---

27. Choose the sequence having correct match between left and right panels.

	Left		Right
A)	Diamagnetic	i)	Nickel
B)	Paramagnetic	ii)	Fe_3O_4
C)	Ferromagnetic	iii)	Chromium
D)	Antiferromagnetic	iv)	Magnesium
E)	Ferrimagnetic	v)	Gold

(1) A-iv, B-v, C-ii, D-iii, E-i (2) A-v, B-iii, C-i, D-iv, E-ii
(3) A-iv, B-v, C-iii, D-i, E-ii (4) A-v, B-iv, C-i, D-iii, E-ii

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28. The unit of magnetic field strength is

(1) Weber/A.m (2) A/m

(3) Tesla/m (4) Weber/m^2

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29. A non-conducting thin disc of radius R rotates about its axis with angular velocity ω. If the disc is charged with surface charge density varying with distance from the center as $\sigma(r) = \sigma_0\left[1+\left(\frac{r}{R}\right)^2\right]$, where σ_0 is a constant. If the magnetic induction at the center is $B = \alpha\left(\mu_0\sigma_0\omega R\right)$, then the value of constant α is

(1) $\frac{2}{3}$ (2) $\frac{3}{4}$ (3) $\frac{4}{5}$ (4) $\frac{6}{7}$

---

30. A sphere of radius 3 cm carried a charge of 10 nC distributed uniformly throughout the sphere. The charge density of the sphere approximately is

(1) 20 μC/m^3 (2) 38 μC/m^3 (3) 88 μC/m^3 (4) 99 μC/m^3

---

31. Two charges q_1 and q_2 are placed such that, the electric field at one-fourth of the way from q_1 to q_2 is zero. Determine the ratio q_1:q_2

(1) 1:9 (2) 2:1 (3) 1:16 (4) 16:1

---

32. A 12 V storage battery is being charged at the rate of 15 C/s. How much energy is stored in the battery if it is charged at this rate for 60 min.

(Assume charging process is perfectly efficient)

(1) 1.08×10^4 J (2) 5.4×10^4 J

(3) 6.5×10^5 J (4) 4.3×10^5 J

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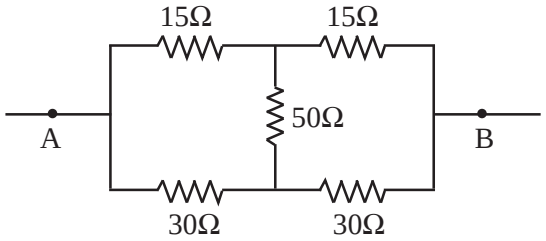
33. Find the equivalent resistance of the network shown in the figure below between the points A and B



(1) 10 Ω (2) 15 Ω (3) 20 Ω (4) 25 Ω

---

34. Calculate the EMF when the flux is given by $(3 \sin \omega t + 5 \cos \omega t)/\omega$

(1) $3 \cos \omega t - 5 \sin \omega t$ (2) $-3 \cos \omega t + 5 \sin \omega t$

(3) $-3 \sin \omega t - 5 \cos \omega t$ (4) $3 \cos \omega t + 5 \sin \omega t$

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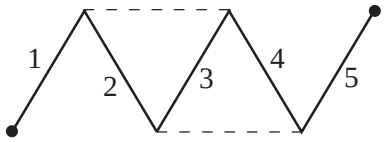
35. Consider the circuit of resistance R_1 shown in the figure.



If two similar conductors are added as shown by the dashed line, the circuit resistance changes to R_2. The ratio of the change in the resistance of the circuit (R_2/R_1) consisting of the five (1 – 5) identical conductors before and after the addition of conductors is

(1) 3/5 (2) 5/3 (3) 0 (4) 5/2

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36. The value of resistance and the rms current of a bulb, which is rated at 60 W for a 240 V supply are respectively

(1) 4 Ω and 0.25 A (2) 960 Ω and 4 A

(3) 4 Ω and 4 A (4) 960 Ω and 0.25 A

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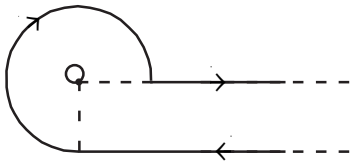
37. Consider the current carrying wire shown in the following figure. The current in the wire is I and the radius of the circular portion is R. The magnetic induction at the point O is

(The linear parts of the circuit are assumed to be very long)



(1) $\frac{\mu_0}{4\pi}\frac{I}{R}\left(1+\frac{3\pi}{2}\right)$ (2) $\frac{\mu_0}{4\pi}\frac{I}{R}(2+\pi)$

(3) $\frac{\mu_0}{4\pi}\frac{I}{R}\times\left(\frac{\pi}{2}\right)$ (4) $\frac{\mu_0}{4\pi}\frac{I}{R}\times\left(\frac{3\pi}{2}\right)$

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38. Choose the sequence containing the correct match between the left and right panels.

	Left		Right
A)	k_β line of X-rays	i)	inverse photoelectric effect
B)	Short wavelength limit of X-rays depends upon	ii)	Metal used for the target
C)	X-ray emission	iii)	Potential difference across the X-ray tube
D)	Frequency of X-ray line spectrum	iv)	Transition from n = 3 $\rightarrow$ n = 1

(1) A-iii, B-ii, C-iv, D-i (2) A-ii, B-iii, C-i, D-iv

(3) A-iv, B-iii, C-i, D-ii (4) A-iv, B-i, C-ii, D-iii

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39. According to Rutherford's model, choose the correct option for the velocity of an electron in an orbit, when *e* and *m* are the charge and mass of electron respectively, *r* is the radius of the orbit and ε_0 is the permittivity of free space

(1) $\frac{e}{\sqrt{4\pi\varepsilon_0 mr}}$ (2) $e\sqrt{r / 4\pi\varepsilon_0 m}$

(3) $e\Big/\sqrt{4\pi\varepsilon_0 m}$ (4) $\frac{e^2}{4\pi\varepsilon_0 mr}$

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40. The approximate average binding energy of a nucleon in the nucleus of an atom is

(1) 7.9 eV (2) 2.8 k eV

(3) 5.6 M eV (4) 8.9 G eV

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41. Free neutrons of mass, 1.67×10^{-27} kg and de Broglie wavelength 1 nm have a mean life time of about 900 s. The distance from the source where the number of neutrons have decayed to one-half its initial value is ($h = 6.62 \times 10^{-34}$ Js)

(1) 2.4×10^5 m (2) 2.4×10^{-4} m

(3) 4.8×10^5 m (4) 4.8×10^{-4} m

---

42. How long does it take for 80% of a radioactive sample to decay? Given half-life period is 3.465 days (ln2 = 0.693)

(1) 5 ln 1.25 days (2) 0.2 ln 5 days

(3) 0.2 ln 1.25 days (4) 5 ln 5 days

---

43. With N denoting number of neutrons, Z-denoting number of protons and A denoting the mass number, the sequence containing the correct statements is

A) Nuclei with same N and different A are called isotopes

B) Nuclei with same A and different Z are known as isobars

C) Nuclei with same N and different Z are known as isotones

D) N/Z becomes less than 1 for higher Z

(1) B and C (2) C and D (3) A and B (4) B and D

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44. Singly charged ions of mass '*m*' amu, and charge 'e' emitted from a heated anode are accelerated by a potential 'V' applied between the anode and cathode. If the ions then pass through a hole in the cathode into a uniform magnetic field of strength 'B' applied perpendicular to their direction of motion, then the radius of the path of the ions is

(1) $\frac{1}{B}\left(\frac{2Vm}{e}\right)^{\frac{1}{4}}$ (2) $\frac{1}{B}\left(\frac{2Vm}{e}\right)$ (3) $\sqrt{\frac{1}{B}\left(\frac{2Vm}{e}\right)}$ (4) $\frac{1}{B}\sqrt{\left(\frac{2Vm}{e}\right)}$

---

45. The mobility of electron in Si at 300 K is 0.13 m^2/V-s. Calculate the diffusion constant of electron ($k_B = 1.38 \times 10^{-23}$ J/K)

(1) 0.0034 m^2/s (2) 0.0024 m^2/s

(3) 0.0044 m^2/s (4) 0.0054 m^2/s

---

46. The Fermi level of a n-type semiconductor at a temperature of 300 K is at a position 0.3 eV below the conduction band. Find the position of fermi level at a temperature 320 K wrt to the conduction band

(1) 0.26 eV (2) 0.28 eV (3) 0.34 eV (4) 0.32 eV

---

47. A transistor has $\alpha = 0.99$. If it is connected in Common-Emitter mode, what would be the change in collector current for a change of 10 μA in base current?

(1) 1.50 mA (2) 0.99 mA (3) 0.85 mA (4) 1.05 mA

---

48. The reverse biased current of a particular p-n junction diode increases when it is exposed to light of wavelength less than or equal to 600 nm. Assuming that the increase in carrier concentration takes place due to creation of near hole-electron pairs by absorption of light, find the band -gap ($h = 6.63 \times 10^{-34}$ Js)

(1) 2.1 eV (2) 1.4 eV (3) 2.07 eV (4) 1.11 eV

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49. The basic storage element in a digital system is

(1) Flip-flop (2) Counter

(3) Multiplexer (4) Encoder

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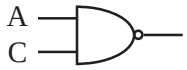
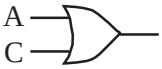
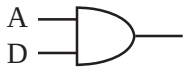
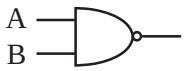
50. The Boolean expression $\bar{A}B\bar{C}D+\bar{A}B\bar{C}\bar{D}+\bar{A}\bar{B}\bar{C}D+\bar{A}\bar{B}\bar{C}\bar{D}$ is equivalent to

(1) 

(2) 

(3) 

(4) 

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51. Calculate the length of column of water that could exert 2 bar of pressure. Given, height of mercury column required to exert 1 bar pressure is 750 mm and density of Hg is 13.6 g cm^{-3}.

(1) 20400 mm (2) 10200 mm (3) 750 mm (4) 1500 mm

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52. 11.2 L of a gas at STP weighs 14 g. Which of the following is the gas?

(1) N_2O (2) CO_2 (3) SO_2 (4) CO

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53. In general, High Performance Liquid Chromatography (HPLC) cannot be used to

a) Identify various Pigments in a leaf extract

b) Separate organic pesticides

c) Determine arsenic content in a water sample

d) O_2 content in a given gas sample

(1) (a), (b) (2) (b), (c) (3) (d), (a) (4) (c), (d)

---

54. 1 mole of carbondioxide and 1 mole of Ammonia are placed in a container kept at 850 °C. What is the ratio of effusion rate of $NH_{3(g)}$ to $CO_{2(g)}$

(1) $\sqrt{\frac{44}{17}}$ (2) $\sqrt{\frac{88}{17}}$ (3) $\sqrt{\frac{44}{34}}$ (4) 1

---

55. Bleaching powder is prepared by the action of Cl_2 on

(1) slaked lime (2) quick lime

(3) limestone (4) soda lime

---

56. On adding dilute acid to 'X' produced a compound 'Y', which has rotten egg smell. Compound X and Y respectively are

(1) Fe; SO_2 (2) FeS; H_2S

(3) Fe SO_4; SO_2 (4) FeO; H_2S

57. If 20 g of $CaCO_3$ is treated with 20 g of HCl, how many grams of CO_2 is produced?

(1) 29.4 g (2) 44 g (3) 77 g (4) 8.8 g

58. Approximately how much time it would take to react Avogadro's number of atoms, at a rate of 1 billion atoms in one second

(1) 19×10^8 year (2) 19×10^7 year

(3) 19×10^6 year (4) 19×10^5 year

59. Input materials for the Solvay process are

(1) NaCl and NH_3

(2) NaCl, Conc. NH_3

(3) NH_4Cl, $NaHCO_3$ and H_2O

(4) Saturated solution of NaCl, Conc. NH_3 and CO_2

60. Identify conjugate acid-base pairs from the following

a) HCl, NaOH

b) H_2O, OH^-

c) H_2SO_4, SO_4^{2-}

d) $HClO_4$, ClO_3^-

e) $H_3C\text{-}NH_2$, $H_3C - NH_3^+$

f) H_2SO_3, HSO_3^-

(1) (a), (b), (d), (e) (2) (b), (d), (f)

(3) (b), (e), (f) (4) (e), (f)

61. A sample of hydrated magnesium sulphate, $MgSO_4\ x\ H_2O$ has 51.1% water. What is the value of 'x'?

(1) 5 (2) 6 (3) 4 (4) 7

62. The co-ordination number and oxidation state respectively of 'X' in $\left[X\ SO_4 \left(NH_3 \right)_4 \right] Cl$

(1) 3, 6 (2) 2, 6 (3) 6, 3 (4) 6, 4

63. The density of 3 M NaCl solution is 1.25 g ml^{-1}. Calculate the molality (m) of the solution [M.Wt. of NaCl = 58.5]

(1) 3 (2) 2.79 (3) 1.07 (4) 3.75

---

64. Balance the following equation

$$xNaNO_3 + yPbO \rightarrow aPb(NO_3)_2 + bNa_2O$$

x, *y*, *a* and *b* respectively are

	x	*y*	*a*	*b*
(1)	1	1	2	2
(2)	2	4	1	2
(3)	2	1	1	1
(4)	2	1	2	1

---

65. If a domestic microwave oven emits radiation of wavelength 0.5 cm, what is the corresponding frequency in Hz

(1) 6.67×10^{-7} (2) 6×10^{8}

(3) 6×10^{23} (4) 6×10^{10}

---

66. Identify the representation where Aufbau rule is violated?

	2s	2p
(1)	⇅	1 1 1
(2)	⇅	⇅ 1
(3)	⇅	⇅ ⇅ 1
(4)	1	⇅ 1 1

---

67. The normalised radial wave function for 2 p electron is correctly represented in

(1) $2\left(\frac{1}{a_0}\right)^{\frac{3}{2}} e^{-\frac{r}{a_0}}$ (2) $\frac{1}{2\sqrt{6}}\left(\frac{1}{a_0}\right)^{\frac{1}{2}}\left(\frac{r}{a_0}\right)e^{-\frac{r}{2a_0}}$

(3) $\frac{1}{2\sqrt{2}}\left(\frac{1}{a_0}\right)^{\frac{3}{2}}\left(2-\frac{r}{a_0}\right)e^{-\frac{r}{2a_0}}$ (4) $\frac{1}{2}\left(\frac{1}{a_0}\right)^{\frac{1}{2}}$

---

68. Calculate the De-Broglie wavelength of an electron moving with a velocity of 5.93×10^6 ms^{-1}. (Given $m_e = 9.11 \times 10^{-31}$ kg and $h = 6.626 \times 10^{-34}$ Js)

(1) 123 pm (2) 123 nm (3) 123 μm (4) 123 mm

---

69. If 'r' is the radius of an orbit, the angular momentum of H-atom is proportional to

(1) r^2 (2) $\frac{1}{r}$ (3) $\sqrt{r}$ (4) $\frac{1}{\sqrt{r}}$

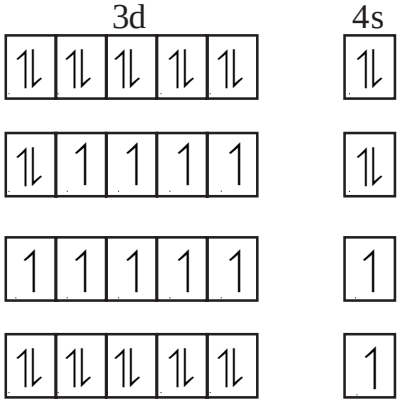
---

70. The speed of the electron in Bohr first orbit of H-atom is 'x' then speed of the electron in 3rd orbit is

(1) $x/3$ (2) $x/9$ (3) $3x$ (4) $9x$

---

71. The correct representation of the electric configuration of copper atom in ground state is



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72. Which state of Be^{3+} has the same orbit radius as that of ground state H-atom?

(1) $n = 2$ (2) $n = 3$ (3) $n = 4$ (4) $n = 1$

---

73. Which one of the following expressions is correct according to Henry Moseley's observation?

[Hint: v = frequency, z is nuclear charge, a and b are constants]

(1) $v = a(z - b)^2$ (2) $\sqrt{v} = a(z - b)$

(3) $v = az$ (4) $\frac{1}{\sqrt{v}} = a(z - b)$

---

74. Identify the correct statements from the following

a) The atomic radius of Si, Na, Cl follow the order, Na > Si > Cl

b) Gadolinium is a f-block element

c) Electronegativity of halogens follow the order, Cl > F > Br > I

d) F^-, Na^+, Mg^{2+} and O^- are isoelectronic species

(1) (a), (b), (c), (d) (2) (a), (c), (d)

(3) (c), (d) (4) (a), (b)

---

75. Predict the general formula of compound, which might be formed by Aluminium and Sulphur

(1) Al_2S_3 (2) AlS_4

(3) Al_4S_2 (4) Al_3S_2

---

76. Assertion (A) : Be has higher ionisation potential than B.

Reason (R) : Removal of electron from *s* orbital needs more energy than *p* orbital

(1) Both (A) and (R) correct, and (R) is the correct explanation of (A)

(2) Both (A) and (R) are correct, but (R) is not the correct explanation of (A)

(3) (A) is correct, but (R) is wrong

(4) (A) is wrong, but (R) is correct

---

77. The correct order of first ionisation potential of the 3rd period elements is

(1) Na > Al > S > P > Mg

(2) Na < Al < S < P < Mg

(3) Na < Al < Mg < S < P

(4) Na < Mg < Al < P < S

---

78. Which of the following statements are correct for lanthanide contraction?

a) There is a steady decrease in the ionic size

b) Basic nature decreases from Ce to Lu

c) Many trivalent lanthanides ions are colored

d) There is a slight decrease in electronegativity with increase in atomic number of lanthanides

(1) (a), (b), (d) (2) (a), (b), (c)

(3) (a), (c), (d) (4) (a), (b), (c), (d)

---

79. Which of the following is the correct representation of the isoelectronic species?

(1) $P^{3-}, S^{2-}, Cl^{-}, \mathrm{Ar}, \mathrm{K}^{+}$

(2) $P^{2+}, S^{-1}, Cl^{+}, K^{+}, Ar$

(3) $Si^{3+}, Na^{+}, Mg^{2+}, Al^{3+}, Ar$

(4) $Na^{+}, Mg^{+}, Al^{+}, Si^{+}, P^{+}$

---

80. From the given set of compounds, identify the number of compounds in which 'S' does not obey octal rule

SO_2, SF_2, SF_4, SF_6

(1) 4 (2) 3 (3) 1 (4) 2

---

81. Which of the following compounds has ionic, covalent and coordinate covalent bonds?

(1) PCl_3 (2) NH_4Cl

(3) $MgCl_2$ (4) NaCl

---

82. The correct order of Lewis acidity of BF_3, BCl_3, BBr_3 and BI_3 is

(1) $BF_3 > BCl_3 > BBr_3 > BI_3$ (2) $BF_3 < BCl_3 < BBr_3 < BI_3$

(3) $BBr_3 > BI_3 > BCl_3 > BF_3$ (4) $BBr_3 > BCl_3 > BF_3 > BI_3$

---

83. Identify the set of species with the correct order of bond order

(1) $NO_3^- > NO_2^- > NO_2^+$ (2) $NO_2^- > NO_3^- > NO_2^+$

(3) $NO_2^+ > NO_3^- > NO_2^-$ (4) $NO_2^+ > NO_2^- > NO_3^-$

---

84. The correct order of the bond angles of NH_3, NH_4^+ and NH_2^- is

(1) $NH_4^+ > NH_3 > NH_2^-$ (2) $NH_2^- > NH_3 > NH_4^+$

(3) $NH_3 > NH_2^- > NH_4^+$ (4) $NH_3 > NH_4^+ > NH_2^-$

---

85. What is special about the bonding of B_2H_6?

(1) B-atom in B_2H_6 does not obey octet rule because each B-atom contributes only three valence electrons

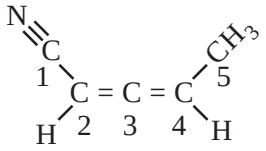
(2) B-atoms in B_2H_6 obey octet rule by forming two three-center-2e-bonds

(3) B-atoms in B_2H_6 obey octet rule by forming a B-B covalent bond

(4) B-atoms shares three H-atoms in the middle to satisfy the octet rule

---

86. Indicate the hybridization of each carbon atoms of the below compound



(1) $C_1 - sp, C_2 - sp^2, C_3 - sp, C_4 - sp^2, C_5 - sp^3$

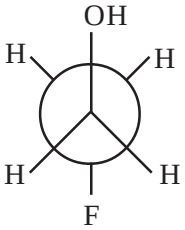
(2) $C_1 - sp, C_2 - sp^2, C_3 - sp^2, C_4 - sp^2, C_5 - sp^3$

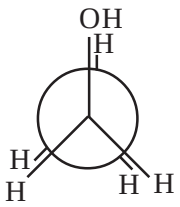
(3) $C_1 - sp, C_2 - sp^2, C_3 - sp^2, C_4 - sp, C_5 - sp^3$

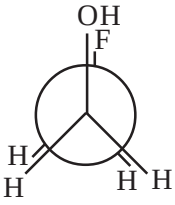
(4) $C_1 - sp^2, C_2 - sp^2, C_3 - sp, C_4 - sp^2, C_5 - sp^3$

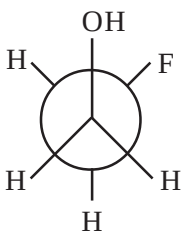
---

87. Which one among the following conformational isomers is relatively more stable?

(1) 

(2) 

(3) 

(4) 

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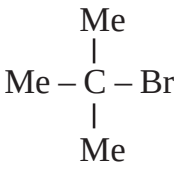
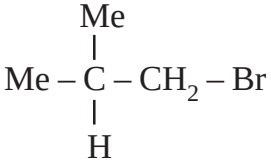
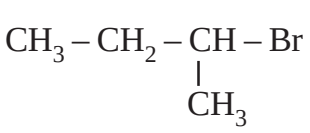
88. The correct order of reactivity for the following compounds in SN^2 reactions is

a) 

b) 

c) 

d) $CH_3 - CH_2 - CH_2 - CH_2 - Br$

(1) b > a > c > d (2) d > b > c > a

(3) d > c > b > a (4) a > c > d > b

---

89. The possible compounds with the empirical formula "CH_2" are

(1) acetylene, ethylene, benzene

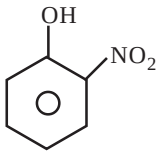
(2) ethylene, butene, cyclohexane

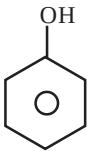
(3) ethylene, cyclobutene, benzene

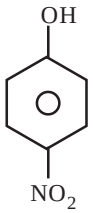
(4) butene, cyclopentane, cyclohexene

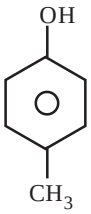
---

90. Arrange the followings compounds in decreasing acid character


(a)


(b)


(c)


(d)

C_2H_5OH
(e)

(1) d > c > a > b > e (2) d > b > a > c > e

(3) c > a > b > d > e (4) c > e > a > b > d

---

91. Identify polysaccharides from the following

a) starch b) maltose

c) cellulose d) glucose

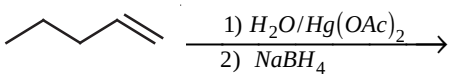
e) glycogen f) sucrose

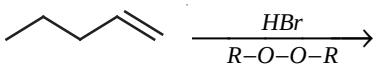
(1) (a), (c), (d), (e) (2) (b), (c), (d), (e)

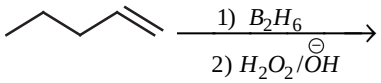
(3) (a), (c), (e) (4) (a), (c), (f)

---

92. Identify the reactions which follow Morkovnikov's addition from the following :

i) 

ii) 

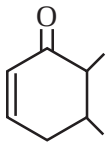
iii) 

iv) 

(1) (i), (ii) (2) (ii), (iv) (3) (i), (iii) (4) (i), (iv)

---

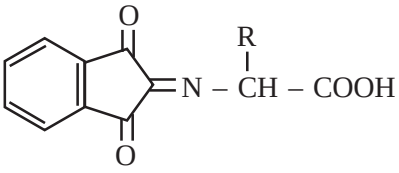
93. IUPAC name for the below compound is

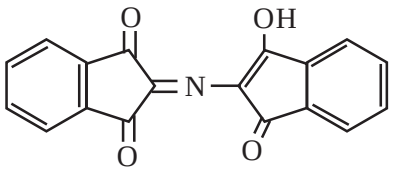


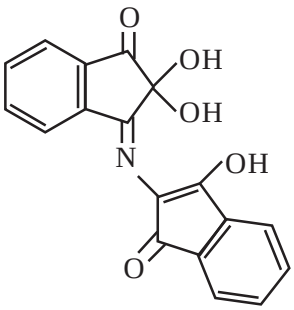
(1) 2, 3-Dimethyl cyclohex-5-en-1-one
(2) 5, 6-Dimethyl cyclohex-2-en-1-one
(3) 4, 5-Dimethyl cyclohex-1-en-3-one
(4) 4, 5-Dimethyl cyclohex-1-en-6-one

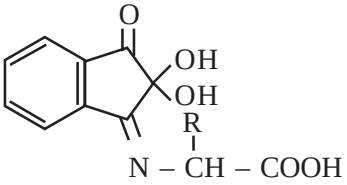
---

94. In the Ninhydrin test for proteins, violet colour formation is due to

(1) 

(2) 

(3) 

(4) 

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95. Which of the following is an artificial sweetener?

(1) Chloromphenicol (2) Norethindrone

(3) Bithionol (4) Alitame

---

96. Assertion (A): PAN is the main constituent of photochemical smog

Reason (R) : It is formed due to the action of NO_x and hydrocarbons in the presence of UV light of Sun

(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(2) Both (A) and (R) are correct and (R) is not the correct explanation of (A)

(3) Only (A) is correct, but (R) is wrong

(4) Both (A) and (R) are wrong

---

97. In the sacrificial anodic protection the base structure containing iron metal is protected by which metal?

(1) Zn (2) Ni

(3) Cu (4) Au

---

98. Identify A, B, C respectively in the following reaction.

Impure Nickel + $A \xrightarrow{60-70^{\circ}C} B \xrightarrow{180^{\circ}C} Ni + C$

(1) $CO_2, Ni(CO)_4, H_2O$ (2) $CO, NiCO_3, CO$

(3) $CO_2, Ni(CO)_4, CO$ (4) $CO, Ni(CO)_4, CO$

---

99. One of the following is responsible for Bhopal gas tragedy. Identify its formula

(1) CH_3CHO (2) CH_3NCO

(3) CH_3CN (4) CH_3NC

---

100. The ore that is concentrated by froth flotation is

(1) Chalcopyrites (2) Cryolite

(3) Cuprite (4) Calamine

SPACE FOR ROUGH WORK

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