TEST SERIES CSIR-NET/JRF June 2017

BOOKLET SERIES E

Paper Code 05

Test Type: TEST SERIES

PHYSICAL SCIENCES

Duration: 3:00 Hours

Date: 10-06-2017

Maximum Marks: 200

Read the following instructions carefully:

* Single Paper Test is divided into three Parts.

Part - A: This part shall carry 20 questions. The candidate shall be required to answer any 15 questions. Each question shall be of **2 marks.**

Part - B: This part shall contain 20 questions covering the topics given in the Part 'B' of syllabus. The candidates are required to answer all questions. Each question shall be of **3.5 Marks.**.

Part - C: This part shall contain **25** questions from Part - C of the syllabus. There will be 10 compulsory questions and out of remaining 15 questions , a candidate will be required to answer any 10. Each question shall be of **5 Marks**.

* Darken the appropriate bubbles with HB pencil/Ball Pen to write your answer.
* There will be negative marking @25% for each wrong answer.
* The candidates shall be allowed to carry the Question Paper Booklet after completion of the exam.
* For rough work, blank sheet is attached at the end of test booklet.

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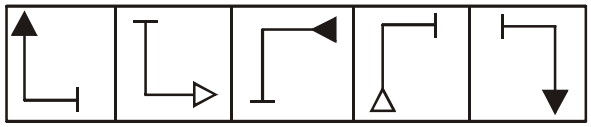
PART-A

1. Next term of the series

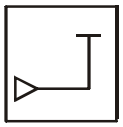
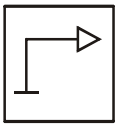
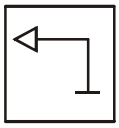
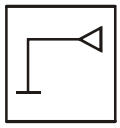
   4 9 20 43 __ is

   (a) 90 (b) 84 (c) 96 (d) 95

2. Next figure of the sequence



is

(a)  (b)  (c)  (d) 

3. Find the number of rectangles in

(a) 24 (b) 36 (c) 40 (d) 30

4. It is being given that $(2^{32} + 1)$ is completely divisible by a whole number. Which of the following numbers is completely divisible by this number?

   (a) $(2^{16} + 1)$ (b) $(2^{16} - 1)$ (c) 7×2^{33} (d) $(2^{96} + 1)$

5. The maximum number of students among them 1001 pens and 910 pencils can be distributed in such a way that each student gets the same number of pens and same number of pencils is

   (a) 91 (b) 910 (c) 1001 (d) 1911

6. A piece of cloth costs Rs. 35. If the length of the piece would have been 4 m longer and each metre costs Re. 1 less, the cost would have remained unchanged. How long is the piece?

   (a) 9 m (b) 10 m (c) 12 m (d) 14 m

7. A vendor losses the selling price of 4 organges on selling 36 oranges. His loss percent is

   (a) 10% (b) $11\frac{1}{9}\%$ (c) $12\frac{1}{2}\%$ (d) None of these

8. Ronald and Elan are working on an assignment. Ronald takes 6 hours to type 32 pages on a computer, while Elan takes 5 hours to type 40 pages. How much time will they take, working together on two different computers to type an assignment of 110 pages?

   (a) 7 hours 30 minutes (b) 8 hours

   (c) 8 hours 15 minutes (d) 8 hours 25 minutes

9. Walking $\frac{6}{7}$ th of his usual speed, a man is 12 minutes too late. The usual time taken by him to cover that distance is

   (a) 1 hour (b) 1 hour 12 minutes

   (c) 1 hour 15 minutes (d) 1 hour 20 minutes

10. Two goods train each 500 m long, are running in opposite directions on parallel tracks. Their speeds are 45 km/hr and 30 km/hr respectively. Find the time taken by the slower train to pass the driver of the faster one

(a) 12 sec (b) 24 sec (c) 48 sec (d) 60 sec

11. A man can row three-quarters of a kilometre against the stream in $11\frac{1}{4}$ minutes. The speed (in km/hr) of the man in still water is

(a) 2 (b) 3 (c) 4 (d) 5

12. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk should he mix from each of the containers so as to get 12 litres of milk such that the ratio of water to milk is 3 : 5?

(a) 4 litres, 8 litres (b) 6 litres, 6 litres
(c) 5 litres, 7 litres (d) 7 litres, 5 litres

13. The calendar for the year 2007 will be the same for the year

(a) 2014 (b) 2016 (c) 2017 (d) 2018

14. In how many different ways can the letters of the word 'MATHEMATICS' be arranged so that the vowels always come together?

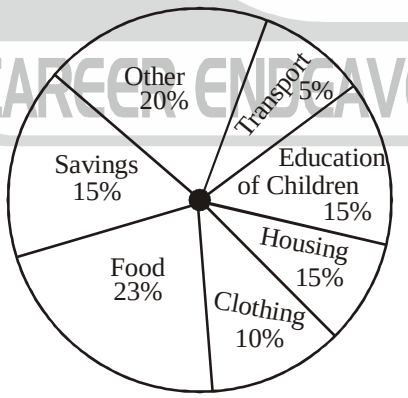
(a) 10080 (b) 4989600 (c) 120960 (d) None of these

15. A speaks truth in 75% cases and B in 80% of the cases. In what percentage of cases are they likely to contradict each other, narrating the same incident?

(a) 5% (b) 15% (c) 35% (d) 45%

The pie chart given below, shows the expenditure on various items and saving of the family during the year 2009. Study the pie chart and answer question No. 16 based on it.

PERCENTAGE OF MONEY SPENT ON VARIOUS ITEMS AND SAVINGS BY A FAMILY DURING 2009



16. If the total income of the family for the year 2009 was Rs. 1,50,000 then the difference between the expenditures on housing and transport was

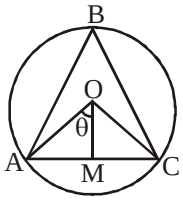
(a) Rs. 15,000 (b) Rs. 10,000 (c) Rs. 12,000 (d) Rs. 7,500

17. The area of a circle is halved when its radius is decreased by *n*. The radius of the circle is

(a) $(2+\sqrt{2})n$ (b) $(2-\sqrt{2})n$ (c) (a) or (b) (d) $\sqrt{2}n$

18. The dimensions of a cuboid are 18 cm × 12 cm × 9 cm. How many cubes of side 3 cm can be made by melting the cuboid?

(a) 60 (b) 55 (c) 69 (d) 72

19. 

In the figure given above, O is the centre of the circle, OA = 3 cm, AC = 3 cm and OM is perpendicular to AC. What is $\angle ABC$ equal to?

(a) 60º (b) 45º (c) 30º (d) 90º

20. If A's height is 40% less than that of B, how much percent B's height is more than that of A?

(a) $33\frac{1}{3}\%$ (b) 40% (c) 60% (d) $66\frac{2}{3}\%$

PART-B

21. A point charge +q is placed outside a grounded conducting sphere of radius *a*. Which of the following statements is not true?

(a) the induced surface charge density on the sphere is not the same everywhere
(b) the electric field inside the sphere is zero
(c) the total induced charge on the sphere is -q
(d) the electrostatic potential at a large distance *d* (compared to the distance between the charge and the sphere) falls off as 1/*d*.

22. In a region of space, a time dependent magnetic field $B(t) = 0.4t$ Tesla points vertically upwards. Consider a horizontal, circular loop of radius 2 cm in this region. The magnitude of the electric field (in mV/m) induced in the loop is

(a) 2.00 (b) 4.00 (c) 6.25 (d) 12.50

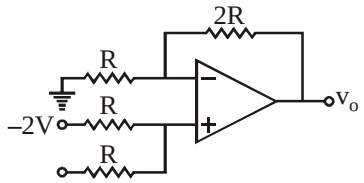
23. For an electromagnetic wave travelling in free space, the electric field is given by $\vec{E} = 100\cos\left(10^8 t + kx\right)\hat{j}\, V/m$. Which of the following statements is not ***TRUE***?

(a) The wavelength of the wave is 6π meter.
(b) The corresponding magnetic field is directed along the positive z-direction
(c) The poynting vector is directed along the negative *x*-direction
(d) The wave is linearly polarized.

24. In heat transport, the rate of flow $\frac{dQ}{dt}$ through a solid slab is related to the temperature difference ΔT as, $\frac{dQ}{dt} = \frac{kA\Delta T}{L}$. Here k, A and L are thermal conductivity, cross-sectional area and thickness of the slab, respectively. In actual experiment, assume that the percentage errors in the measurement of heat flow rate, each length scale and temperature difference are 3%, 1% and 5% respectively. The maximum percenrtage error in the measurement of thermal conductivity is

(a) 8% (b) 9% (c) 10% (d) 11%

25. A non-inverting op-amp is shown below (assume ideal op-amp)



$v_i = [2 + \sin(100\,t)]V$

The output voltage V_o for an input $V_i = [2 + \sin(100\,t)]V$

(a) $3/2 \sin(100\,t)$ (b) $3 \sin(100\,t)$ (c) $2 \sin(100\,t)$ (d) $3 \sin(100\,t) + 1/2$

26. A J-K flip-flop can be made from an S-R flip-flop by using two additional

(a) AND gates (b) OR gates (c) NOT gates (d) NOR gates

27. A particle of mass *m* moves under central potential $V(r) = -\frac{k}{r}$. If energy of system is zero then speed at its closest distance r_0 from centre of force is

(a) $\sqrt{\frac{2k}{mr_0}}$ (b) $\sqrt{\frac{k}{2mr_0}}$ (c) $\sqrt{\frac{k}{mr_0}}$ (d) $2\sqrt{\frac{k}{mr_0}}$

28. A spherical shell has mass M and inner and outer radii R and 2R. Its moment of inertia about diameter is

(a) $\frac{12}{13}MR^2$ (b) $\frac{12}{5}MR^2$ (c) $\frac{62}{35}MR^2$ (d) $\frac{31}{32}MR^2$

29. From a box containing 10 cards, numbered 1, 2, 3, ...10 four cards are drown together. What is the probability that their sum is even ?

(a) 13/18 (b) 11/21 (c) 7/16 (d) 8/25

30. The eigenvalues of the matrix $P = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$ are

(a) $\frac{1}{2}\left(\sqrt{3} \pm i\right)$ When $\theta = 45^o$ (b) $\frac{1}{2}\left(1 \pm \sqrt{3}i\right)$ When $\theta = 60^o$

(c) $\frac{1}{2}\left(\sqrt{3} \pm i\right)$ When $\theta = 60^o$ (d) $\frac{1}{2}\left(1 \pm \sqrt{3}i\right)$ When $\theta = 30^o$

31. Consider the function: $f(x) = \int_0^x \left(t^2 - 3t + 2\right) dt$. The function $f(x)$ has

(a) maximum at x=1 and x=2. (b) minimum at x=1 and minimum at x=2.
(c) maximum at x=1 and minimum at x=2. (d) minimum at x=1 and x=2.

32. Suppose the Laplace transform of two time varying signals $f_1(t)$ and $f_2(t)$ is given to be $g_1(s)$ and $g_2(s)$ and the convolution theorem is defined as:

$$L^{-1}\left[g_1(s)\,g_2(s)\right] = \int_0^p f_1(t)\, f_2(p-t)\, dt$$

The Laplace transform of the integral $\int_0^m e^t \sin(m-t)\, dt$ will be

(a) $\frac{1}{(s-1)\left(s^2+1\right)}$ (b) $\frac{1}{(s-1)\left(s^2-1\right)}$ (c) $\frac{1}{(s+1)\left(s^2-1\right)}$ (d) None of these

33. Consider a particle of mass *m* in the state $\psi(x) = \phi_1(x) - i\,\phi_3(x)$, where $\phi_1(x)$ and $\phi_3(x)$ are energy eigenfunctions of an infinite potential well of width *L*. The expectation value of square of the momentum is

(a) $\frac{3\pi^2\hbar^2}{2L^2}$ (b) $\frac{5\pi^2\hbar^2}{L^2}$ (c) $\frac{\pi^2\hbar^2}{L^2}$ (d) 0

34. Consider a particle of *m* that is moving in the one-dimensional potential $V(x)$ is in a state at $t = 0$

$$\psi(x, t=0) = \psi_1(x) + i\psi_2(x)$$

where $\psi_1(x)$ and $\psi_2(x)$ are energy eigenfunctions with energy E_1 and E_2 ($E_2 > E_1$) respectively. The uncertainty in energy ΔE is given by

(a) $\frac{E_1 + E_2}{2}$ (b) $E_2 - E_1$ (c) $\langle E\rangle - E_1$ (d) $\langle E\rangle + E_2$

35. The molar specific heat at constant temperature of a particular material is given by $C_V = aT + bT^3$ in a particular range of temperature. For $a = 1.35\times10^{-3}\ J/K^2$ and $b = 2.48\times10^{-5}\ J/K^2$. The value of absolute entropy at temperature –263°C is

(a) $1.36\times10^{-3}\ J/K$ (b) $2.18\times10^{-2}\ J/K$ (c) $1.36\times10^{-5}\ J/K$ (d) $2.18\times10^{-8}\ J/K$

36. The equation for a particular process is given by

$$P = P_0 - aV^2$$

where P_0, *a* are positive constant and *P* is pressure and *V* is volume of one mole. The maximum temperature attainable by one mole of an ideal gas is

(a) $\frac{3}{2R}\sqrt{\frac{P_0^3}{a}}$ (b) $\frac{2}{3R}\sqrt{\frac{P_0^3}{3a}}$ (c) $\frac{1}{3R}\sqrt{\frac{P_0^3}{3a}}$ (d) $\frac{4}{3R}\sqrt{\frac{P_0^3}{2a}}$

37. Consider an electron bound in a hydrogen atom under the influence of a homogeneous magnetic field $\mathbf{B} = B\hat{\mathbf{z}}$. Ignore the electron spin. The Hamiltonian of the system is $H = H_0 - \omega L_z$, with $\omega = eB/2mc$. The eigenstates $|nlm\rangle$ and eigenvalues as known. Assume that initially (at t =0) the system is in state

$$|\psi(0)\rangle = \frac{1}{\sqrt{2}}\left(|21{-1}\rangle - |211\rangle\right)$$

The expectation value of the magnetic dipole moment associated with the orbital angular momentum at time t, is

(a) $\frac{e\hbar}{2mc}$ (b) $\frac{e\hbar}{mc}$ (c) $\frac{2e\hbar}{mc}$ (d) 0

38. For a particular substance near the triple point, $0 < \left(\frac{dp}{dT}\right)_{sublimation} < \left(\frac{dp}{dT}\right)_{vaporization}$. If this is correct then

(a) Molar entropy of solid phase is smaller than the liquid phase.
(b) Molar entropy of solid phase is greater than the liquid phase.
(c) This result violets the second law of thermodynamics.
(d) Options (b) and (c) both are correct.

39. A free particle is initially (at t=0) in a state corresponding to the wave function

$$\psi(r) = \left(\frac{\gamma}{\pi}\right)^{3/4} e^{-\gamma r^2/2}$$

(a) The wave function is an eigen function of Hamiltonian only.

(b) The wave function is an eigen function of L^2 and L_z only.

(c) The wave function is an eigen function of H, L^2 and L_z at time $t = 0$ but not at all time.

(d) The wave function is an eigen function of H, L^2 and L_z at time $t = 0$ and also at all time t.

40. Consider a system of N and distinguishable particles (in which particles can move in one dimensional segment $q = 0$ and $q = L$) in thermal equilibrium at temperature T. The single particle Hamiltonian is given by

$$H = \frac{p^2}{2m} - \alpha \ell \mathrm{n}\left(\frac{q}{L_0}\right),$$

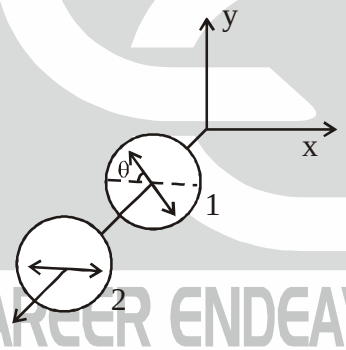
where α is positive constant and L_0 is characteristic length. The equation of state of the system is

(a) $\frac{NKT}{L}$ (b) $\frac{\alpha NKT}{L}\left(1-\frac{\alpha}{kT}\right)$ (c) $\frac{NKT}{L}\left(1+\frac{\alpha}{kT}\right)$ (d) $\frac{NKT}{\alpha L}$

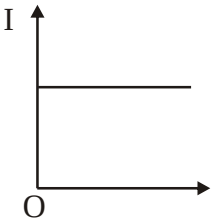
PART-C

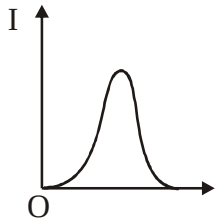
COMPULSORY QUESTIONS

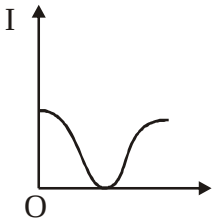
41. A plane polarized electromagnetic wave with polarization along y-axis, is incident on a system of two polarizing sheets as shown below.

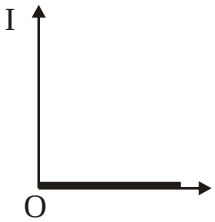


The polarization axis of polarizer 2 is fixed along the x-axis, while polarizer 1 can be rotated in the x-y plane. If θ is the angle between the polarization axes of polarizers 1 and 2, which of the following figures give the correct description of the intensity at the output of polarizer 2 as a function θ between zero and $\pi/2$?

(i) 

(ii) 

(iii) 

(iv) 

(a) (i) (b) (ii) (c) (iii) (d) (iv)

42. X-rays are diffracted from a set of planes with miller indices (110) in NaCl crystal at Bragg angle of 30°. If the lattice parameter (a) of the crystal is 4.2Å, the wavelength λ of the X-rays is:

(a) 2.96Å (b) 5.94Å (c) 1.48Å (d) 4.2Å

43. Which one of the following gases of diatomic molecules is Raman active, infrared active and NMR inactive?

(a) $^{1}H-^{1}H$ (b) $^{12}C-^{16}O$ (c) $^{1}H-^{35}Cl$ (d) $^{16}O-^{16}O$

44. An n-channel JFET has $I_{DSS}=2\,mA$ and $V_P=-4V$. Its transconductance g_m (in *mV/V*) for applied gate to source voltage V_{GS} of $-2V$ is.

(a) 0.25 (b) 0.5 (c) 0.75 (d) 1.0

45. Lagrangian of a particle moving in *x-y* plane under the influence of a uniform magnetic field $B\hat{k}$ is given as

(a) $L=\frac{1}{2}m\left(\dot{x}^2+\dot{y}^2\right)-\frac{qB}{2}\left(\dot{y}x-\dot{x}y\right)$ (b) $L=\frac{1}{2}m\left(\dot{x}^2+\dot{y}^2\right)+\frac{qB}{2}\left(\dot{y}x-\dot{x}y\right)$

(c) $L=\frac{1}{2}m\left(\dot{x}^2+\dot{y}^2\right)+qB\left(\dot{y}x-\dot{x}y\right)$ (d) $L=\frac{1}{2}m\left(\dot{x}^2+\dot{y}^2\right)-qB\left(\dot{y}x-\dot{x}y\right)$

46. The generating function of the Hermite polynomial $H_n(x)$ is given as following:

$$e^{2xt-t^2}=\sum_{n=0}^{\infty}H_n(x)t^n$$

The value of $H_{31}(x=0)$ will be

(a) 256 (b) 512 (c) 1024 (d) 0

47. The value of temperature above and below which the change in Helmholtz free energy of a H-atom in moving from ground state to first excited state is positive and negative is

(a) $5.3\times10^{23}K$ (b) $5.3\times10^{2}K$ (c) $8.5\times10^{12}K$ (d) $8.5\times10^{4}K$

48. Consider a particle of mass *m* moving in the one dimensional potential

$$V(x)=\begin{cases}0, & 0<x<L\\ \infty & \text{otherwise}\end{cases}$$

The uncertainty in momentum in the state

$$\psi(x)=\begin{cases}A\cos^2\left(\frac{\pi x}{L}\right)\sin\left(\frac{\pi x}{L}\right), & 0\le x\le L\\ 0 & \text{otherwise}\end{cases}$$

is

(a) 0 (b) $\frac{\pi\hbar}{L}$ (c) $\sqrt{5}\frac{\pi\hbar}{L}$ (d) $\sqrt{10}\frac{\pi\hbar}{L}$

49. Let us consider a quantum system with Hamiltonian $\hat{H}$ such that

$$\begin{cases}\hat{H}|0\rangle=0\\ \hat{H}|n\rangle=n!Q|n\rangle, \quad n=1,2,3,.....\end{cases}$$

Where $|n\rangle$ is eigenstates with $\langle n|m\rangle=\delta_{nm}$ and $Q>0$ is a positive constant. A time independent perturbation $\hat{V}=V\sum_{n=0}^{+\infty}\alpha^{n/2}\left(|n\rangle\langle 0|+|0\rangle|n\rangle\right)$ with $V>0$ constant, is applied to system. What is the value of α such that total correction $E_0^1+E_0^2=0$ (E_0^1 *and* E_0^2 are first and second order correction in energy) ?

(a) $\ell n\left(\frac{2Q+V}{V}\right)$ (b) $\ell n\left(\frac{Q+2V}{V}\right)$ (c) $-\ell n\left(\frac{Q+2V}{V}\right)$ (d) $\left(\frac{Q+2V}{V}\right)$

50. Suppose $y = f(x)$ be a twice continuously differentiable function on $(0, \infty)$ satisfying the following conditions:

$$f(1) = 1 \text{ and } f'(x) = \frac{1}{2} f\left(\frac{1}{x}\right) \quad (x > 0)$$

The differential equation that will be satisfied by $y = f(x)$ will be

(a) $4x^2 \frac{d^2y}{dx^2} - y = 0$ (b) $4x^2 \frac{d^2y}{dx^2} + y = 0$

(c) $4x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$ (d) $4x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 0$

ANSWER ANY 10 QUESTIONS OUT OF THE REMAINING 15

51. Consider second line of Lyman series in hydrogen atom, the number of Zeeman components observed for this line in weak magnetic field are :
(a) 4 components (b) 6 components (c) 10 components (d) 12 components

52. Positronium is an atom formed by an electron and positron. The mass of a positron is the same as that of an electron and its charge is equal in magnitude but opposite in sign to that of an electron. The shortest wavelength present in the Paschen series in the spectra of Positronium atom will be
(a) 364 *nm* (b) 820 *nm* (c) 1640 *nm* (d) 1092 *nm*

53. An electron is orbiting in the circular path of radius 0.5Å in x-y plane horizontally with angular velocity 4×10^{16} rad/sec. An external magnetic field $\vec{B} = (2\hat{x} + 5\hat{z})\, 4\times10^{-4}$ T exists in the space. The torque on the electron orbit is (in weber-Amp)
(a) 6.4×10^{-27} (b) 1.6×10^{-26} (c) 1.8×10^{-26} (d) 0

54. A dielectric sphere of radius R has constant polarization $\vec{P} = P_0\hat{z}$ so that the field inside the sphere is $\vec{E}_{in} = -\frac{P_0}{3\in_0}\hat{z}$. Then, which of the following is not correct?
(a) The bound charge density on the surface of sphere is $P_0 \cos\theta$
(b) The electric field at a distance *r* on the *z*-axis varies as $\frac{1}{r^3}$ for $r \gg R$
(c) The electric potential at a distance 2R on the z-axis is $\frac{P_0 R}{6\in_0}$
(d) The electric field outside is equivalent to that of a dipole at the origin

55. KCl has the NaCl type structure which is fcc with two-atom basis, one at (0, 0, 0) and the other at $\left(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}\right)$. Assume that the atomic form factors of K^+ and Cl^- are identical. In an *x*-ray diffraction experiment on KCl, which of the following (*h k l*) peaks will be observed?
(a) (1 0 0) (b) (1 1 0) (c) (1 1 1) (d) (2 0 0)

56. An intrinsic semiconductor of band gap 1.25 eV has an electron concentration 10^{10} cm^{-3} at 300K. Assume that its band gap is independent of the temperature and that the electron concentration depends only exponentially on the temperature. If the electron concentration at 200K is $Y \times 10^N$ cm^{-3} ($1 < Y < 10$, N = integer), then the value of N is (assume $300k_B = 25$ meV, $\exp(12.5) = 2.68\times10^5$, $\exp(-12.5) = 3.72\times10^{-6}$)

(a) 15 (b) 14 (c) 5 (d) 4

57. If π^+ decays at rest to μ^+ and ν_μ, then the energy and momentum of μ^+ are respectively. (Given : Rest masses $m_\pi = 0.1396\,GeV$ and $m_\mu = 0.1057\,GeV$)

(a) 0.1098 GeV and 0.0298 GeV/c (b) 0.5723 GeV and 0.2895 GeV/c
(c) 0.1350 GeV and 0.0140 GeV/c (d) 0.4210 GeV and 0.1350 GeC/c

58. The Q-value in MeV of the three reactions,

$$^2_1H + {}^2_1H \longrightarrow {}^3_1H + {}^1_1H$$

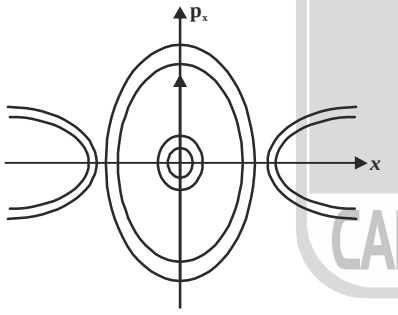
$$^2_1H + {}^2_1H \longrightarrow {}^3_2He + {}^1_0n$$

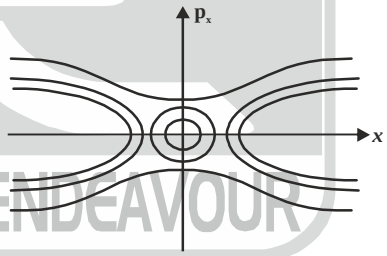
$$^3_1H \longrightarrow {}^3_2He + \beta^-$$

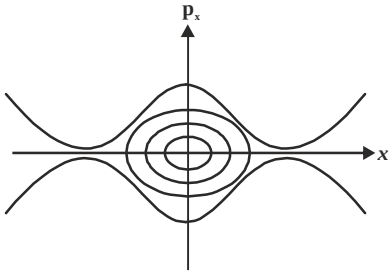
are 4.031, 3.265 and 0.0185 respectively. The mass difference between the neutron and the hydrogen atom from these data is

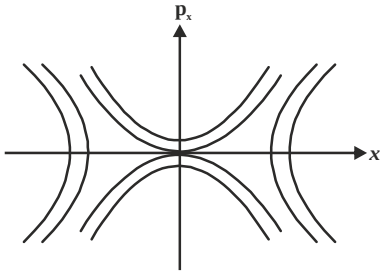
(a) 0.00842 amu (b) 0.000842 amu (c) 0.000614 amu (d) 0.00425 amu

59. Two equal point charges are fixed at some separation and a third equal charge is constrained to move on the line joining the fixed charges. Phase space trajectory of moving charge is

(a) 

(b) 

(c) 

(d) 

60. The value of the following complex integral $\oint_C \frac{1}{z\left(e^z - 1\right)}\,dz$ (where C is defined by $|z-2| = 3$ traversed in the clockwise direction) is

(a) πi (b) $-\pi i$ (c) $2\pi i$ (d) $-2\pi i$

61. A system of 5 localized and independent quantum oscillators in contact with a thermal reservoir at temperature T. The energy levels of single oscillator are given by

$$E_n = \hbar\omega_0\left(n+\frac{1}{2}\right), \qquad n = 1,3,5,7.....$$

The average internal energy of the system is

(a) $\frac{1}{2}\hbar\omega_0 + \frac{\hbar\omega_0}{e^{\frac{\hbar\omega_0}{kT}}-1}$ (b) $\frac{5}{2}\hbar\omega_0 + \frac{5\hbar\omega_0}{e^{\frac{\hbar\omega_0}{kT}}-1}$ (c) $\frac{3}{2}\hbar\omega_0 + \frac{2\hbar\omega_0}{e^{\frac{2\hbar\omega_0}{kT}}-1}$ (d) $\frac{15}{2}\hbar\omega_0 + \frac{10\hbar\omega_0}{e^{\frac{2\hbar\omega_0}{kT}}-1}$

62. The value of Poission bracket, $\sum_i \{\{\vec{r}, L_i\}, L_i\}$ is

(a) 0 (b) $-\vec{r}$ (c) $-2\vec{r}$ (d) $2\vec{r}$

63. A source of light is moving with respect to lab frame with velocity $\frac{c}{2}$. An observer is moving in opposite direction and towards source with velocity $\frac{c}{2}$ with respect to lab frame. If frequency of light measured by the observer is ν_0 then frequency in rest frame of source is

(a) $\frac{\nu_0}{3}$ (b) $3\nu_0$ (c) $\sqrt{3}\nu_0$ (d) $\frac{\nu_0}{\sqrt{3}}$

64. A particle of mass m is moving in the potential $V(x) = \frac{1}{2}kx^2$, where k is spring constant. The particle is in the ground state. If spring constant is suddenly quadrupled, the probability of finding the energy of particle $\hbar\omega$ is

(a) 0 (b) $\frac{2}{3}$ (c) $\frac{1}{3}$ (d) $\frac{2\sqrt{2}}{3}$

65. The equation for the sublimation and vapourization curves of a particular material are given by

$$\ln p = 0.04 - \frac{6}{T}(\text{sublimation})$$

$$\ln p = 0.03 - \frac{4}{T}(\text{vapourization})$$

where the pressure p is in atmospheric pressure, the temperature T is in kelvin and R is universal gas constant. Assume that the specific volume in vapour phase is much larger than that of liquid and solid phases. The specific latent heat of vapourization is

(a) R (b) $2R$ (c) $6R$ (d) $4R$

Space for rough work

PHYSICAL SCIENCES
TEST SERIES-E

Date : 10-06-2017

PART-A

1. (a)	2. (c)	3. (b)	4. (a)	5. (a)	6. (b)	7. (a)
8. (c)	9. (b)	10. (c)	11. (d)	12. (b)	13. (d)	14. (c)
15. (c)	16. (a)	17. (c)	18. (d)	19. (c)	20. (d)	

PART-B

21. (c)	22. (b)	23. (b)	24. (d)	25. (a)	26. (a)	27. (a)
28. (a)	29. (b)	30. (b)	31. (a)	32. (a)	33. (b)	34. (c)
35. (b)	36. (b)	37. (d)	38. (d)	39. (d)	40. (c)	

PART-C

41. (b)	42. (c)	43. (b)	44. (b)	45. (b)	46. (d)	47. (d)
48. (c)	49. (a)	50. (b)	51. (c)	52. (c)	53. (a)	54. (c)
55. (d)	56. (d)	57. (a)	58. (b)	59. (c)	60. (a)	61. (d)
62. (c)	63. (a)	64. (d)	65. (d)			