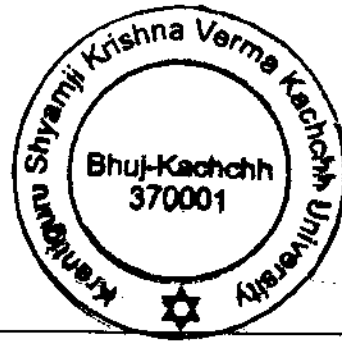


PHDKU18



Subject Code : **22-Physics**

તમને કહેવામાં ન આવે ત્યાં સુધી પ્રશ્નપુસ્તિકા ખોલવી નહીં.  
Do not open the Question Booklet until ask to do so.



**A**

Booklet Sr. No.  
**1770059**

A

ઉમેદવારનું નામ :

Candidates Name :

ઉમેદવારનો સીટ નંબર

ઉમેદવારની સહી

ખંડ નિરીક્ષકની સહી

સમય : 60 મિનિટ

કુલ પ્રશ્નો : 50

કુલ ગુણ : 100

ઉમેદવારોને સૂચના

- (1) આ પ્રશ્નપુસ્તિકામાં પ્રશ્ન ક્રમાંક 1-50 સુધી કુલ 50 પ્રશ્નો છે. પ્રત્યેક પ્રશ્નનો ઉત્તર (1), (2), (3) અને (4) પૈકી કોઈ એક છે. પ્રશ્નની સાથે જ ચારેય વિકલ્પો આપવામાં આવેલ છે. તમારે બધા જ પ્રશ્નોના ઉત્તર આપવાના છે. તમારે આ સાથે અલગ આપેલ ઉત્તરવહી (OMR SHEET)માં જ ઉત્તર આપવાના છે.

ઉદાહરણ તરીકે :

ભારતનું કયું રાજ્ય સૌથી લાંબો દરિયા-કિનારો ધરાવે છે ?

- (1) મહારાષ્ટ્ર (2) તામિલનાડુ  
(3) ગુજરાત (4) આંધ્રપ્રદેશ

જવાબવહી (Answer Sheet)માં

① ② ● ④

ઉપર્યુક્ત ઉદાહરણમાં સાચો જવાબ '3' છે. આથી '3'નું વર્તુળ કાર્યુ (encode) કરેલ છે. ઉમેદવારોએ જવાબમાં "ગુજરાત" લખવું નહીં.

- (2) પ્રત્યેક પ્રશ્નના સાચા જવાબ માટે (2)બે ગુણ છે.  
(3) આ પ્રશ્નપુસ્તિકામાં તમારે કશું જ લખવાનું નથી.  
(4) સમય પૂર્ણ થયે પ્રશ્નપુસ્તિકા અને OMR ઉત્તરપત્ર સુપરવાઈઝરને પરત સોંપી દેવું.  
(5) કસોટીની સમય મર્યાદા 60 મિનિટ છે.  
(6) ઉમેદવારે વાદળી / કાળી બોલપોઈન્ટ પેનથી ઉત્તરો લખવાના છે. અન્ય શાહી, પેન કે પેન્સિલનો ઉપયોગ કરી શકાશે નહીં.

Instructions to Candidates

- (1) In this Test Booklet, there are Ques. No. 1-50, total 50 questions. The answer of each is any one out of (1), (2), (3) and (4). Four alternatives are given with the question. You have to answer all the questions. You have to answer on the OMR Sheet given separately to you.

*For example :*

Which state of India has the longest sea coast ?

- (1) Maharashtra (2) Tamilnadu  
(3) Gujarat (4) Andra Pradesh

*In answer sheet :*

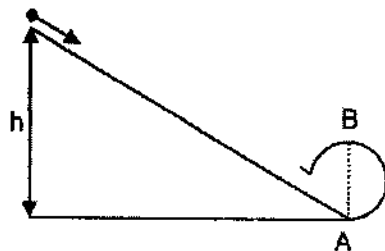
① ② ● ④

In the above example, the true answer is '3'. Hence, the circle of '3' is blackened (encoded) candidates should not write 'Gujarat' in the answer.

- (2) Each correct answer carries (2)Two marks.  
(3) Do not write anything in this question paper.  
(4) Hand over Test Booklet and OMR Answer sheet to supervisor, after examination is over.  
(5) Time limit for this test is 60 minutes.  
(6) Use blue/black ball point pen for filling responses in Answer Sheet. Any other ink, pen or Pencil is strictly prohibited.

પરીક્ષા પૂરી થયા બાદ પ્રશ્નપુસ્તિકા તથા OMR ઉત્તરવહી વર્ગ નિરીક્ષકને પરત કર્યા બાદ જ વર્ગખંડ છોડવાનો રહેશે.  
તેમ કરવામાં કસૂર થયેથી શિસ્તભંગનાં પગલાં ગણી પરીક્ષા માટે જે તે ઉમેદવારને ગેરલાયક ઠરાવવામાં આવશે.

- 1 A physical quantity of the dimension of length that can be formed out of  $c$ ,  $G$  and  $e^2/4\pi\epsilon_0$  is.....  
( $c$  is velocity of light,  $G$  is universal constant of gravitation and  $e$  is charge)
- (1)  $c^2(Ge^2/4\pi\epsilon_0)^{1/2}$                       (2)  $(1/c^2)(e^2/G4\pi\epsilon_0)^{1/2}$   
(3)  $(1/c)(Ge^2/4\pi\epsilon_0)$                       (4)  $(1/c^2)(Ge^2/4\pi\epsilon_0)^{1/2}$
- 2 A particle executes linear simple harmonic motion with an amplitude of 3cm. When the particle is at 2cm from the mean position, the magnitude of its velocity is equal to its acceleration. Then its time period in seconds is.....
- (1)  $(5)^{1/2}/2\pi$                                       (2)  $4\pi/(5)^{1/2}$   
(3)  $2\pi/(3)^{1/2}$                                       (4)  $(5)^{1/2}/\pi$
- 3 Suppose the charge of a proton and an electron differ slightly. One of them is  $-e$ , and the other is  $(e+\delta_e)$ . If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance  $d$  (much greater than atomic size) apart is zero, then  $\delta_e$  is the order of.....
- [Given mass of hydrogen= $1.67\times 10^{-27}$ kg], [Coulomb's constant =  $9\times 10^9$ SI]
- (1)  $10^{-23}C$                                       (2)  $10^{-37}C$   
(3)  $10^{-47}C$                                       (4)  $10^{-20}C$
- 4 A body initially at rest and sliding along a frictionless track from a height  $h$  (as shown in the figure) just-completes a vertical circle of diameter  $AB=D$ . The height is equal to.....



- (1)  $3D/2$                                       (2)  $5D/4$   
(3)  $7D/5$                                       (4)  $D$
- 5 The minimum number of NAND gates required to design NOR gate is
- (1) 3    (2) 5  
(3) 4    (4) 6

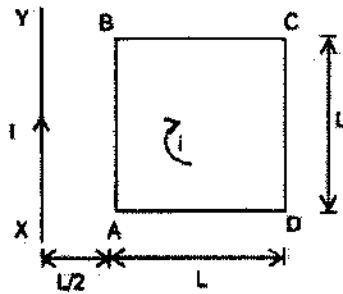
- 6 Three objects A(a solid sphere), B(a thin circular disk), C(a circular ring), each have the same mass  $M$  and radius  $R$ . They all spin with the same angular speed, about their own symmetry axes. The amount of work  $W$ , required to bring them to the rest, would satisfy the relation..

- (1)  $W_C > W_B > W_A$  (2)  $W_A > W_C > W_B$   
 (3)  $W_B > W_A > W_C$  (4)  $W_A > W_B > W_C$

- 7 A moving block having mass  $m$ , collides with another stationary block having mass  $4m$ . The lighter block comes to rest after collision. When the initial velocity of the lighter block is  $v$ , then the value of coefficient of restitution( $e$ ) will be

- (1) 0.5 (2) 0.4  
 (3) 0.8 (4) 0.25

- 8 A square loop ABCD carrying a current  $i$ , is placed near and coplanar with a long straight conductor XY carrying a current  $I$ , the net force on the loop will be :



- (1)  $\mu_0 i I L / 2 \pi$  (2)  $2 \mu_0 i I / 3 \pi$   
 (3)  $\mu_0 I i / 2 \pi$  (4)  $2 \mu_0 I i L / 3 \pi$

- 9 A piece of ice falls from a height  $h$  so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of  $h$  is :

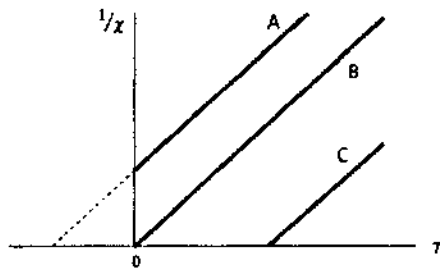
[Latent heat of ice is  $3.4 \times 10^5 \text{ J/kg}$  and  $g = 10 \text{ N/kg}$ ]

- (1) 68 km (2) 34 km  
 (3) 544 km (4) 136 km

- 10 In a diffraction pattern due to a single slit of width "a" the first minimum is observed at an angle  $30^\circ$  when light of wavelength  $5000 \text{ \AA}$  is incident on the slit. The first secondary maximum is observed at an angle of :

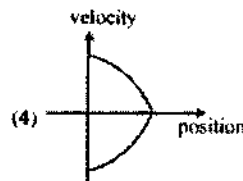
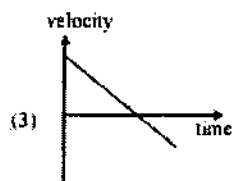
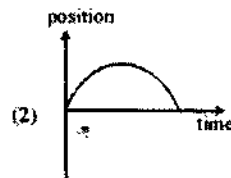
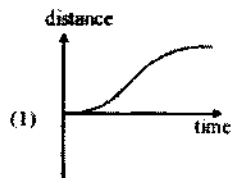
- (1)  $\sin^{-1}(3/4)$  (2)  $\sin^{-1}(1/4)$   
 (3)  $\sin^{-1}(2/3)$  (4)  $\sin^{-1}(5/4)$

- 11 The magnetic susceptibility  $\chi$  of three samples A, B and C is measured as a function of their absolute temperature  $T$ , leading to the graph shown below



From this graph, the magnetic nature of the samples can be inferred to be

- (1) A:Antiferromagnet    B:Diamagnet    C:Paramagnet  
 (2) A:Diamagnet    B:Paramagnet    C:Antiferromagnet  
 (3) A:Paramagnet    B:Antiferromagnet    C:Ferromagnet  
 (4) A:Antiferromagnet    B:Paramagnet    C:Ferromagnet
- 12 A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30N?
- (1)  $0.25 \text{ rad/s}^2$     (2)  $25 \text{ rad/s}^2$   
 (3)  $5 \text{ rad/s}^2$     (4)  $25 \text{ m/s}^2$
- 13 Unpolarized light of intensity  $I$  passes through an ideal polarizer A. Another identical polarizer B is placed behind A. The intensity of light beyond B is found to be  $1/2$ . Now another identical polarizer C is placed between A and B. The intensity beyond B is now found to be  $1/8$ . The angle between polarizer A and C is:
- (1)  $30^\circ$     (2)  $45^\circ$   
 (3)  $60^\circ$     (4)  $0^\circ$
- 14 All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up.

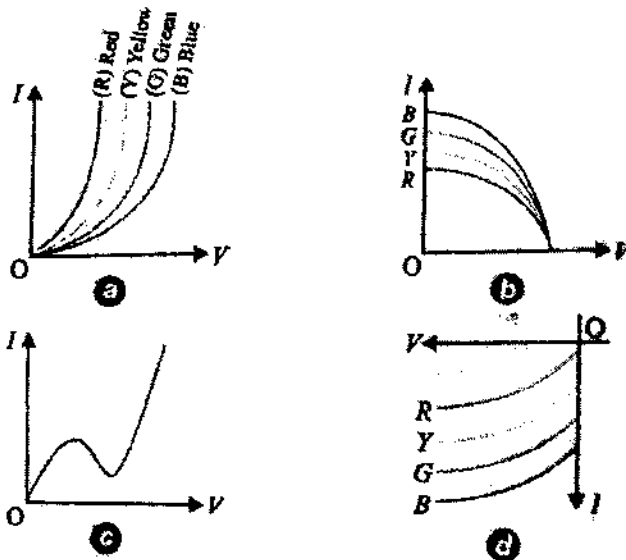


- (1) 1    (2) 2  
 (3) 3    (4) 4
- 15 The evaluation of the transition dipole moment gives rise to selection rules which specifies that.....
- (1) The transition that may occur on the basis of dipole approximation.  
 (2) The transition is allowed if the dipole moment is non-zero.  
 (3) The transition is forbidden if the dipole moment is zero.  
 (4) All of above

- 16 Three blocks A, B and C of masses 4kg, 2kg and 1kg respectively, are in contact on a frictionless surface, as shown. If a force of 14N is applied on the 4kg block, then the contact force between A and B is :

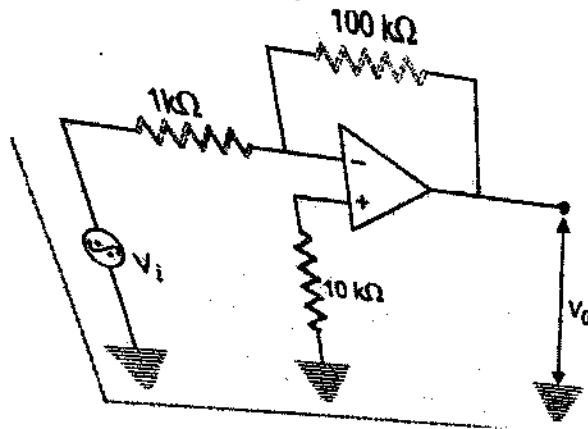


- (1) 6N (2) 8N  
 (3) 18N (4) 2N
- 17 The ratio of the specific heats  $C_p/C_v = \gamma$  in terms of degrees of freedom( $n$ ) is given by :
- (1)  $(1+n/3)$  (2)  $(1+2/n)$   
 (3)  $(1+n/2)$  (4)  $(1+1/n)$
- 18 The number density of free electrons in the semi-conductor is  $10^{18}m^{-3}$ . It is doped with a pentavalent impurity atoms of number density  $10^{24}m^{-3}$ , the number density of free electrons  $m^{-3}$  increases by a factor of..
- (1)  $4/3$  (2) 6  
 (3)  $10^6$  (4)  $10^{24}$
- 19 The I-V characteristics of an LED is



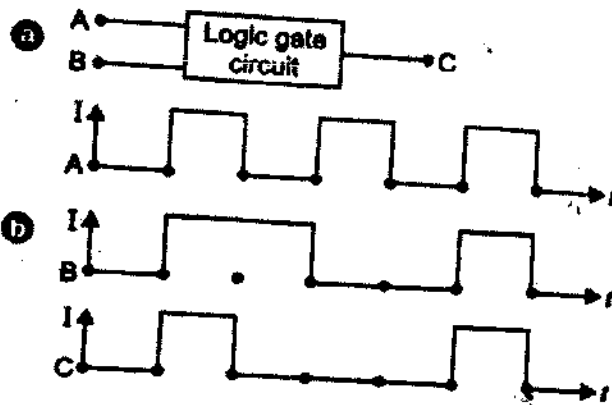
- (1) a (2) b  
 (3) c (4) d
- 20 For a common emitter configuration, if  $\alpha$  and  $\beta$  have their usual meanings, the incorrect relationship between  $\alpha$  and  $\beta$  is
- (1)  $1/\alpha = [1/\beta] + 1$  (2)  $\alpha = \beta/[1-\beta]$   
 (3)  $1/\beta = [1/\alpha]-1$  (4)  $\alpha = \beta/[1+\beta]$

21 The voltage gain of the amplifier shown in figure is



- (1) 10  
 (2) 100  
 (3) 1000  
 (4) 9.9

22 The figure shows a logic gate circuit with two points A and B and the output C. The voltage waveforms A, B, C are shown in figure.



The logic gate is

- (1) OR gate  
 (2) AND gate  
 (3) NAND gate  
 (4) NOR gate

23 A working transistor with its three legs marked P, Q and R is tested using a multimeter. No conduction is found between P and Q. By connecting the common(negative) terminal of the multimeter to R and the other(positive) terminal to P and Q, some resistance is seen on the multimeter. Which of the following is true for the transistor?

- (1) It is an npn transistor with R as base.  
 (2) It is an pnp transistor with R as collector.  
 (3) It is an pnp transistor with R as emitter.  
 (4) It is an npn transistor with R as collector.

- 24 Various electromagnetic waves are given in column-1 and various applications in column-2.

**Column-1**

- A- Infrared waves
- B- Radiowaves
- C- X-rays
- D- Ultraviolet rays

Match correctly.

- (1) A-R;B-Q;C-P;D-S
- (3) A-S;B-R;C-Q;D-P

**Column-2**

- P- To treat muscular strain
- Q- For broadcasting
- R- To detect fractures of bones
- S- Absorbed by the ozone layer

- (2) A-P;B-Q;C-R;D-S
- (4) A-P;B-Q;C-S;D-R

- 25 Sun also sends electromagnetic waves to earth. Which one of the electromagnetic waves out of the visible portion, from sun will be reaching the surface of the earth earlier than others:

- (1) violet waves
- (2) green waves
- (3) yellow waves
- (4) red waves

- 26 The total energy of electron in the ground state of hydrogen atom is 13.6 eV. The Kinetic energy of this electron in first excited state is.....eV.

- (1) 6.8
- (2) 13.6
- (3) 1.7
- (4) 3.4

- 27 A nucleus  ${}_nX^m$  emits one  $\alpha$  particle and two  $\beta$ -particles. The resulting nucleus is

- (1)  ${}_{n-4}X^{m-6}$
- (2)  ${}_nX^{m-6}$
- (3)  ${}_nX^{m-4}$
- (4)  ${}_{n-2}X^{m-4}$

- 28 The probability of survival of a radioactive nucleus for one mean life is

- (1)  $1/e$
- (2)  $1-(1/e)$
- (3)  $(\log 2)/e$
- (4)  $1-[(\log 2)/e]$

- 29 Which one is not true in relation of the nuclear forces –

- (1) are stronger, being roughly hundred times that of electromagnetic forces.
- (2) have a short range dominant over a distance of about a few Fermi.
- (3) are central forces, independent of spin of nucleus.
- (4) are independent of the nuclear charge.

- 30 In the Young's double slit experiment, when separation between two slits is increased, fringe width.....

- (1) decreases
- (2) increases
- (3) remains the same
- (4) none of these

- 31 The type of wave-front that emerges from a distant light source is.....
- (1) converging spherical      (2) diverging spherical  
 (3) plane      (4) cylindrical
- 32 A proton, a neutron, an electron and an  $\alpha$ -particle have same energy. Then their de Broglie wavelengths compare as
- (1)  $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$       (2)  $\lambda_\alpha < \lambda_p = \lambda_n < \lambda_e$   
 (3)  $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$       (4)  $\lambda_p = \lambda_n = \lambda_e = \lambda_\alpha$
- 33 Match the columns and find the correct option:
- Column 1: Fundamental experiment  
 Column 2: Its conclusion
- | Column 1                     | Column 2                          |
|------------------------------|-----------------------------------|
| A-Frank Hertz experiment     | P-Particle nature of light        |
| B-Photo electric experiment  | Q- Discrete energy level of atoms |
| C-Davidson Germer experiment | R-wave nature of electron         |
|                              | S-Structure of atom               |
- (1) A-P;B-S;C-R      (2) A-Q;B-S;C-R  
 (3) A-Q;B-P;C-R      (4) A-S;B-R;C-Q
- 34 The Stern-Gerlach experiment proves.....
- (1) Both space and spin quantization.  
 (2) Splitting of spectral lines due to electric field.  
 (3) Only space quantization and no spin quantization.  
 (4) Only spin quantization and no space quantization.
- 35 The ground state energy of a particle of mass  $m$  in a three-dimensional cubical box of side  $l$  is not zero but  $3h^2/8ml^2$ . This is because.....
- (1) The ground state has no nodes in the interior of the box.  
 (2) This is the most convenient choice of the zero level of potential energy.  
 (3) The potential at the boundaries is not really infinite, but very large.  
 (4) Position and momentum cannot be exactly determined simultaneously.

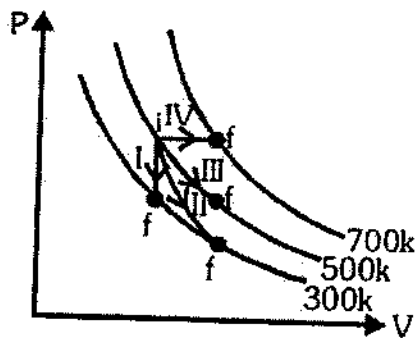


- 36 An object is held in front of a concave mirror between F and C. The image formed is
- (1) at F (2) at C  
(3) beyond C (4) none of these
- 37 The efficiency of an ideal heat engine working between the freezing point and boiling point of water is.....
- (1) 26.8%  
(2) 12.5%  
(3) 6.25%  
(4) 20%
- 38 The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is \_\_\_\_\_ cm.
- (1) 13.2 (2) 16  
(3) 12.5 (4) 8
- 39 Which of the following particle is unstable ?
- (1) Neutron  
(2) Proton  
(3) Neutrino  
(4) Antineutrino
- 40 What will be the correct choice for neutron ?
- (1) uuu (2) uud  
(3) udd (4) ddd

- 41 Three sound waves of equal amplitudes have frequencies  $(n-1)$ ,  $n$ ,  $(n+1)$ . They superimpose to give beats. The number of beats produced per second will be
- (1) 1 (2) 4  
(3) 3 (4) 2

- 42 The wettability of a surface by a liquid depends primarily on.....
- (1) angle of contact between the surface and the liquid  
(2) viscosity  
(3) surface tension  
(4) density

- 43 Thermodynamic processes are indicated in the following diagram:



Match the following :

**Column 1**

A-Process I

B-Process II

C-Process III

D-Process IV

(1) A-R;B-P;C-S;D-Q

(3) A-S;B-Q;C-P;D-R

**Column 2**

P-Adiabatic

Q-Isobaric

R-Isochoric

S-Isothermal

(2) A-R;B-S;C-Q;D-P

(4) A-P;B-R;C-S;D-Q

- 44 A particle in a one-dimensional potential has the wavefunction

$$\psi(x) = \frac{1}{\sqrt{a}} \exp\left(\frac{-|x|}{a}\right)$$

where  $a$  is a constant. It follows that for a positive constant  $V_0$ , the potential  $V(x) =$

(1)  $-V_0/|x|$

(2)  $-V_0\delta(x)$

(3)  $V_0x^2$

(4)  $V_0|x|$

- 45 The wave nature of particle is supported by the.....
- (1) Oil drop experiment  
(2) Cathode ray experiment  
(3) Electron defraction experiment  
(4) Compton's scattering

- 46 Rain drops fall with constant velocity due to.....
- (1) buoyancy (2) gravity  
(3) density (4) viscosity
- 47 Pick up the law from the list below that represents the principle of charge conservation.
- (1) Thevenin's law  
(2) Kirchoff's voltage law  
(3) Kirchoff's current law  
(4) Maximum power transfer law
- 48 The corpuscular nature of light can be illustrated through.....
- (1) polarization of light  
(2) diffraction of light  
(3) Compton scattering  
(4) wave front of light
- 49 The barrier potential of a PN junction depends on
1. Type of semi-conductor material
  2. Amount of dopping
  3. Temperature.
- Which one of the following is correct ?
- (1) 1 and 2 only  
(2) 2 only  
(3) 2 and 3 only  
(4) 1, 2 and 3 all
- 50 The exact GPS location is basically related to the field of.....
- (1) classical physics (2) quantam physics  
(3) theory of gravity (4) theory of relativity



*SPACE FOR ROUGH WORK*

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