

**AMRESH SHARMA CLASSES**

**DROPPER Batch : IIT Advanced Pattern**

**Test - I(PCM)**

**[P.No. 7073**

**]**

**Name:………………………………………… Adress………………………………………………………...**

**…………………………………………………School…………………………………………………………**

**Parent’s Mobile No – I……………………..Parent’s Mobile No.- II………………………………………...**

1. **Match the column**

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| (i) Aufbau principle  (vkQckÅ fl)kar) | (a) Line spectrum in  visible region  (n`'; {ks=k esa js[kh; LisDVªe) |
| (ii) De Broglie (Mh czksXyh) | (b) Maximum  multiplicity of electron  (bySDVªkWu dh vf/kdre  cgqydrk) |
| (iii) Angular momentum  (dks.kh; laosx) | (c) Photon  (QksVkWu) |
| (iv) Hund’s rule (gq.M fu;e) | (d)  = h/(mv) |
| (v) Balmer series  (ckej Js.kh) | (e) Electronic  configuration  (bysDVªksfud foU;kl) |
| (vi) Planck’s law  (Iykad fu;e) | (f) mvr |

1. **Match the column.**

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| (i) Cathode rays  (dsFkksM fdj.ks) | (a) Helium nuclei  (ghfy;e ukfHkd) |
| (ii) Dumb-bell  ( MEcsy) | (b) Uncertainty  principle  (vfuf'prrk dk fl)kar) |
| (iii) Alpha particles  (vYQk d.k) | (c) Electromagnetic  radiation  (fo|qr pqEcdh; fofdj.k) |
| (iv) Moseley  (ekslys) | (d) P-orbital  (p-d{kd) |
| (v) Heisenberg  (gkbtsucxZ) | (e) Atomic number  (ijek.kq la[;k) |
| (vi) X-rays  (X-fdj.ks) | (f) Electrons  (bysDVªkWu) |

1. **Match the column**

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| (i) Lyman series  (ykbeu Js.kh) | (a) maximum number of  spectral line observed= 6  (LisDVªy js[kk dh vf/kdre  la[;k = 6) |
| (ii) Balmer series  (ckej Js.kh) | (b) maximum number of  spectral line observed  = 2  (LisDVªy js[kk dh vf/kdre  la[;k = 2) |
| (iii) In a sample of H-atom  for 5 upto 2 transition  (gkbMªkstu ds uewus esa 5 ls 2  rd laØe.k) | (c) 2nd line has wave  number  (2nd js[kk dh rjax la[;k  = ) |
| (iv) In a single isolated H-  atom for 3 upto1 transition  (,d foyfxr H ijek.kq esa 3 ls  1 rd laØe.k) | (d) 2nd line has wave  number  (2nd js[kk dh rjax la[;k  = ) |
|  | (e) Total number of  spectral line is 10.  (dqy LisDVªe js[kk dh la[;k  10 gS) |

1. In the photoelectric effect the electrons are emitted instantaneously from a given metal plate, when it is irradiated with radiation of frequency equal to or greater than some minimum frequency, called the threshold frequency. According to planck's idea, light may be considered to be made up of discrete particles called photons . Each photon carries energy equal to h. When this photon collides with the electron of the metal, the electron acquires energy equal to the energy of the photon. Thus the energy of the emitted electron is given by :

(izdk'k fo|qr izHkko esa /kkrq dh lrg ij U;wure vko`fÙk ¼nsgyh vko`fÙk dgrs gS½ ;k blls vf/kd ;k blds leku vko`fÙk dh fofdj.ksa vkofrZr gksus ij bysDVªkWu mRlftZr gksrs gSA Iykad ds vuqlkj izdk'k fofdj.ksa vlrr~ d.kksa ls feydj cuh gksrh gS bu d.kksa dks QksVkWu dgrs gSaA izR;sd QksVkWu dh ÅtkZ hds cjkcj gksrh gS tc QksVkWu /kkrq ds bysDVªkWuksa ls Vdjkrs gS rks /kkrq ds bysDVªkWu QksVkWu ds leku ¼iw.kZ :i ls½ ÅtkZ xzg.k dj ysrs gSaA bl izdkj mRlftZr bysDVªkWu dh ÅtkZ fuEu lehdj.k ls nh tkrh gS %)

h = K.Emaximum + P. E. = mu2 + PE

If the incident radiation is of threshold frequency the electron will be emitted without any kinetic energy i.e. h0 = PE

(;fn vkifrr fofdj.kksa dh vko`rh nsgyh vko`fÙk ds leku gks rks mRlftZr bysDVªkWuksa dh xfrt ÅtkZ 'kwU; gksxh vFkkZr~ h0 = PE)

 mu2 = h – h0

A plot of kinetic energy of the emitted electron versus frequency of the incident radiation yields a straight line given as

(mRlftZr bysDVªkWuksa dh xfrt ÅtkZ rFkk vkifrr izdk'k dh vko`fÙk esa xzkQ ,d lh/kh js[kk izkIr gksrk gSA tks fuEu izdkj gS %)



(i) A beam of white light is dispersed into its wavelength components by a Quartz prism and falls on a thin sheet of potassium metal. What is the correct decreasing order of maximum kinetic energy of the electron emitted by the different light component.

(;fn lQsn izdk'k dks DokVZ fizTe (Quartz prism) }kjk fofHkUu rjaxnS/;Z esa foHksfnr dj izR;sd jax ds izdk'k dks iksVsf'k;e /kkrq dh iryh ijr ij Mkyk tkrk gS rks mRlftZr bysDVªkWuksa dh vf/kdre xfrt ÅtkZ dks ?kVrs Øe (decreasing order) esa O;ofLFkr fdft;s ;fn fofdj.kksa ds fofHkUu jax iz;qDr gksA)

(a) Blue > Green > Orange > Yellow

(uhyk > gjk > ukajxh > ihyk)

(b) Violet > Blue > Orange > Red

(csaxuh > uhyk > ukjaxh > yky)

(c) yellow > green > blue > violet

(ihyk > gjk > uhyk > casxuh)

(d) orange > yellow > blue > violet

(ukjaxh > ihyk > uhyk > csaxuh)

(ii) A laser producing monochromatic light is used to eject electron from the sheet of gold having threshold frequency 6.15 x 1014 s–1 which of the following incident radiation will be suitable for the ejection of electron :

(,d ,do.khZ fofdj.k (monochromatic light) mRiUu djus okys yslj ls izkIr QksVkWuksa dks Lo.kZ i=k ls bysDVªkWuksa ds mRltZu esa iz;qDr djrs gSA ;fn Lo.kZ i=k dss fy, nsgyh vko`fÙk 6.15 × 1014 s–1 gS rks bysDVªkWu mRltZu ds fy, fuEu esa ls dkSulk vkifrr fofdj.k mi;qDr gksxkA)

(a) 1.5 moles of photons having frequency 3.05 ×1014 s–1

(3.05 × 1014 s–1 vko`fÙk ds 1.5 eksy QksVkWu)

(b) 0.5 moles of photon of frequency 12.3 × 1012 s–1

(12.3 × 1012 s–1 vko`fÙk dk 0.5 eksy QksVkWu)

(c) One photon with frequency 5.16 × 1015 s–1

(5.16 × 1015 s–1 vko`fÙk dk 1 QksVkWu)

(d) All of the above

(mijksDr lHkh)

(iii)The number of photoelectrons emitted depends upon :

(mRlftZr izdk'k-bysDVªkWuksa dh la[;k fuEu ls fdl ij fuHkZj djrh gSA)

(a) The intensity of the incident radiation

(vkifrr fofdj.kksa dh rhozrk ij)

(b) The frequency of the incident radiation

(vkifrr fofdj.kksa dh vko`fÙk ij)

(c) The product of intensity and frequency of incident radiation

(vkifrr fofdj.kksa dh vko`fÙk o rhozrk nksuksa ds xq.kuQy ds eku ij)

(d) None of these

(mijksDr esa ls dksbZ ugha)

1. De Broglie proposed dual nature for electron by putting his famous equation  = . Later on Heisenberg proposed uncertainty principle as p. x  . On the contrary, particle nature of electron was established on the basis of photoelectric effect. When a photon strikes the metal surface, it gives up its energy to the electron. Part of this energy (say W) is used by the electrons to escape from the metal and the remaining energy imparts kinetic energy (1/2 mv2) to the ejected photoelectron. The potential applied on the surface to reduce the velocity of photoelectron to zero is known as stopping potential.

(Mh&czksXyh us bysDVªkWu dh }Sr izd`fr dks fuEu lehdj.k  = }kjk le>k;kA ckn esa gkbtsucxZ us vfuf'prrk dk fl}kUr izLrqr fd;kA tks fuEu gS p. x , ysfdu bysDVªkWu dh d.k izo`fr izdk'k fo|qr izHkko }kjk izLrqr dh xbZ tc ,d QksVkWu /kkrq dh lrg ls Vdjkrk gS rks viuh ÅtkZ /kkrq ds bysDVªkWu dks LFkkukUrfjr dj nsrk gS bl ÅtkZ dk dqN Hkkx bysDVªkWu dks /kkrq dh lrg NksMus esa [kpZ gks tkrk gS (W) rFkk ÅtkZ dk 'ks"k Hkkx mRlftZr izdkf'k; bysDVªkWuksa dh xfrt ÅtkZ (1/2 mv2) dks nsrk gSA /kkrq dh lrg ls mRlftZr bysDVªkSu dh xfrt ÅtkZ 'kwU; djus ds fy;s vko';d foHko dks jksd.k foHko (stopping potential) dgrs gSA)

(i) Uncertainity in the position of an electron (mass 9.1  10–31 kg) moving with a velocity 300 ms–1, accurate upto 0.001% will be : ( = 5.8  10–5)

(,d bysDVªkWu (nzO;eku = 9.1  10–31 kg) ftldk osx 300 ms–1 gS] osx dks 0.001% 'kqf) ds lkFk Kkr fd;k tkrk gSA rks bysDVªkWu dh fLFkfr esa vfuf'prrk gksxh (= 5.8  10–5)

(a) 19.2  10–2 m (b) 5.76  10–2 m

(c) 3.84  10–2 m (d) 1.92  10–2 m

(ii) When a beam of photons of a particular energy was incident on a surface of a particular pure metal having work function = (40 eV), some emitted photoelectrons had stopping potential equal to 22 V, some had 12 V and rest had lower values. Calculate the wavelength of incident photons assuming that at least one photoelectron is ejected with maximum possible kinetic energy.

(fdlh fuf'pr ÅtkZ ds QksVkWuksa dks ,d 'kq} /kkrq dh lrg ij vkifrr fd;k tkrk gS ftldk dk;Z Qyu 40 eV gSA ;fn èkkrq ls mRlftZr dqN izdkf'k; bysDVªkWuksa dk jksd.k foHko (stopping potential) 22 V, dqN dk 12 V rFkk 'ks"k dk blls de gksrk gS rks vkifrr QksVkuksa dh rjax }s/;Z Kkr dhft;sA ¼;g ekuk tk;s fd mRlftZr izdkf'k; bysDVªkWuksa esa de ls de ,d izdkf'kd bysDVªkWu] vf/kdre laHko xfrt ÅtkZ j[krk gSA½)

(a) 310 Å (b) 298 Å (c) 238 Å (d) 200 Å

(iii) The circumference of third orbit of a single electron species is 3 nm. What may be the approximate wavelength of the photon required to just ionize electron from this orbit.

(,d ,dy bysDVªkWu Lih'kht ds r`rh; d{kk dh ifjf/k 3 nm gS rks bl d{kk ls bysDVªkWu dks vk;fur djus ds fy;s vko';d QksVkWu dh rjax }S/;Z yxHkx gksxhA)

(a) 91.1 nm (b) 364.7 nm

(c) 821 nm (d) 205 nm

1. After the failure of Bohr atomic theory but its ability to explain the atomic spectra a need was felt for the new model that could incorporate, the concept of stationary orbit, de Broglie concept, Heisenberg uncertainty principle. The concept that in corporate above facts is called quantum mechanics of the atomic model wave mechanical model. It includes set of quantum numbers and |2|a mathematical expression of the probability of finding an electron at all points in space. This probability function is the best indication available of how the electron behaves, for as a consequence of the Uncertainty Principle, the amount we can know about the electron is limited. While quantum mechanics can tell us the exact probability of finding an electron at any two particular points, it does not tell us how the electron moves from one of these points to the other. Thus the idea of an electron orbit is lost; it is replaced with a description of where the electron is most likely to be found. This total picture of the probability of finding an electron at various points in space is called an orbital.

(cksj ijek.kq fl)kar dh vlQyrk ds ckn bldh ijek.kq LisDVªe dks le>kus dh {kerk ds dkj.k] ,d ,sls çfr:i dh vko'drk vuqHko gqbZ tks fLFkj dks'k fl)kar] Mh&czksXyh fl)kar rFkk gkbtsucxZ ds vfuf'prrk ds fl)kar dks lfEefyr dj lds A mijksDr rF;ksa dks lfEefyr djus okys fl)kUr dks Dok.Ve ;kaf=kdh dgrs gSA blesa Dok.Ve la[;kvksa dk leqPp; rFkk f=kfoe esa bysDVªkWu ds ik;s tkus dh vf/kdre laHkkouk dks n'kkZus okyk xf.krh; O;atd |2| lfEefyr gSA ;g çkf;drk Qyu] bysDVªkWu ds O;ogkj ds lanHkZ esa miyC/k loksZre lwpdkad gS] D;ksafd vfuf'prrk fl)kar ds dkj.k] bysDVªkWu ds ckjs esa tkudkjh ds L=kksr lhfer gSA Dok.Ve ;kaf=kdh gesa fdUgh nks fof'"V fcUnqvksa ij bysDVªkWu ds ik;s tkus dh lgh lEHkkouk crk ldrk gS] fdUrq bysDVªWku ,d fcUnq ls nwljs fcUnq ij fdl çdkj tkrk gS] ;g ugh cryk ldrkA blfy,] bysDVªkWu d{kk ladYiuk dk cfg"dkj gqvkA blds LFkku ij ,d u;h ladYiuk çLrqr gqbZ ftlesa bysDVªkWu ds ik;s tkus dh vf/kdre lEHkkfor fopkj/kkjk dks çLrqr fd;k x;kA vr% vUrfj{k esa fofHkUu LFkkuksaA ij ,d bysDVªkWu ds ik;s tkus dh bl lEHkkouk dks d{kd dgk x;kA)



There are various types of orbitals possible, each corresponding to one of the possible combinations of quantum numbers. These orbitals are classified according to the value of n and l associated with them. In order to avoid confusion over the use of two numbers, the numerical values of l are replaced by letters; electrons in orbitals with l = 0 are called s-electrons those occupying orbitals for which l = 1 are p-electrons and those for which l = 2 are called d-electrons. The numerical and alphabetical correspondences are summarized in table. Using the alphabetical notation for l, we would say that in the ground state of hydrogen atom (n = 1, l = 0) we have a 1s-electron, or that the electron moves in a 1s-orbital. The relation of the spherical polar co-ordinates r, and to Cartesian coordinates x, y and z. To make the concept of an orbital more meaningful, it is helpful to examine the actual solution of the wave function for the one-electron atom. Because of the spherical symmetry of the atom, the wave functions are most simply expressed in terms of a spherical polar-coordinate system, shown in fig., which has its orbit at the nucleus. It is found that the wave functions can be expressed as the product of two functions, one of which (the “angular part” X) depends only the angle and , the other of which (the “radial part” R) depends only on the distance from the nucleus. Thus we have

(;gk¡ fofHkUu çdkj ds d{kd lEHko gS] çR;sd d{kd ds fy, lEHkkfor Dok.Ve la[;k dk ,d leqPp; gksrk gSA bu d{kdksa dks buls lacaf/kr n rFkk l ds eku ds vk/kkj ij oxhZd`r fd;k x;k gSA nks Dok.Ve la[;kvksa dk ç;ksx djrs le; ;g /;ku j[kuk pkfg,sa fd l esa vkafdd ekuksa dks dqN d{kdh; 'kCnksa ls lacaf/kr fd;k x;k gS tsSls % ;fn l = 0 j[kus okys d{kdksa dks s-bysDVªkWu dgrs gSa] l = 1 j[kus okys d{kdksa ds bysDVªkWuksa dks p-bysDVªkWu dgrs gS rFkk l = 2 j[kus okys d{kdksa ds bysDVªkWuksa dks d-bysDVªkWu dgrs gSA vkafdd eku ,oe~ o.kZekyk eku ds lca/k dks lkj.kh esa lwphc) fd;k x;k gSaA l ds fy, o.kZekyk ladsr dk mi;ksx djrs le;] ge ;g dg ldrs gS fd gkbMªkstu ijek.kq dh vk| voLFkk (n = 1, l = 0) esa] gesa 1s-bysDVªkWu çkIr gksrk gS vFkkZr~ bysDVªkWu 1s-d{kd esa ços'k djrk gSA vc] xksyh; /kqzoh; lg&funsZ'kkad r, rFkk rFkk dVsZfu;e lg&funsZ'kkad x, y rFkk z ds e/; laca/k LFkkfir fd;k x;kA d{kd ladYiuk dks vf/kd vFkZ iw.kZ cukus ds fy,] ,d&bysDVªkWu ijekk.kq ds fy, rjax Qyu ds okLrfod foy;u dk ifj{k.k fd;k x;k vFkkZr~ bysDVªkWu ds rjax Qyu dk v/;;u fd;k x;k gSA ijek.kq dh xksyh; leferh gksus ds dkj.k] rjax Qyuksa dks eq[;r;k ,d xksyh; /kqzoh;&funsZ'kkad ra=k ds :i esa ljy :i esa çLrqr fd;k x;k] tSlkfd Åij fp=k esa n'kkZ;k x;k gS] ifj{k.k ds nkSjku ;g ik;k x;k fd rjax Qyu] nks rjax Qyuksa dk xq.kuQy gks ldrh gS] ftlesa ,d Qyu ¼dks.kh; Hkkx X½ dsoy dks.k rFkk ij fuHkZj gksrh gS] rFkk bldh rjax Qyu ¼v{kh; Hkkx R) dsoy ukfHkd ls nwjh ij fuHkZj djrh gSa vr% gesa fuEu lehdj.k çkIr gksrh gSA)

(r, , ) = R(r) X (, )

Angular and radial parts of hydrogen atom wave functions

Angular part X() Radial part Rn, (r)

(gkbMªkstu ijek.kq ds dks.kh; ,oe~ v{kh; Hkkx ds rjax Qyu gSA fuEu gS

dks.kh; Hkkx X() v{kh; Hkkx Rn, (r))

X(s) = R(1s) = 2 

X(px)=sin cos R(2s)

= (2 – )

X(py) =sin sinR(2p) =  

X(pz) = cos

X(dz2) =  (3 cos2 – 1)

X(dxz) = sin coscos R(3s)

= 

X(dyz) = sin cossin R(3p) = 

X(dx2 – y2) = sin2 cos2 R(3d)

= 

X(dxy) = sin2 sin 2



This factorization helps us to visualize the wave function, since it allows us to consider the angular and radial dependences separately. It contains the expression for the angular and radial parts of the one electron atom wave function. Note that the angular part of the wave function for an s-orbital it always the same, (1/4)1/2, regardless of principal quantum number. It is also true that the angular dependence of the p-orbitals and of the d-orbitals is independent of principle quantum number. Thus all orbitals of a given types (s, p, or d) have the same angular behaviour The table shows, however, that the radial part of the wave function depends both on the principal quantum number n and on the angular momentum quantum number l. To find the wave function for a particular state, we simply multiply the appropriate angular and radial parts together called normalized wave function. The probability of finding an electron at a point within an atom is proportional to the square of orbital wave function, i.e., 2 at that point. Thus, 2 is known as probability density and alwyas a positive quantity.

2 dV (or 2.4r2dr). represents the probability for finding electron in a small volume dV surrounding the nucleus.

(bl laca/k vFkok foHkktu laca/k }kjk rjax Qyu dks vklkuh ls le>k tk ldrk gSa] D;ksafd bl lEcU/k ls Kkr gksrk gS fd rjax Qyu ds dks.kh; ,oe~ v{kh; Hkkx ,d&nwljs ij fuHkZj ugha gksrs gSA blesa ,d bysDVªkWu ijek.kq ds rjax Qyu ds dks.kh; ,oe~ v{kh; Hkkx dks O;Dr fd;k x;k gSA ijUrq s-d{kd ds fy, rjax Qyu ds dks.kh; Hkkx dk eku ges'kk ,d&leku] jgrk gS] eq[; DokUVe la[;k ls Lora=k ekurs gq,sA ;g Hkh lR; gS fd p-d{kdksa ,oe~ d-d{kdksa dh dks.kh; fuHkZjrk eq[; Dok.Ve la[;k ij fuHkZj ugha djrh gSA vr% fn;s x;s lHkh çdkj ds d{kd (1/4)1/2 leku dks.kh; O;ogkj j[krs gSA vr%] lkj.kh ls Li"V gS fd rjax Qyu dk v{kh; Hkkx eq[; Dok.Ve la[;k n rFkk dks.kh; laosx Dok.Ve la[;k l nksuksa ij fuHkZj gksrk gSA

fdlh fuf'pr voLFkk dh rjax Qyu Kkr djus ds fy,] rjax Qyu ds mi;qZDr dks.kh; ,oe~ v{kh; nksuksa Hkkxksa dks xq.ku djds ,d rjax Qyu çkIr fd;k tkrk gS] ftls fu;ec) rjax Qyu dgrs gSA

,d ijek.kq ds fdlh Hkh fcUnq ij bysDVªkWu ds ik;s tkus dh çkf;drk d{kd ds rjax Qyu ds oxZ ¼2½ ds lekuqikrh gksrh gSA vr%] 2 dks çkf;drk ?kuRo dgrs gS rFkk bldk eku ges'kk /kukRed gh gksrk gSA

2 dV (or 2.4r2dr) ukfHkd ds pkjksa vksj ,d NksVs ls vk;ru dV esa ik;s tkus okys bysDVªkWu dh çkf;drk dks n'kkZrk gSA)

(i) The electron probability density for 1s-orbital is best represented by the relation

(1s-d{kd esa bysDVªkWu çkf;drk ?kuRo dks fuEu esa ls fdl lEcU/k }kjk n'kkZrs gS %)

(a)  (b) 

(c)  (d) 

(ii)The wave function () of 2s-orbital is given by :

(2s-d{kd dk rjax Qyu () fuEu }kjk fn;k tkrk gS)

2s =. At r = r0, radial node is formed.( ij] f=kT; uksM curk gSA)

Then which of the following is correct :

(rc fuEu esa ls dkSulk dFku lR; gS %)

(a) r0 = a0 (b) r0 = 2a0

(c) r0 = 3a0 (d) None of these

(iii)The angular wave function of which orbital will not disturb by the variation with azimuthal angle only

(dsoy f}xa'kh dks.k ds ifjorZu ls dkSuls d{kd dk dks.kh; rjax Qyu çHkkfor ugha gksxk %)

(a) 1s and 2s (b) 2pz and 2dz2

(c) 2px and 3dz2 (d) 2px and 2s

1. Choose the correct relations on the basis of Bohr’s theory.

(cksj fl)kUr ds vk/kkj ij lgh lEcU/k dks pquksA)

(a) Velocity of electron (bysDVªkWu dk osx) 

(b) Frequency of revolution (?kw.kZu dh vko`fÙk) 

(c) Radius of orbit (d{kk dh f=kT;k)  n2 Z

(d) Electrostatic force on electron

(bysDVªkWu ij fLFkjoS|qfrdh cy) 

1. A hydrogen - like atom has ground state binding energy 122.4 eV. Then :

(,d gkbMªkstu ijek.kq dh vk| d{kk dh cU/k ÅtkZ 122.4 eV gSA rks)

(a) Its atomic number is 3

(bldk ijek.kq Øekad 3 gSA)

(b) A photon of 90 eV can excite it to a higher state

(90 eV okyk QksVkWu bls mPp voLFkk esa mÙksftr dj ldrk gSA)

(c) A 80 eV photon cannot excite it to a higher state

(80 eV okyk QksVkWu bls mPp voLFkk esa mÙksftr ugha dj ldrk gSA)

(d) None

(dksbZ ugah)

1. A sodium street light gives off yellow light that has a wavelength of 600 nm. Then(For energy of a

(,d lksfM;e cYc gYdh ihyh jks'kuh nsrk gS ftldh rajx ns/;Z 600 nm gSA rc)

photon take E = )

(fn;k x;k gS] ,d QksVkWu dh ÅtkZ E = )

(a) frequency of this light is 7× 1014 s–1

(bl izdk'k dh vko`fr 7× 1014 s–1 gksxh)

(b) frequency of this light is 5× 1014 s–1

(izdk'k dh vko`fr 5× 1014 s–1 gksxh)

(c) wavenumber of the light is 3 × 106 m–1

(izdk'k dh rajx la[;k 3 × 106 m–1)

(d) energy of the photon is approximately 2.07 Ev

(QksVkWu dh ÅtkZ yxHkx 2.07 eV gksxh)

1. The qualitative order of Debroglie wavelength for electron, proton and a particle is if

(bySDVªkWu] izksVksu rFkk d.kksa ds fy, Mh&czksXyh rjaxnS/;Z dk xq.kkRed Øe e > P >  gSa] ;fn&)

(a) If kinetic energy is same for all particles

(lHkh d.kksa ds fy, xfrt ÅtkZ leku gksa)

(b) If the accelerating potential difference **'V'** is same for all the particles (from rest)

(lHkh d.kksa ds fy, Rofjr foHkokUrj 'V' leku gksa ¼fojkekoLFkk ls½)

(c) If velocities are same for all particles

(lHkh d.kksa ds fy, osx leku gksa)

(d) None of the above

(mijksDr esa ls dksbZ ugha)

1. If there are only two H-atoms, each is in 3rd excited state then

(;fn dsoy nks H-ijek.kq gksa] ftuesa izR;sd 3rd mÙksftr voLFkk esa gSa rc)

(a) Maximum number of different photons emitted is 4.

(mRlftZr gksus okys fofHkUu QksVkWu dh vf/kdre la[;k 4 gSA)

(b) Maximum number of different photons emitted is 3.

(mRlftZr gksus okys fofHkUu QksVkWu dh vf/kdre la[;k 3 gSA)

(c) Minimum number of different photons emitted is 1.

(mRlftZr gksus okys fofHkUu QksVkWu dh U;wure la[;k 1 gSA)

(d) Minimum number of different photons emitted is 2.

(mRlftZr gksus okys fofHkUu QksVkWu dh U;wure la[;k 2 gSA)

1. Which of the following statements is/are correct for an

electron of quantum numbers n = 4 and m = 2?

(DokaVe la[;k n = 4 rFkk m = 2 ds ,d bysDVªkWu ds fy, fuEu esa ls dkSuls dFku lgh gS ?)

(a) The value of  may be 2.

( dk eku 2 gks ldrk gSA)

(b) The value of may be 3.

( dk eku 3 gks ldrk gSA)

(c) The value of s may be +1/2.

(s dk eku +1/2 gks ldrk gSA)

(d) The value of  may be 0, 1, 2, 3.

( dk eku 0, 1, 2, 3 gks ldrk gSA)

1. **Direction :** Read the assertion and reason carefully to mark the correct option out of the options given below:

(fuEufyf[kr iz'uksa esa çDdFku (Assertion) ds oDrO; ds i'pkr dkj.k (Reason) dk oDrO; gSA)

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(çDdFku vkSj dkj.k nksuksa lgh gSa vkSj dkj.k çDdFku dk lgh Li"Vhdj.k nsrk gS)

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(çDdFku vkSj dkj.k nksuksa lgh gSa fdUrq dkj.k çDdFku dk lgh Li"Vhdj.k ugh nsrk gS)

(c) If assertion is true but reason is false.

(çDdFku lgh gS fdUrq dkj.k xyr gS)

(d) If the assertion and reason both are false.

(çDdFku vkSj dkj.k nksuksa xyr gSa)

(e) If assertion is false but reason is true.

(çDdFku xyr gS fdUrq dkj.k lgh gS)

(i) **Assertion :** Red shift confirms that the universe is expanding

(**çDdFku :** yky foLFkkiu ls fuf’pr gksrk gS] fd czãk.M QSy jgk gSA)

**Reason :** Wavelength of red light is maximum in the visible region

(**dkj.k :** n`’; {ks= esa yky jax dh rjaxnS/;Z lcls vf/kd gSA)

(ii) **Assertion :** Sun is at the galactic centre C of the milky way

(**çDdFku :** lw;Z ÞfeYdh osß ds dsUæ ij fLFkr gSA)

**Reason :**  All planets of solar system revolve around the sun.

(**dkj.k :** lkSj ifjokj ds lHkh xzg lw;Z ds pkjksa vksj ifjØek yxkrs gSaA)

(iii) **Assertion :**  Moon is seen as it partly reflects the sun light falling on it

(**çDdFku :** pUæek fn[kkbZ nsrk gS] D;ksafd ;g bl ij vkifrr çdk’k dks va’kr% ijkofrZr djrk gSA)

**Reason :** Moon is a satellite of earth. It does not emit light of its own

(**dkj.k :** pUæek i`Foh dk mixzg gSA blesa Lo;a dk çdk’k ugha gksrk gSA)

(iv) **Assertion :** The value of Hubble's constant is 16 km/s

(**çDdFku :** gcy fu;rkad dk eku 16 *km/s* gSA)

**Reason :**  Hubble's constant means that a galaxy at 1 million light years away is receding at the rate of 16 *km*/*s*.

(**dkj.k :** gcy fu;rkad dk eryc gS] fd 10 yk[k çdk’k o"kZ nwj fLFkr xSysDlh 16 *km*/*s* dh nj ls nwj tk jgh gSA)

1. **Direction:** In the following question a statement of assertion is followed by a statement of reason mark the correct choice as:

(**funsZ”k%** fuEu iz”uksa esa vfHkdfku ds oDrO; ds ckn rdZ ds oDrO;dh fn;k x;k gSA lgh fodYi ij fu”kku yxkb,A)

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(vfHkdFku vkSj rdZ nksuksa lgh gS rFkk rdZ vfHkdFku dh lgh O;k[;k djrk gSA)

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(vfHkdFku vkSj rdZ nksuksa lgh gS ysfdu rdZ vfHkdFku dh lgh O;k[;k ugha djrk gSA)

(c) If assertion is true but reason is false

(vfHkdFku lgh gS] ysfdu rdZ xyr gSA)

(d) If both assertion and reason are false.

(vfHkdFku vkSj rdZ nksuksa xyr gSA)

(i) **Assertion:** The basic laws of electromagnetism govern all electric and magnetic phenomena

(**vfHkdFku%** fo/kqrpqcdh;rk ds ewy fu;e lHkh fo/kqrh; ,oa pqacdh; ?kVukvks dks lapkfyr djrs gSA)

**Reason:** The attempts to unify fundamental forces of nature reflect the quest for unification

(**rdZ%** izd`fr ds ewyHkwr cyksa dks ,dhd`r djus ds iz;kl ,dhdj.k ds fy, ftKklk dks izfrfcfEcr djrs gSA)

(ii) **Assertion:** The elastic spring force arises due to the net attraction or repulsion between the neighbouring atoms of the spring when it is elongated or compressed

(**vfHkdFku%** izR;kLFk faLaizx cy fLaizx ds iM+kslh ijek.kqvksa ds e/; yxus okys “kq) vkd’kZ.k ;k izfrd’kZ.k cy ds dkj.k rc iSnk gksrk gS tc bls yack fd;k tkrk gS vFkok laihfMr (Compress) fd;k tkrk gSA)

**Reason:** The laws of derived forces such as spring force, friction force are independent of the laws of fundamental forces in nature

(**rdZ%** O;qRiUucyksa tSls fLizax cy ?k’kZ.k cy ds fu;e izd`fr esa ewyHkwr cyksa ds fu;eksa ls Lora= gksrs gSA)

(iii) **Assertion:** In a nuclear process mass gets converted into energy

(**vfHkdFku%** ukfHkdh; izfØ;k esa nzO;eku ÅtkZ esa ifjofrZr gks tkrk gSA)

**Reason:** According to Einstein’s mass energy equivalence relation, mass m is equivalent to energy E, given by the relation E= mc2 where c is the speed of light in vacuum

(**rdZ%** vkabLVhu ds nzO;eku ÅtkZ lehdj.k ds laca/k ls nzO;eku m, ÅtkZ E ds cjkcj gksrk gS] ftls  laca/k ds }kjk n”kkZ;k tkrk gS tgk¡ c, fuokZr esa izdk”k dh pky gSA)

(iv) **Assertion:** If we perform an experiment in our laboratory today and repeat the same experiment on the same objects under identical conditions after a year, the results are found to be same

(**vfHkdFku**% ;fn ge viuh iz;ksx”kkyk esa vkt dksbZ iz;ksx djrs gS rFkk mlh iz;ksx dks ge ,d o’kZ ckn leku fLFkfr;ksa ds vanj leku oLrqvksa ij laiUu djrs gSA rks ifj.kke leku izkIr gksaxsA)

**Reason:** The law of nature do not change with time

(**rdZ%** izd`fr ds fu;e le; ds lkfk cnyrs ugha gSA)

(v) **Assertion:** Electrons do not experience strong nuclear force

(**vfHkdFku%** bysDVªkWu izcy ukfHkdh; cy dk vuqHko ugha djrs gSA) **Reason:** Strong nuclear force is charge-independent force

(**rdZ%** izcy ukfHkdh; cy vkos”k Lora= cy gksrk gSA)

1. **Direction:** In the following question a statement of assertion is followed by a statement of reason mark the correct choice as:

(**funsZ”k%** fuEu iz”uksa esa vfHkdfku ds oDrO; ds ckn rdZ ds oDrO;dh fn;k x;k gSA lgh fodYi ij fu”kku yxkb,A)

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(vfHkdFku vkSj rdZ nksuksa lgh gS rFkk rdZ vfHkdFku dh lgh O;k[;k djrk gSA)

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(vfHkdFku vkSj rdZ nksuksa lgh gS ysfdu rdZ vfHkdFku dh lgh O;k[;k ugha djrk gSA)

(c) If assertion is true but reason is false

(vfHkdFku lgh gS] ysfdu rdZ xyr gSA)

(d) If both assertion and reason are false.

(vfHkdFku vkSj rdZ nksuksa xyr gSA)

(i) **Assertion:** Gravitational force is always attractive in nature, while electromagnetic force can be attractive or repulsive

(**vfHkdFku%** xq:Roh; cy dh izd`fr ges”kk gh vkd’kZ.k djus dh gksrh gS tcfd fo/kqrpqEcdh;cy vkd’kZd ;k izfrd’kZd gks ldrs gS)

**Reason:** Electromagnetic force dominates terrestrial phenomena

(**rdZ%** fo/kqrpqEcdh; cy ikfFkZo ?kVukvksa (Terrestrial

phenomena) ij izHkkoh gksrs gSA)

(ii) **Assertion:** In physics, we attempt to derive the properties of a bigger, more complex system from the properties and interactions of its constituent simpler parts

(**vfHkdFku%** HkkSfrdh esa vis{kkd`r cM+s vf/kd tfVy fudk; ds xq.k/keksZ dks ge blds ljyre /kVd fgLlksa ds xq.kksa rFkk vUrjfØ;kvksa (Interactions) ls O;qRiUu djus dk iz;kl djrs gSA)

**Reason:** This approach is called unification and is at the heart of physics

(**rdZ%** bl lksp dks ,dhdj.k (Unification) dgk tkrk gS rFkk ;g HkSfrdh dkg`n; gSA)

(iii) **Assertion:** The microscopic domain of physics deals with the constitution and structure of matter at the minute scales of atoms and nuclei

(**vfHkdFku%** HkkSfrdh dk lw{e izHkko {ks= (Microscopic domain) inkFkZ ds ?kVd ,oa lajpuk dk ijek.kqvksa ,oaukfHkdksa ds lw{e Lrj ij v/;;u djrk gSA )

**Reason:** Classical physics is adequate to deal with the macroscopic domain of physics

(**rdZ%** fpjlEer HkkSfrdh HkSfrdh ds LFkwy izHkko {ks= dk v/;;u djus ds fy, i;kZIr gSA)

(iv) **Assertion:** The acceleration due to gravity on the moon is one-sixth that on the earth

(**vfHkdFku%** panzek ij xq:Roh; Roj.k /kjrh dh rqyuk esa NBok¡ Hkkx gksrk gSA)

**Reason:** The law of gravitation is the same on both the moon and the earth

(**rdZ%** xq:Rokd’kZ.kdkfu;e panzek,oa/kjrh nksuksa ijgh leku gSA)

(v) **Assertion:** A stone and a feather dropped from the same height do not reach the ground at the same time

(**vfHkdFku%** ,d gh ÅapkbZ ls fxjk, x, iRfkj o ia[k tehu ij ,d lkFk ugha igq¡prs gSA)

**Reason:** Acceleration due to gravity is dependent on the mass of the object

(**rdZ%** xq:Roh; Roj.k oLrq ds nzO;eku ij fuHkZj djrk gSA)

1. Working : Resonance tube is a 100 cm tube. Initially it is filled with water. To increase the length of air column in the tube, water level is lowered. The air column is forced with a tuning fork of frequency f0. Let at length 1, we get a first resonance (loud voice) then

(fØ;kfof/k : vuqukn uyh 100 cm dk V~;wc gksrk gSA izkjEHk esa ;g ty ls iwjk Hkjk gksrk gSA ok;q LrEHk dh yEckbZ c<+kus ds fy, ty Lrj dks ?kVk;k tkrk gSA ok;q LrEHk dks f0 vko`fÙk ds Lofj=k ls nksfyr fd;k tkrk gSA ekuk 1, yEckbZ ij igyk vuqukn (rst /ofu) izkIr gksrk gS rks -)

eq1 = 



 1 +  = .........(i)

where  is end correction (tgka  fljk la'kks/ku gSA)

If we further lower the water level, the noise becomes moderate. But at 2. We, again get a loud noise (second resonance) then

(;fn ty Lrj dks vkSj uhps ys tk,xsa rks /ofu okil de gks tkrh gS] ysfdu 2 yEckbZ ij iqu% gesa rhoz /ofu lqukbZ nsxh (f}rh; vuqukn) rc)

eq2 = 



 2 +  = ........(ii)

From (i) and (ii) (lehdj.k (i) o (ii) l)

V = 2f0 (2 – 1)

Observation table (izs{k.k lkfj.kh) :

Room temperature is (dejs dk rki) 27ºC



(i) Speed of sound calculated is roughly

(/ofu dh pky yxHkx gksxh -)

(a) 340 m/sec (b) 380 m/sec

(c) 430 m/sec (d) 330 m/s

(ii) In the previous question, speed of sound at 0ºC is roughly

(fiNys iz'u esa 0º ij /ofu dh pky yxHkx gksxh -)

(a) 324 m/sec (b) 380 m/sec

(c) 430 m/sec (d) 314 m/s

(iii) What should be minimum length of tube, so that third resonance can also be heard.

(V~;wc dh U;wure yEckbZ fdruh gks] rkfd rhljk vuqukn Hkh lqukbZ ns\)

(a) 3 = 421 cm (b) 3 = 214 cm

(c) 3 = 124 cm (d) None of these

(iv) Rom equation (i) and (ii) end correction can be calcualted. Estimate the diameter of the tube using imparical formula ( 0.3d)

(lehdj.k (i) rFkk (ii) ls fljk la'kks/ku  Hkh Kkr fd;k tk ldrk gSA ukyh dk O;kl lw=k ( 0.3d) ls Kkr djsa)

(a) 2.5 cm (b) 3.3 cm (c) 5.2 cm (d) None of these

1. Some physical quantities are given in Column  and some possible SI units in which these quantities may be expressed are given in Column . Match the physical quantities in Column  with the units in Column .

(dkWye  esa dqN HkkSfrd jkf'k;k¡ nh xbZ gS vkSj dkWye  esa dqN lEHkkfor S bdkbZ;k¡ nh xbZ gS ftuesa bu jkf'k;ksa dks O;Dr fd;k tk ldrk gSA dkWye  esa nh xbZ HkkSfrd jkf'k;ksa dk dkWye  esa nh xbZ bdkbZ;ksa ds lkFk lqesy djk;saA)

|  |  |
| --- | --- |
| **Column  (dkWye )** | **Column  dkWye  ** |
| (A) GMeMs  G – universal  gravitational constant  (lkoZf=kd xq:Rokd"kZ.k  fLFkjkad),  Me - mass of the  Earth (i`Foh dk nzO;eku),  Ms - mass of the Sun  (lw;Z dk nzO;eku) | (p) (volt) (coulomb)  (metre)  (oksYV) (dwykWEc) (ehVj) |
| (B)  R - universal gas  Constant  (lkoZf=kd xSl fLFkjkad),  T - absolute  Temperature  (ije rki),  M- molar mass  (eksyj nzO;eku) | (q) (kilogram) (metre)3  (second)–2  fdykksxzke) (ehVj)3  (lSd.M)–2 |
| (C)  F - force (cy),  Q - charge (vkos'k),  B-magnetic field  (pqEcdh; {ks=k) | (r) (metre)2 (second)–2  (ehVj)2 (lSd.M)–2 |
| (D)  G - universal  gravitational constant  (lkoZf=kd xq:Rokd"kZ.k  fLFkjkad),  Me - mass of the  Earth (i`Foh dk nzO;eku)  Re - radius of the  earth (i`Foh dh f=kT;k) | (s) (farad) (volt)2  (kg)–1  (QSjM) (oksYV)2  (fdyksxzke)–1 |

1. Let [0]denote the dimensional formula of the permittivity of the vacuum and [0] that of the permeability of the vacuum. If M = mass, L = length, T = time and  = electric current, then :

(ekuk [0] fuokZr esa fo|qr'khyrk dh foek vkSj [0] fuokZr dh pqEcd'khyrk dh foek dks fu:fir djrk gSA ;fn M = nzO;eku, L = yEckbZ , T = le; vkSj  = fo|qr /kkjk gS rc)

(a) [0] = [M–1 L–3T2 ] (b) [0] = [M–1 L–3T4 2]

(c) [0] = [MLT–2 2] (d) [0] = [ML2 L–1 ]

1. The SI nit of the inductance, the henry can by written as :

(izjsdRo dh SI foek, gSujh dks fy[kk tk ldrk gS½

(a) Weber/ ampere (cScj/ ,fEi;j)

(b) Volt-second/ampere (oksYV lSd.M /,fEi;j)

(c) Joule/(ampere)2 (twy/(,fEi;j)2)

(d) Ohm-second (vkse lSd.M)

1. The pair(s) of physical quantities that have the same dimensions is (are) :

(HkkSfrd jkf'k;ksas ds os ;qXe ftudh foek (foek;s) leku gS, gksxs)

(a) Volumetric strain and coefficient of friction

(vk;rfud fod`fr vkSj ?k"kZ.k xq.kkad)

(b) Disintegration constant of a radioactive substance and frequency of light wave

(fdlh jsfM;ks,fDVo iznkFkZ dh fo|Vu fu;rkad vkSj izdk'k rjax dh vko`fr)

(c) Heat capacity and gravitational potential

(Å"ek /kkfjrk vkSj xq:Roh; foHko)

(d) Plank's constant and torque.

(Iykad fu;rkad vkSj cyk/kw.kZ)

1. Units of CR2 is /are (CR2 dk ek=kd½

(C = capacitance and (/kkfjrk vkSj) R = resistance (izfrjks/k))

(a) Henry (b) 

(c)  (d) 

1. 0E2 has the dimensions of

(0E2 dh foek gksxhA½

(0 = permittivity of free space (fuokZr dh fo|qr'khyrk),

E = electric field (fo|qr {kS=k))

(a) Pressure (nkc) (b) kT

(c) R/T (d) All of these

Here \*(;gka),

K = Boltzmann constant (oksYVteku fu;rkad)

T = absolute temperature (ije rkieku)

R = universal gas constant. (lkoZfrd xSl fu;rkad)

1. **Directions:** In the following question, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

(**funsZ”k%** fuEu iz”uksa esa] vfHkdFku ds oDrO; ds ckn rdZ ds oDrO; dks fn;k x;k gSA lgh fodYi ij fu”kku yxkb,A)

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(vfHkdFku vkSj rdZ nksuksa lgh gSa rFkk rdZ vfHkdFku dh lgh O;k[;k djrk gSA)

(b) If both assertion and reason are true but reason is not the correct explanation of assertion.

(vfHkdFku vkSj rdZ nksuksa lgh gS ysfdu rdZ vfHkdFku dh lgh O;k[;k ugh djrk gSA)

(c) If assertion is true but reason is false.

(vfHkdFku olgh gS] ysfdu rdZ xyr gSA)

(d) If both assertion and reason are false.

(vfHkdFku vkSj rdZ nksuksa xyr gSA)

(i) **Assertion:** Kinematic equatins are exact and are always correct.

(**vfHkdFku%** “kq)xfrdh (Kinematic) lehdj.k ,dne lVhd gksrs gSa rfkdk ges”kk lgh gksrs gSA)

**Reason:** The definitions of instantaneous velocity and acceleration are true only for motion in which the magnitude and direction of acceleration are constant during the course of motion.

(**rdZ%** rkR{kf.kd osx ,oa Roj.k dh ifjHkk’kk,¡ ges”kk gh ml pky ds fy, lgh gksrh gSa ftlesa Roj.k dk ifjek.k o fn”kk pky dh izfØ;k ds nkSjku fLFkj gksrs gSA)

(ii) **Assertion:** The average speed of an object is greater than or equal to the magnitude of the average velocity over a given time interval.

(**vfHkdFku%** fn, x, le;kUrjky ij fdlh oLrq dh vkSlr pky vkSlr osx ds ifjek.k ls cM+h ;k cjkcj gksrh gSA)

**Reason:** The two are equal only if the path length is equal to the magnitude of displacement.

(**rdZ%** nksuksa cjkcjdsoy rHkh gksrs gSa tc iFk dh yackbZ foLFkkiu ds ifjek.k ds cjkcj gksrk gSA)

(iii) **Assertion:** The relative velocity between any two bodies moving in opposite direction is equal is equal to sum of two velocities of two bodies.

(**vfHkdFku%** foijhr fn”kkvksa esa xfrekufdUgha nks fi.Mksa dk vkisf{kd osx mu nksuksa fi.Mksa ds osxksads ;ksx dscjkcjgksrk gSA)

**Reason:** Sometimes relative velocity between two bodies is equal to difference in velocities of the two bodies.

(**rdZ%** dHkh & dHkh nks fi.Mksa ds chp dk vkisf{kd osx mu nksuksa fi.Mksa dsosxksa ds vUrj ds cjkcj gksrk gSA)

(iv) **Assertion:** The position time graph of a body moving uniformly in a straight line is parallel to position axis.

(**vfHkdFku%** fdlh ljy js[kk esa ?kweus okys fdlh fi.M dk fLFkfr le; xzkQ] fLFkfr v{k dslekukUrj gksrk gSA)

**Reason:** The position time graph in a non – uniform motion gives constant velocity at all instants of time.

(**rdZ%** fLFkfr le; xzkQ vleku pky esa le; ds lHkh {k.kksa esa fLFkj osxdks iznku djrk gSA)

(v) **Assertion:** Acceleration and velocity cannot change values abruptly at an instant.

(**vfHkdFku%** Roj.k o osx rkR{kf.kd :i ls ekuksa (values) dks ifjofrZr ugha dj ldrs gSaA)

**Reason:** Their changes can either be continuous or discontinuous.

(**rdZ%** muds ifjorZu ;k rks lrr~ gks ldrs gSA vFkok vlrr~A)

1. **Statement** (oDrO;) -1 **:** The magnitude of velocity of two boats relative to river is same. Both boats start simultaneously from same point on one bank may reach opposite bank simultaneously moving along different paths.

(nks ukoksa dk unh ds lkis{k osx dk ifjek.k leku gSA nksuksa ukosa ,d fdukjs ij ls] ,d gh fcUnq ls ,d lkFk pyuk izkjEHk djrh gSA os lkeus okys fdukjs ij vyx&vyx iFkksa ds vuqfn'k xfr djrs gq;s ,d lkFk igq¡p ldrh gSaA)

**Statement** (oDrO;)-2 **:** For boats to cross the river in same time. The component of their velocity relative to river in direction normal to flow should be same.

(unh dks ikj djus esa nksuksa uko leku le; ysrh gS rks izokg dh yEcor~ fn'kk esa unh ds lkis{k muds osx dk ?kVd leku gksuk pkfg,A)

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(oDrO;-1 lR; gS] oDrO;-2 lR; gS ; oDrO;-2, oDrO;-1 dk lgh Li"Vhdj.k gSA)

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(oDrO;-1 lR; gS] oDrO;-2 lR; gS ; oDrO;-2, oDrO;-1 dk lgh Li"Vhdj.k ugha gSA)

(c) Statement-1 is True, Statement-2 is False

(oDrO;-1 lR; gS] oDrO;-2 vlR; gS ;)

(d) Statement-1 is False, Statement-2 is True

(oDrO;-1 vlR; gS] oDrO;-2 lR; gS)

1. **STATEMENT**(oDrO;)–1**:**Two stones are projected with different velocities from ground from same point and at same instant of time. Then these stones cannot collide in mid air. (Neglect air friction)

(nks iRFkj ,dleku le; esa ,d gh LFkku ls /kjkry ls fHkUu fHkUu osx ls iz{ksfir fd;s tkrs gS rks ;s iRFkj gok esa ugh Vdjk ldrsA ¼ok;q ?k"kZ.k ux.; gS½)

**STATEMENT**(oDrO;)–2**:** If relative acceleration of two particles initially at same position is always zero, then the distance between the particle either remains constant or increases continuously with time.

(,d gh txg fLFkr nks d.kksa dk ;fn izkjEHk esa lkisf{kd Roj.k lnSo 'kwU; gks rks d.kksa ds e/; nwjh ;k rks fu;r jgsxh ;k le; ds lkFk fujUrj c<+sxhA)

(a) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1

(oDrO;-1 lR; gS, oDrO;-2 lR; gS; oDrO;-2 oDrO;-1 dk lgh Li"Vhdj.k gSA)

(b) Statement-1 is True, Statement-2 is True;

Statement-2 **is NOT** a correct explanation for Statement-1

(oDrO;-1 lR; gS, oDrO;-2 lR; gS ; oDrO;-2 oDrO;-1 dk lgh Li"Vhdj.k ugha gSA)

(C) Statement-1 is True, Statement-2 is False

(oDrO; -1 lR; gS, oDrO;-2 vlR; gSA)

(D) Statement-1 is False, Statement-2 is True.

(oDrO; -1 vlR; gS , oDrO;-2 lR; gSA)

1. Raindrops are falling with a velocity10m/s making an angle of 450 with the vertical. The drops appear to be falling vertically to a man running with constant velocity. The velocity of rain drops change such that the rain drops now appear to be falling vertically with times the velocity it appeared earlier to the same person running with same velocity.

(o"kkZ dh cwans 10m/s ds osx ls Å/okZ/kj ls 450 dk dks.k cukrs gq, fxjrh gSA fu;r osx ls {kSfrt fn'kk esa Hkkxrs gq, vkneh dks ;s cwans iw.kZr% Å/okZ/kj fxjrh gqbZ çrhr gksrh gSA o"kkZ dh cwanks dk osx ifjofrZr gksrk gS vkSj vc mlh leku osx ls Hkkxrs gq, vkneh dks o"kkZ dh cwans igys dh rqyuk es xquk osx ls Å/okZ/kj fxjrh gqbZ çrhr gksrh gSA )

(i) The magnitude of velocity of man with respect to ground is

(tehu ds lkis{k vkneh ds osx dk ifjek.k gS% &)

(a) 10m/s (b) m/s (c) 20 m/s (d) 10 m/s

(ii) After the velocity of rain drops change, the magnitude of velocity of raindrops with respect to ground is:

(o"kkZ dh cw¡nksa ds osx ifjorZu ds ckn tehu ds lkis{k o"kkZ dh cw¡nksa ds osx½

(a) 20 m/s (b) 20m/s (c) 10 m/s (d) 10m/s

(iii) The angle (in degrees) between the initial and the final velocity vectors of the raindrops with respect to the ground is:

(o"kkZ dh cwanks dk tehu ds lkis{k çkjfEHkd osx lfn'k vkSj vfUre osx lfn'k (tehu ds lkis{k) ds e/; dks.k (fMxzh esa) gS%)

(a) 8 (b) 15 (c) 22.5 (d) 37

1. A swimmer can swim with a speed v in still water.

(,d rSjkd fLFkj ikuh esa v pky ls rSj ldrk gS)



(i) If the swimmer crosses a swimming pool 'd' from A to directly opposite point B on other side in time t1 as shown in figure (i) and in a flowing river (river velocity 'u') of same width d from A to directly opposite point B on other bank in time t2 , then (t1/t2) is equal to : (Assume v > u)

(;fn rSjkd fcUnq A ls nwljh vksj foijhr fcUnq B rd 'd' pkSM+kbZ ds laxzg.k VSad (swimming pool) dks t1 le; esa ikj djrk (fp=k (i)) gS rFkk cgrh gqbZ unh ¼unh dk osx u½ esa fcUnq A ls fcUnq B rd igq¡pus esa yxk le; t2 gS] rks (t1/t2) dk eku gksxk:

(ekfu, fd v > u))

(a)  (b)  (c)  (d) 1

(ii) If the minimum time taken in swimming pool to reach opposite bank is t1 and minimum. time to reach opposite bank in river is t2 , then the ratio will have

a value :

(;fn VSad ds foijhr fdukjs rd igq¡pus esa yxk U;wure le; t1 gS rFkk unh esa foijhr fdukjs rd igq¡pus esa yxk U;wure le; t2 gS] rks dk vuqikr gksxk : )

(a) 1 (b)  (c)  (d) 

(iii)If the time taken by swimmer to reach opposite point on other bank in river is T1 and the time taken to travel an equal distance upstream (against the water current) in the river is T2 , then ratiowill have a value :

(;fn unh esa nwljs fdukjs ij fLFkr foijhr fcUnq ij igq¡pus esa rSjkd }kjk fy;k x;k le; T1 gks rFkk unh ds foijhr fn'kk esa leku nwjh r; djus esa yxk le; T2 gS] rks dk vuqikr gksxk :)

(a) (b) 

(c)  (d) 

1. The equation of motion of the particle is described in column I. At t = 0, particle is at origin and at rest. Match the column I with the statements in column II .

(dkWye I esa d.k dh xfr ds lehdj.k fn;s x;s gSaA t = 0, d.k ewyfcUnq ij fojkekoLFkk esa gSA dkWye I dks dkWye II esa fn;s x;s dFkuksa ls lqesfyr dhft,A)

|  |  |
| --- | --- |
| **Column –I** | **Column –II** |
| (A) x = (3t2 + 2t)m | (p) Velocity of particle  at t = 1 s is 8 m/s.  (t = 1 s ij d.k dk osx 8  m/s gSA) |
| (B) v = 8t m/s | (q) Particle moves with  uniform acceleration.  (d.k ,dleku Roj.k ls xfr]  djrk gSA) |
| (C) a = 16 t | (r) Particle moves with  variable acceleration.  (d.k ifjorhZ Roj.k ls xfr  djrk gSA) |
| (D) v = 6t – 3t2 | (s) Acceleration of the  particle at t = 1sec is  2m/s2  (t = 1sec ij d.k do  Roj.k 2m/s2 gSA) |
|  | (t) Particle will change  its direction some time.  (d.k dh fn'kk fdlh le; Ikj  cny tk;sxhA) |

1. In the column-, the path of a projectile (initial velocity 10 m/s and angle of projection with horizontal 60° in all cases) is shown in different cases. Range 'R' is to be

matched in each case from column-. Take g = 10

Arrow on the trajectory indicates the direction of motion of projectile.

Match each entry of column–I with its corresponding entry in column–II

(LrEHk- esa] ,d iz{ksI; dk iFk vyx&vyx fLFkfr;ksa esa crk;k x;k gSA lHkh fLFkfr;ksa esa izkjfEHkd osx 10 m/s o {kSfrt ds lkFk iz{ksi.k dks.k 60° gSA ijkl 'R' dks izR;sd fLFkfr ds laxr LrEHk- ls lqesfyr dfj;sA (g=10 m/s2 ysa) fp=k esa rhj iz{ksI; xfr dh fn'kk dks iznf'kZr djrk gSA)

|  |  |
| --- | --- |
| **Column-I** | **Column-II** |
| (A) | (p) R= m |
| (B) | (q) R= m |
| (C) | (r) R= m |
| (D) | (s) R= m |
|  | (t) R= 100m |

1. Read the following comprehensions carefully and

answer the questions.

(fuEu vuqPNsnksa dks /;ku ls if<, vkSj iz'uksa ds mÙkj nhft,A)

Let f(x) = x2 + b1x + c1 , g(x) = x2 + b2x + c2.

Real roots of f(x) = 0 be ,  and real roots of g(x) = 0 be  +  ,  +  . Least value of f(x) be –. Least value of g(x) occurs at x =

(ekuk f(x) = x2 + b1x + c1 , g(x) = x2 + b2x + c2 gSaA f(x) = 0 ds okLrfod ewy ,  rFkk g(x) = 0 ds okLrfod ewy  +  ,  + gSA f(x) dk U;wure eku – gSA g(x) dk U;wure eku x = ij çkIr gksrk gSA)

(i) The roots of g(x) = 0 are (g (x) = 0 ds ewy gS&)

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

1. If roots of the equation x4 – 12x3 + bx2 + cx + 81 = 0 are positive, then

(;fn lehdj.k x4 – 12x3 + bx2 + cx + 81 = 0 ds ewy /kukRed gks] rks)

(i) Root of equation 2bx + c = 0 is (2bx + c = 0 dk ewy gS&)

(a) – (b)  (c) 1 (d) – 1

1. **Match the column**

|  |  |
| --- | --- |
| **Column-I** | **Column-II** |
| (A) If set of all possible values of k  for which every solution of the  inequation x2 – (3k – 1) x + 2k2 – 3k –  2  0 is also a solution of the  inequation x2 – 1  0 is [, m], then   + m is equal to  **(**;fn vlfedk x2 – (3k – 1) x + 2k2 – 3k  – 2  0 dk izR;sd gy vlfedk x2 – 1  0  dk Hkh ,d gy gS ftlds fy, k ds lHkh  lEHko ekuksa dk leqPp; [, m] gS] rks  + m  dk eku gksxk&**)** | (p) 3 |
| (B) If a, b, c and d are four positive  real numbers such that abcd = 1 and  minimum value of (1 + a) (1 + b)  (1 + c) (1 + d) is 16 , then  + 2 is  equal to  (;fn a, b, c rFkk d pkj /kukRed okLrfod  la[;k,¡ bl izdkj gSa fd abcd = 1 rFkk  (1 + a) (1 + b) (1 + c) (1 + d) dk U;wure  eku 16 gS] rks  + 2 dk eku gksxk&) | (q) 1 |
| (C) If solution set of the inequality  5x + 2 > is(, ), then  is equal  to (vlfedk 5x + 2 >  ds gyksa dk  leqPp; (, ) gS, rks  dk eku gksxk &) | (r) 4 |
| (D) Let f(x) = x3 + 3x + 1. If g(x) is  the inverse function of f(x) and g(5)  =, then 4 is equal to  (ekuk fd f(x) = x3 + 3x + 1 gSA ;fn g(x),  Qyu f(x) dk izfrykseh; Qyu gS rFkk  g(5) =gS ] rks 4 dk eku gksxk&) | (s) 2 |
|  | (t) 0 |

1. Let , ,  are three real numbers such that

 +  +  = 2, 2 + 2 + 2 = 6 and 3 + 3 + 3 = 8, then

(ekuk , ,  rhu okLrfod la[;k,a bl çdkj gS fd  +  + 

= 2, 2 + 2 + 2 = 6 rFkk 3 + 3 + 3 = 8, rc)

|  |  |
| --- | --- |
| **Column-I** | **Column-II** |
| (A) The value of 4 + 4 + 4 is | (p) 20 |
| (B) The value of (1 – ) (1 – )  (1 – ) is | (q) 18 |
| (C) If |x| < 1, then (x – ) (x – )  (x – ) is | (r) Positive |
| (D) The value of (1 + 2) (1 + 2)  (1 + 2) is | (s) Negative |
|  | (t) Zero |

1. If and  does not have

two distinct real roots, then

(;fn  rFkk ds nks fofHkUu

okLrfod ewy ugh gS] rks &)

(a) Minimum possible value of  is 

( dk U;wure laHko eku gSA)

(b) Minimum possible value of  is 

( dk U;wure laHko eku gSA)

(c) Minimum possible value of is 

( dk U;wure laHko eku  gSA)

(d) Minimum possible value of  is 

( dk U;wure laHko eku  gSA)

1. The graph of the quadratic polynomial

is as shown in the figure . Then

(fdlh f}?kkr cgqin  dk xzkQ fp=kkuqlkj gS] rks :)



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

1. has

( j[krk gS&)

(a) One real root in and other in 

(,d okLrfod ewy vUrjky  esa rFkk nwljk vUrjky

 esa)

(b) One real root in and other in 

(,d okLrfod ewy vUrjky esa rFkk nwljk vUrjky

 esa)

(c) Two real roots in 

(nksuksa okLrfod ewy vUrjky  esa)

(d) No real roots (dksbZ okLrfod ewy ugha)

1. If the roots of the equation  form an increasing G.P., then

(;fn lehdj.k  ds ewy] ,d o`f)eku xq.kksÙkj Js<+h cukrs gks] rks)

(a) 

(b) 

(c) One of the roots is 1 (,d ewy 1 gSA)

(d) One root is smaller than 1 and one root is more than 1. (,d ewy 1 ls NksVk gS rFkk ,d ewy 1 ls cM+k gSA)

1. If f : (0, )  (0, ) satisfy f(xf(y)) = x2ya (a  R), then

(;fn f : (0, )  (0, ), f(xf(y)) = x2ya (a  R) dks larq"V djrk gS] rks)

(i) Value of a is

(a dk eku gS&)

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

(ii) **n**C**r** is

(a) n.2n – 1 (b) n(n – 1) 2n – 2

(c) n.2n – 1 + n(n – 1) 2n – 2 (d) 0

(iii) Number of solutions of 2 f(x) = ex is

(2 f(x) = ex ds gyksa dh la[;k gS &)

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

1. Left hand derivative and Right hand derivative of a function f(x) at a point x = a are defined as

(fdlh fcUnq x = a ij ,d Qyu f(x) dk ck¡;k vkSj nk¡;k vodyt Øe'k%)

f (a**–**)= =and

f(a**+**)= =

=respectively.

Let f be a twice differentiable function. (ekukfd f nks ckj vodyuh; Qyu (twice differentiable function) gSA)

(i) If f is odd, which of the following is Left hand derivative of f at x = – a

(;fn f fo"ke gS] rks fuEu esa ls dkSulk x = – a ij f dk ck¡;k vodyt gS &)

(a) (b) 

(c)  (d) 

(ii) If f is even which of the following is Right hand derivative of f  at x = a.

(;fn f le gS] rks fuEu esa ls dkSulk x = a ij f dk nk¡;k vodyt gS½

(a) 

(b) 

(c) 

(d) 

(iii) The statement (dFku) 

=implies that (bafxr djrk gS fd)]

(a) F is odd (f fo"ke gS)

(b) F is even (f le gS)

(c) F is neither odd nor even (f u rks le gS u gh fo"ke gS)

(d) Nothing can be concluded

(dksbZ fu"d"kZ ugha fudky ldrs gS)

1. **Match the following (LrEHk feyku dhft,) :**

|  |  |
| --- | --- |
| **Column - I** | **Column - II** |
| (A) Number of points of discontinuity  of f(x) = tan2x – sec2x in (0, 2) is  (0, 2) esa f(x) = tan2x – sec2x ds vlrr~  fcUnqvksa dh la[;k gS&) | (p) 4 |
| (B) Number of points at which f(x)  = sin–1x + tan–1x + cot–1x is non-  differentiable in (–1, 1) is  (–1, 1) esa fcUnqvksa dh la[;k ftl ij f(x)  = sin–1x + tan–1x + cot–1x vodyuh; ugha  gSA) | (q) 3 |
| (C) Number of points of discontinuity  of y = [sin x], x  [0, 2) where [ . ]  represents greatest integer function  (y = [sin x], x  [0, 2) ds vUrxZr vlrr~  fcUnqvksa dh la[;k tgk¡ [.] egÙke iw.kk±d  Qyu dks iznf'kZr djrk gSA) | (r) 2 |
| (D) Number of points where  y = |(x – 1)3| + |(x – 2)5| +  |x– 3| is non- differentiable  (fcUnqvksa dh la[;k tgk¡ y = |(x – 1)3| +  (x – 2)5| + |x – 3| vodyuh; ugha gSA) | (s) 1 |
|  | (t) 0 |

1. The graph of the function y = f (x) is as shown in the figure. Then which one of the following graphs are correct?

(Qyu y = f (x) dk vkys[k fp=k esa iznf'kZr gSA rks fuEufyf[kr esa ls dkSulk vkys[k lR; gS \)



(a)y=sgn (f (x)) 

(b)y = sgn ( f (x))

(c) y = f x 

(d) y = xsgn (f (x)) 

1. If f : R  R, f(x) = e–| x | – ex is a given function, then which of the following are correct :

(;fn f : R  R, f(x) = e–| x | – ex ,d fn;k x;k Qyu gS] rks fuEu esa ls dkSuls lgh gSa&)

(a) f is many-one into function (f cgq,dh vUrZ{ksih Qyu gSA)

(b) f is many one onto function(f cgq,dh vPNknd Qyu gSA)

(c) Range of f is [0, ] (f dk ifjlj [0, ] gSA)

(d) Range of f is (–, 0] (f dk ifjlj (–, 0] gSA)

1. Which of the following function(s) has/have removable discontinuity at x = 1.

(fuEu eas ls dksulk@dkSuls Qyu x = 1 ij foLFkkiuh; vlrr~rk j[krs gS)

(a) f(x) = (b) f(x) =

(c) f(x) = (d) f(x) =