(4)

(j)   Explain the significance of binding energy per nuclear.

Ûeefl e veeefVekeâece keâCe yevOeve Tpee&keâe cenÛe   eeFS~

Unit - I

Fkeâf&~ I

2.   (a)   Show that the perpendicular distance between the adjascent planes of a set (hkl) in a simple cubic lattice of constant 'a' is

$$d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

6

oMee&FS ekeâ 'a' peeuekeâ efmLej ekeâ keâ mej ue leveeUe peeuekeâ ceWmece ÙUeUe (hkl) keâ efvekeââ Jeleea meceleueeWkeâ yeefŒe keââ uecyeJele oÙÛer nefeer nw:

$$d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

(b)   Describe briefly the structure of NaCl crystal and deduce the number of molecules per unit cell.   5

NaCl ef&eâmšue keâer mejjUevee keâe metŒe cewUeCette keââefpeS

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A   (Printed Pages 8)

Roll No. _____

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B.Sc. (Part-III) Examination, 2015

(Regular & Exempted)

PHYSICS

Second Paper

(Solid State Physics & Nuclear Physics)

Time Allowed : Three Hours]   *[Maximum Marks : 75*

Note :   Answer five questions in all. Question No. 1 is compulsory. Attempt one question from each unit.

keâgue heeBÛe ÛeMveeWkeââ Gòej oefpeeS~ ÛeMve meb 1 DeefveJeeÙe&nw ÛelÛekeââ FkeââF&mes Skeâ ÛeMve keââefpeS~

1.   Answer the following questions briefly : 3×10

efvecveefueefKele ÛeMveeWkeââ mebef#ehle Gòej oefpeeS :

(a)   Show that reciprocal lattice to simple cubic lattice is simple cubic lathic.

oMee&FŒes ekeââ mejue leveeUe peeuekeââ keââ JÙelÙeeÙece peeuekeââ

P.T.O.

mejue leveeÙe peeuekeâ neSlee n#

(b) Show that a lathice can not have five fold rotational symmetry.

oMeeKÙes ekeâ ekeââmeer peeuekeâ ceWheÛe JeieieÙee meceeÛeÙle veneR nes mekeââlee~

(c) Compare the spacing between the successive (100), (110) and (111) planes in a fcc lattice.

Skeâ Heâuekeâ keâievõle leveekeââej uemiÕme keâ efueS (100), (110) leLee (111) leueeeWkeâer Devllee&ue ofÝer keâer lejyevee keââefÝpeS~

(d) Why X-rays are appropriate to infold crystal structure?

efkeââmŠue mejjÛevee keâ %eeve keâ efueS Skeâe-efkeââj CeWkeâèeel GeÙele jnleer n0?

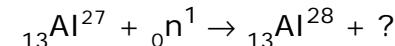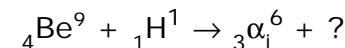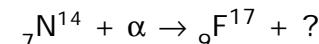(e) Calculate the hard sphere packing fraction of a b.c.c. lattice.

Skeâ Devle: keâievõle leveekeââej peeuekeâ keâ efueS eâ"ej ieesueeÙle mekeââuve ieÛeekeâ keâer ieCevee keââefÝpeS~
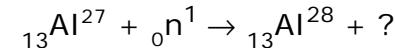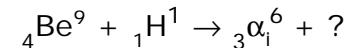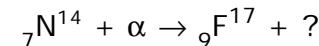
(f) What are 'mirror nuclei'? Explain with at least three examples.

ÛeÙeeÛe veeeÙekeâ keâÙlee veÝes n0? keââce meskeââce Goenj Ceâ keâ meeLe JÙeeKÙee keââefÝpeS~

(g) Complete the following reactions :

$_7N^{14} + \alpha \rightarrow _9F^{17} + ?$

$_4Be^9 + _1H^1 \rightarrow _3\alpha_i^6 + ?$

$_{13}Al^{27} + _0n^1 \rightarrow _{13}Al^{28} + ?$

efvecveefueeKele Ûeâleeâ&âefÝeesSB heCe&âkeââefÝpeS :

$_7N^{14} + \alpha \rightarrow _9F^{17} + ?$

$_4Be^9 + _1H^1 \rightarrow _3\alpha_i^6 + ?$

$_{13}Al^{27} + _0n^1 \rightarrow _{13}Al^{28} + ?$

(h) Why is 'Heavy water', a better moderator than 'ordinary water' in a nuclear reactor?

keââmeer veeeÙekeââÙle efj Skeâëj ceW'meeOeej Ce peue' keâer lejyevee ceW'Yeejer peue' Skeâ yesnlej DeÙecebkeââ n# keâ0leeÙ?

(i) What are magic numbers?

cecÝekeââ meKÙeeSB keâlee veÝes n0?

Unit - IV

FkeâeF&- IV

8. Discuss the principle and working of a scintilla-tion counter. What are the advantages of this counter in comparision with other counters?

efmeeCšueMeve keâeGvšj keâ efneæevle SJeb keâeÙe&MeeOe keâer JÙeeKÙee keâeâepeS~DevÙe keâeâGCšjeWkeâer legyevee ceWFme keâeâGvšj ceWkeâeÙee ueeYeeÛeo efleMeseleeSB n0? **12**

9. Write short note on the following :

efvecveefuekeÙele keâe me#efehle JeCee keâeâepeS :

(a) Nuclear reactor its construction & work-ing **4**

veeeYekeâeÙe efjSkešj keâer jÛevee leLee keâeâUe&0eCeuee

(b) Classification of elementary particles on the basis of interaction. **4**

DevÙeesÙeeefkeÙeeOeWkeâ DeeOeej hej cetue keââCeeW Jeieeâj jCe

(c) Nuclear fission and fusion. **4**

veeeYekeâeÙe efleKeC[ve SJeb veeeYekeâeÙe mebueÙeve~

---

leLee 0eefle Skeâeeeâ keâeeSP%okeâe ceWDeCeÙeeWkeâeâer meKÙee keâeâ ieCevee keâeâepeS~

3. (a) What is reciprocal lattice? Prove that the reciprocal lattice of f.c.c. lattice is a bcc lattice. **6**

JÙel¡>eâce peeuekeâ keWee ni? efmeae keâeâepeS efkeâ keâ SHkeâ.meer.meer. peeuekeâ keâe JÙel¡>eâce peeuekeâ yeer.meer.meer. peeuekeâ nektee nÉ

(b) Show that in an ideal hcp lattice the ratio

$$\left(\frac{c}{a}\right) = 1.633$$ **5**

oMeefFÙes efkeâ Skeâ DeeoMe& SÛe.meer.heer. peeuekeâ ceW

$$\left(\frac{c}{a}\right)$$ Devehesle 1.633 keâ yejeyej nektee nÉ

Unit - II

FkeâeF&- II

4. Determine the behaviour of an electron in a periodic potential using Kronig-Penny model and explain the inferences drawn. **11**

DeeJeleeaedleYeJe ce‖V ›eâeâeveie-hesveer efveoMe&keâe GheÙeesie keâjles n§ Skeâ

Fuekeešêve keâe JÙeJenej megveeMÛele keââepeS Deej ‖eehle heefj Ceeceel

keâer JÙeeKÙee keââepeS~

5. (a) What is Madelung Constant? Show that
       for a linear chain of equally spaced but
       oppositoly charged ions, the Madelung
       constant is 2 log 2.   6

       ce[uefie efveÙeleeukeâ keäie n‖? oMeeFŚ keâe keââmeer meceoj mLe
       keââvlegeflehejele DeeJeMe Jeeues DeeÙeveeÙükeâer   jKeeÙe keâ‖[eu
       keâ eu̇eS ce[uefie efveÙeleeukeâ keäie ceeve 2 log 2 neŠlee n⧣

   (b) Discuss briefly about Acoustic and optical
       phonons.   5

       OJeeefvekeâ SJeblUekeâeueMekeâe Heâesveeve keâe meb‖#ehle JeCeÙe keââepeS~

                 Unit - III

                 FkeâeF& - III

6. (a) Explain the principle, construction and
       working of the Bainbridge Mass spec-
       trograph.   6

       yesve efyeÒe õJÙeeceeve mhekeâšÊŠeeHeâ keâ efmeæevvle, meﬂjÛevee

---

leLee keââeÙe&‖eÿeeÙe mecePeeF‖es~

   (b) What is the experimental evidence in
       favour of the shell model of nucleus? 5

       veeeYekeâ keâ keââeÙMe ceeŠue keâ meceLete ce‖VÙeeŠfekeâ ŌeceeCe
       keäie n⊕?

7. (a) Write the semi-empirical mass formula
       for an atom with Z protons and (A−Z)
       neutrons. Discuss the origin of each term.

       Z ÒeesŠve leLee (A−Z) vÙešŠve Jeeues hejceeCeg keâ euieS
       meeefceDeeveÙeefekeâ melmeflie melie eﬂieeKeS~ ‖el̇ekeâ heo keâe
       GIheefe keâ efleJeŠevee keââepeS~   6

   (b) Half life time of Radium is 1590 years.
       After how many years 1 gm pure Radius
       will reduced by 1 centigram?   5

       jˢf[Ûece keâe Deæ&DeeÙeg keââeue 1590 Je‹e&n⁞ keââleves Je‹eë
       ceW1 «eece Mege jˢf[Ûece 1 meŵer «eece keââce nes peeSiee?