DAY — 01 SEAT NUMBER 0 0 0 3 4 7

Science

2017 | VII | 11 | 1030 | J-101 | (M)

H.S.C. Exam- July-2017

MARATHI (02)

Time : 3 Hrs. (7 Pages) Max. Marks : 80

प्र. १. खालीलपैकी कोणत्याही **एका विषयावर** सुमारे ३०० शब्दांत निबंध लिहा : [१०]

(१) संगणक : आपला मित्र

(२) माझा महाविद्यालयातील पहिला दिवस

(३) परीक्षा नसत्या तर....

(४) पूरग्रस्तांचो कैफियत

प्र. २. (अ) खालील काव्यवेच्याचे रसग्रहण करा : (६) [१०]

'गावाकडं'

काट्याकुट्याचा तुडवीत रस्ता
माझ्या गावाकडं चल माझ्या दोस्ता
कशी उन्हात, उन्हात तळतात माणसं
कशी मातीत, मातीत मळतात माणसं
कशी खातात जीवाला खस्ता
काळ्या बापाचं, बापाचं हिरवं रान
काळ्या माईनं, माईनं पिकवलं सोनं
त्यांच्या घामाचा भाव लई सस्ता
इथं डब्यात तुला साखर लागते गोड
तिथे शेतात माझ्या बापाच्या अंगाला कोड

भाव ठरतो त्याला न पुस्ता
जेव्हा दुस्काळ दुस्काळ, घिरट्या घाली
तेव्हा गावाला, गावाला कुणी न वाली
कसे घालतात सुगीत गस्ता
या भूमीचा, भूमीचा मूळ अधिकारी
बाप झाला, झालाय आज भिकारी
गाव असून झालाय फिरस्ता

—कवी इंद्रजित भालेराव

किंवा

(अ) खालीलपैकी कोणत्याही एका विषयाशी निगडित सुमारे १५ ते २० ओळींत संवादलेखन करा :

(१) तुमच्या परिसरातील निवेदकाशी साधलेला संवाद.

(२) 'स्त्रीभ्रूणहत्येविषयी' स्त्रीरोग तज्ज्ञांशी संवाद.

(३) बसच्या अनियमितपणामुळे वाहतूक नियंत्रकाशी साधलेला संवाद.

(ब) खालील प्रश्नांच्या उत्तरांचे योग्य पर्याय निवडून लिहा : (४)

(१) खालील नामासाठी योग्य ते विशेषण वापरा:

फूल -

(अ) अनुनासिक (ब) सामासिक

(क) पारिभाषिक (ड) सुवासिक

(२) खालील शब्दाला समानार्थी शब्द ओळखा:

पृथ्वी -

(अ) सुमेधा (ब) राधा

(क) वसुधा (ड) समिधा

(३) गटात न बसणारा शब्द ओळखा :

(१) प्रसिद्ध -

(अ) नामांकित (ब) कीर्तिमान

(क) कुविख्यात (ड) सर्वज्ञात

(२) आकार -

(अ) गोलाकार (ब) आयातकार

(क) त्रिकोणाकार (ड) संस्कार

प्र. ३. खालील प्रश्नांच्या उत्तरांचे योग्य पर्याय ओळखून लिहा : [१२]

(अ) दिलेल्या पर्यायांतून निर्दोष शब्द ओळखा: (२)

(१) (य) अंत:करण (र) अंत:क्करण

(ल) अंतर्करण (व) आंत:करण

(२) (य) धिक्कार (र) धिकार

(ल) धीक्कार (व) धि:कार

(ब) पुढील वाक्प्रचारांच्या अर्थांचा योग्य पर्याय निवडा : (२)

(१) दातखिळी बसणे -

(य) शांत बसणे (र) बडबड बंद करणे

(ल) बोलती बंद होणे (व) दात ओठ खाणे

(२) वृद्धी करणे -

(य) कलम करणे (र) वाढ करणे

(ल) सांभाळ करणे (व) औषधांची फवारणी करणे

(क) **(१)** खालील वाक्याचे होकारार्थी रूपांतर ओळखा : (१)

वाक्य : भर पावसात फूटपाथवरील त्या लोकांचे हाल होत असलेले बघून मला आनंद होणार नाही.

पर्याय :

(य) भर पावसात फूटपाथवरील त्या लोकांचे हाल होत असलेले बघून मला आनंद होणार आहे का?

(र) भर पावसात फूटपाथवरील त्या लोकांचे हाल होत असलेले बघून मला दु:ख होईल.

(ल) अरेरे! भर पावसात फूटपाथवरील त्या लोकांचे हाल होत असलेले बघून मला आनंद होईलच कसा!

(२) खालील वाक्याचे प्रश्नार्थी रूपांतर ओळखा : (१)

वाक्य : भुताचे पाय उलटे असतात.

पर्याय :

(य) भुताचे पाय सुलटे नसतात.

(र) बापरे ! भुताचे पाय उलटे असतात.

(ल) भुताचे पाय उलटे असतात हे खरं आहे का?

(ड) खालील वाक्यांत कोणती विरामचिन्हे वापरता येतील त्याकरिता योग्य पर्याय निवडा : (२)

(१) **वाक्य :** जगातला पहिला शास्त्रज्ञ कोण असतो

पर्याय :

(य) दुहेरी अवतरणचिन्ह, पूर्णविराम

(र) एकेरी अवतरणचिन्ह, प्रश्नचिन्ह

(ल) एकेरी अवतरणचिन्ह, उद्‌गारचिन्ह

(व) अर्धविराम, पूर्णविराम

(२) **वाक्य :** ती जागा खरंच निवांत शांत होती

पर्याय :

(य) अपूर्णविराम, पूर्णविराम

(र) अर्धविराम, पूर्णविराम

(ल) एकेरी अवतरणचिन्ह, प्रश्नचिन्ह

(व) स्वल्पविराम, पूर्णविराम

(इ) खालील विधानात / काव्यपंक्तीत कोणता रस प्रामुख्याने आढळतो, त्यासाठी योग्य पर्याय निवडा : (२)

(१) तो अंधार त्याला दचकवीत होता आणि भीतीचे काटे कुणीतरी काळजात रुतवीत होते.

(य) करुणरस (र) अद्‌भुतरस

(ल) भयानकरस (व) बीभत्सरस

(२) 'सह्यगिरींतील वनराजांनो या कुहरांतुनि आज पुढें
रक्त हवें जर स्वतंत्रतेला रक्ताचे पडतील सडे'

(य) वीररस (र) रौद्ररस

(ल) भयानकरस (व) अद्‌भुतरस

(फ) खालील पारिभाषिक शब्दांसाठी योग्य पर्याय निवडा : (२)

(१) Zero hour -

(य) उत्तर रात्र (र) शून्यकाल

(ल) विश्रांतिकाल (व) मधली सुट्टी

(२) Etiquette -

(य) शिष्टसंमत (र) नम्रता

(ल) पद्धती (व) शिष्टाचार

प्र. ४. (अ) खालीलपैकी कोणत्याही एका प्रश्नाचे उत्तर सुमारे ८० शब्दांत लिहा : (४) [७]

(१) उपहास म्हणजे काय? साहित्यिक त्याचा उपयोग कशासाठी करतात?

(२) बँडच्या आवाजामुळे लेखकाच्या मनात कोणत्या शंका आल्या?

(३) धत्तुऱ्याने कोणकोणती रूपे घेतली? वनातील झाडे व फुले त्याला का हसू लागली?

(ब) खालीलपैकी कोणत्याही तीन प्रश्नांची उत्तरे प्रत्येकी फक्त 'एका' वाक्यात लिहा : (३)

(१) मानवी स्वभावाचा एक महत्त्वाचा पैलू कोणता?

(२) अमावस्येच्या रात्री तुकाराम लांडगे कुठे चालला होता?

(३) लेखक मुकुंद टाकसाळे आणि त्यांची पत्नी आश्चर्यचकित का झाले?

(४) धोतऱ्यापासून कोणकोण दूर पळाले?

(५) तुकाराम लांडगे कोणत्या प्रसंगाचे फक्कड वर्णन करून सांगत असतो?

प्र. ५. (अ) खालीलपैकी कोणत्याही दोन प्रश्नांची उत्तरे प्रत्येकी सुमारे ८० शब्दांत लिहा : (८) [१२]

(१) डॉ. ए.पी.जे. अब्दुल कलाम यांनी लता मंगेशकर यांची कोणती आठवण सांगितली आहे?

(२) लेखिकेला मुरुडच्या समुद्राचे दर्शन प्रेरणादायी का वाटले?

(३) चिनी शिपायांनी लेखकास कशा प्रकारे अटक केली?

(४) 'होयबा' वृत्तीबाबत बादशहा व बिरबल यांच्यातील वांग्याच्या भाजीबद्दलचा किस्सा लिहा.

(ब) खालीलपैकी कोणत्याही चार प्रश्नांची उत्तरे प्रत्येकी फक्त 'एका' वाक्यात लिहा : (४)

(१) कोकणातल्या बाबल्याचे नंदनवन कोणते?

(२) अब्दुल कलाम यांनी 'इंडिया व्हिजन-२०२०' या दस्तऐवजामध्ये मुलांना कोणते आवाहन केले आहे?

(३) 'शांतिसदन' कोणी बांधले?

(४) चिनी शिपायाने लेखकास खायला दिलेले पीठ लेखकाने कोणत्या विचाराने खाल्ले?

(५) यंत्रमानवाने सूनबाईला बाळाजवळ का जाऊ दिले नाही?

(६) लेखकाने आपला बंगला भाडयाने का दिला?

प्र. ६. (अ) खालीलपैकी कोणत्याही दोन प्रश्नांची उत्तरे प्रत्येकी सुमारे ८० शब्दांत लिहा : (८) [११]

(१) संत जनाबाईच्या ओवी रचनेतील रूपकात्मकता स्पष्ट करा.

(२) कुसुमाग्रजांनी देशवासीयांना कोणते आवाहन केले आहे?

(३) 'बहरतील मळे' या कवितेत कवीने कोणता आशावाद व्यक्त केला आहे?

(४) महात्मा जोतीराव फुले यांनी मानवताधर्म कसा समजावून सांगितला आहे?

× (ब) खालीलपैकी कोणत्याही तीन प्रश्नांची उत्तरे प्रत्येकी फक्त 'एका' वाक्यात लिहा : (३)

(१) जात्याचे दोन खुंटे कोणते आहेत?

(२) विंदा करंदीकर यांचे संपूर्ण नाव लिहा.

(३) मध्यरात्री कशाच्या उजेडात कार्यकर्ते भांडत बसतात?

(४) कवीच्या मते भुईचा दुश्मन कोण आहे?

(५) 'नव्या शहराविषयी' या कवितेतील नायिकेला स्वप्नात कोणते दृश्य दिसते?

प्र. ७. (अ) खालीलपैकी कोणत्याही दोन प्रश्नांची उत्तरे प्रत्येकी सुमारे ८० शब्दांत लिहा : (८) [१८]

(१) अग्रलेखाच्या विविध प्रकारांची माहिती लिहा.

(२) उद्घोषणा म्हणजे काय? तिचे महत्त्व स्पष्ट करा.

(३) दूरचित्रवाणीवरील वृत्तनिवेदकाचे महत्त्व स्पष्ट करा.

(४) संकेतस्थळासाठी असणारे एचटीएमएलचे महत्त्व लिहा.

(ब) खालीलपैकी कोणत्याही सहा प्रश्नांची उत्तरे प्रत्येकी फक्त 'एका' वाक्यात लिहा : (६)

(१) लोकशाहीचा चौथा आधारस्तंभ कोणता?

(२) 'क्यूशीट' म्हणजे काय?

(३) दूरदर्शनचे 'ब्रीदवाक्य' कोणते ते लिहा.

(४) 'ब्लॉग्ज' या शब्दाची मराठीतील संज्ञा लिहा.

(५) वृत्तपत्रीय लेखनाचे ढोबळमानाने कोणते तीन प्रकार पडतात?

(६) आकाशवाणीवरील वृत्तनिवेदकाच्या आवाजात कोणते दोन गुण असणे आवश्यक आहे?

(७) दूरचित्रवाणीच्या वार्ताहरासोबत कोणते महत्त्वाचे युनिट असते?

(८) महाजालाचे संदेशवहन कोणामुळे सुरळीत होते?

(९) आकाशवाणीवरील बातमीपत्र कोण तयार करीत असतो?

(क) खालीलपैकी कोणत्याही एका विषयावर मुलाखतपूर्व तयारी म्हणून प्रश्नांची प्रश्नावली तयार करा : (४)

(१) सरकारी रुग्णालयात काम करणाऱ्या परिचारिकेची मुलाखत.

(२) सेनादलातील सेवानिवृत्त अधिकाऱ्याची मुलाखत.

(३) सर्पमित्र म्हणून काम करणाऱ्या व्यक्तीची मुलाखत.

◆◆◆

DAY — 08 SEAT NUMBER

2017	VII	19	1030	J - 178	(E)

MATHEMATICS & STATISTICS (40)
(ARTS & SCIENCE)

Time : 3 Hrs. (8 Pages) Max. Marks : 80

Note : *(i)* *All questions are compulsory.*

(ii) *Figures to the right indicate full marks.*

(iii) *Graph of L.P.P. should be drawn on graph paper only.*

(iv) *Use of logarithmic table is allowed.*

(v) *Answers to the questions of both sections should be written in the same answer book.*

(vi) *Answer to every new question must be written on a new page.*

SECTION – I

Q. 1. (A) Select and write the correct answer from the given alternatives in each of the following sub-questions : **[12]** **(6)**

(i) The inverse of the matrix $\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ is _____.

(a) $\frac{1}{5}\begin{bmatrix} 3 & -1 \\ -2 & 1 \end{bmatrix}$ (b) $\frac{1}{5}\begin{bmatrix} 3 & 1 \\ -2 & 1 \end{bmatrix}$

(c) $\frac{1}{5}\begin{bmatrix} -3 & 1 \\ -2 & 1 \end{bmatrix}$ (d) $\frac{1}{5}\begin{bmatrix} 3 & -1 \\ 2 & -1 \end{bmatrix}$ (2)

(ii) If $\bar{a} = 3\hat{i} - \hat{j} + 4\hat{k}$, $\bar{b} = 2\hat{i} + 3\hat{j} - \hat{k}$, $\bar{c} = -5\hat{i} + 2\hat{j} + 3\hat{k}$, then $\bar{a} \cdot (\bar{b} \times \bar{c}) =$ _____.

(a) 100 (b) 101

(c) 110 (d) 109

(iii) If a line makes angles 90°, 135°, 45° with the X, Y and Z axes respectively, then its direction cosines are _____.

(a) $0, \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$ (b) $0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$

(c) $1, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ (d) $0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

(B) Attempt any THREE of the following :

(i) If the line $\bar{r} = (\hat{i} - 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$ is parallel to the plane $\bar{r} \cdot (3\hat{i} - 2\hat{j} + p\hat{k}) = 10$, find the value of p.

(ii) If a line makes angles α, β, γ with co-ordinate axes, prove that $\cos 2\alpha + \cos 2\beta + \cos 2\gamma + 1 = 0$.

(iii) Write the negations of the following statements :

(a) $\forall\, n \in N,\ n + 7 > 6$

(b) The kitchen is neat and tidy.

(iv) Find the angle between the lines whose direction ratios are 4, –3, 5 and 3, 4, 5.

(v) If $\bar{a}, \bar{b}, \bar{c}$ are position vectors of the points A, B, C respectively such that $3\bar{a} + 5\bar{b} - 8\bar{c} = \bar{0}$, find the ratio in which A divides BC.

Q. 2. **(A)** Attempt any TWO of the following :

(i) If $\tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}$, then find the value of 'x'.

(ii) Write the converse, inverse and contrapositive of the following statement :

"If it rains then the match will be cancelled." (3)

(iii) Find p and q, if the equation

$px^2 - 8xy + 3y^2 + 14x + 2y + q = 0$ represents a pair of perpendicular lines. (3)

(B) Attempt any TWO of the following : **(8)**

(i) Find the equation of the plane passing through the intersection of the planes $3x + 2y - z + 1 = 0$ and $x + y + z - 2 = 0$ and the point $(2, 2, 1)$. (4)

(ii) Let $A(\bar{a})$ and $B(\bar{b})$ be any two points in the space and $R(\bar{r})$ be a point on the line segment AB dividing it internally in the ratio m : n, then prove that $\bar{r} = \frac{m\bar{b} + n\bar{a}}{m+n}$. Hence find the position vector of R which divides the line segment joining the points A(1, –2, 1) and B(1, 4, –2) internally in the ratio 2 : 1. (4)

(iii) The angles of the ΔABC are in A.P. and $b : c = \sqrt{3} : \sqrt{2}$ then find $\angle A, \angle B, \angle C$. (4)

Q. 3. **(A)** Attempt any TWO of the following : **(6) [14]**

(i) Find the vector equation and cartesian equation of a line passing through the points A(3, 4, –7) and B(6, –1, 1). (3)

(ii) Find the general solution of $\cot x + \tan x = 2 \operatorname{cosec} x$. (3)

(ii) Write the converse, inverse and contrapositive of the following statement :

"If it rains then the match will be cancelled." (3)

(iii) Find p and q, if the equation $px^2 - 8xy + 3y^2 + 14x + 2y + q = 0$ represents a pair of perpendicular lines. (3)

(B) Attempt any TWO of the following : **(8)**

(i) Find the equation of the plane passing through the intersection of the planes $3x + 2y - z + 1 = 0$ and $x + y + z - 2 = 0$ and the point $(2, 2, 1)$. (4)

(ii) Let $A(\bar{a})$ and $B(\bar{b})$ be any two points in the space and $R(\bar{r})$ be a point on the line segment AB dividing it internally in the ratio m : n, then prove that $\bar{r} = \frac{m\bar{b} + n\bar{a}}{m+n}$. Hence find the position vector of R which divides the line segment joining the points A(1, –2, 1) and B(1, 4, –2) internally in the ratio 2 : 1. (4)

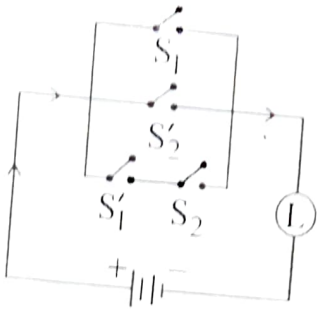
(iii) The angles of the ΔABC are in A.P. and $b : c = \sqrt{3} : \sqrt{2}$ then find $\angle A, \angle B, \angle C$. (4)

Q. 3. **(A)** Attempt any TWO of the following : **(6) [14]**

(i) Find the vector equation and cartesian equation of a line passing through the points A(3, 4, –7) and B(6, –1, 1). (3)

(ii) Find the general solution of $\cot x + \tan x = 2 \operatorname{cosec} x$. (3)

(iii) Express the following switching circuit in symbolic form o logic. Construct its switching table and write your conclusion from it :



(B) Attempt any TWO of the following :

(i) If $A = \begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & -2 \\ 1 & 0 & 3 \end{bmatrix}$ verify that $A\,(\text{adj } A) = |A|\,I$.

(ii) A company manufactures bicycles and tricycles each of which must be processed through machines A and B. Machine A has maximum of 120 hours available and machine B has maximum of 180 hours available. Manufacturing a bicycle requires 6 hours on machine A and 3 hours on machine B. Manufacturing a tricycle requires 4 hours on machine A and 10 hours on machine B.

If profits are ₹180 for a bicycle and ₹220 for a tricycle, formulate and solve the L.P.P. to determine the number of bicycles and tricycles that should be manufactured in order to maximize the profit. (4)

(iii) If θ is the measure of acute angle between the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$, then prove that

$$\tan\theta = \left| \frac{2\sqrt{h^2 - ab}}{a + b} \right|, \quad a + b \neq 0$$

Hence find the acute angle between the lines $x^2 - 4xy + y^2 = 0$. (4)

SECTION - II

Q. 4. (A) Select and write the correct answer from the given alternatives in each of the following sub-questions : [12] (6)

(i) Given $f(x) = 2x, \ x < 0$

$= 0, \ x \geq 0$

then $f(x)$ is _____.

(a) discontinuous and not differentiable at $x = 0$

(b) continuous and differentiable at $x = 0$

(c) discontinuous and differentiable at $x = 0$

(d) continuous and not differentiable at $x = 0$ (2)

(ii) If $\int_0^{\alpha} (3x^2 + 2x + 1)\, dx = 14$, then $\alpha =$ _____.

(a) 1 (b) 2

(c) – 1 (d) –2 (2)

(iii) The function $f(x) = x^3 - 3x^2 + 3x - 100, x \in R$ is _____.

(a) increasing

(b) decreasing

(c) increasing and decreasing

(d) neither increasing nor decreasing (2)

(B) Attempt any THREE of the following : **(6)**

(i) Differentiate 3^x w. r. t. $\log_3 x$. (2)

(ii) Check whether the conditions of Rolle's theorem are satisfied by the function

$f(x) = (x - 1)(x - 2)(x - 3), \ x \in [1, 3]$ (2)

(B) Attempt any TWO of the following : **(8)**

(i) Solve the differential equation

$$\frac{dy}{dx} - y = e^x$$

Hence find the particular solution for $x = 0$ and $y = 1$. (4)

(ii) If $y = f(x)$ is a differentiable function of x such that inverse function $x = f^{-1}(y)$ exists, then prove that x is a differentiable function of y and

$$\frac{dx}{dy} = \frac{1}{\frac{dy}{dx}}, \text{ where } \frac{dy}{dx} \neq 0$$

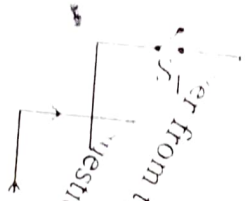
Hence if $y = \sin^{-1} x$, $-1 \leq x \leq 1$, $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$

then show that $\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}$ where $|x| < 1$. (4)

(iii) Evaluate : $\int \frac{8}{(x+2)(x^2+4)}\,dx$ (4)

◆◆◆

(iii) Express the following switching circuit in symbo[illegible] logic. Construct its switching table and write[illegible] from it :



[illegible]ie curve $x^2 - 16y$, [illegible]ie first quadrant. (2

[illegible]d var (X). (2

(B) [illegible]

[illegible]wing : (6)

$$\frac{x-1)^2}{\log(1+2x)}, \text{ for } x \neq 0$$

is [illegible] [illegible]nd $f(0)$. (3)

(ii) The probab[illegible] [illegible]s function for X = number of major defects in a randomly selected appliance of a certain type is

$X = x$	0	1	2	3	4
$P(X = x)$	0·08	0·15	0·45	0·27	0·05

Find the expected value and variance of X. (3)

(iii) Suppose that 80% of all families own a television set. If 5 families are interviewed at random, find the probability that –

(a) three families own a television set.

(b) at least two families own a television set. (3)

(B) Attempt any TWO of the following : (8)

(i) Find the approximate value of $\cos(60^\circ 30')$ (Given : $1^\circ = 0 \cdot 0175^c$, $\sin 60^\circ = 0{\cdot}8660$.) (4)

0 1 7

0 1 7 8

Page 6

(iii) The rate of growth of bacteria is proportional to the number present. If initially, there were 1000 bacteria and the number doubles in one hour, find the number of bacteria after 2 hours.

[Take $\sqrt{2} = 1.414$]

(4)

(iii) Prove that :

$$\int_{a}^{a} f(x)\,dx = 2\int_{0}^{a} f(x)\,dx, \text{ if } f(x) \text{ is an even function.}$$

$$= 0, \qquad \text{if } f(x) \text{ is an odd function.}$$

(4)

Q. 6. **(A)** Attempt any TWO of the following : **(6) [14]**

(i) If $f(x)$ is continuous on $[-4, 2]$ defined as

$f(x) = 6b - 3ax, \quad$ for $-4 \le x < -2$

$= 4x + 1, \quad$ for $-2 \le x \le 2$

show that $a + b = -\dfrac{7}{6}$

(3)

(ii) If u and v are two functions of x, then prove that

$$\int uv\,dx = u\int v\,dx - \int\left[\frac{du}{dx}\cdot\int v\,dx\right]dx$$

(3)

[12]

(iii) Probability distribution of X is given by

$X = x$	1	2	3	4
$P(X = x)$	0·1	0·3	0·4	0·2

Find $P(X \ge 2)$ and obtain cumulative distribution function of X.

(3)

P.T.O

DAY — 04 SEAT NUMBER

2017	VII	14	1030	J - 131	(E)

PHYSICS (54)

Time : 3 Hrs. (8 Pages) Max. Marks : 70

Note : *(i) All questions are compulsory.*

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of only logarithmic table is allowed.

(v) All symbols have their usual meaning unless otherwise stated.

(vi) Answers to both sections must be written in the same answer book.

(vii) Answer to every question must be written on a new page.

SECTION – I

Q. 1. Attempt Any SIX : **[12]**

(i) If the angular speed of the Earth is $7{\cdot}26 \times 10^{-5}$ rad/s and radius of the Earth is 6,400 km, calculate the change in weight of 1 kg of mass taken from equator to pole.

(ii) A small body of mass 0·3kg oscillates in vertical plane with the help of a string 0·5m long with a constant speed of 2 m/s. It makes an angle of 60° with the vertical. Calculate tension in the string ($g = 9{\cdot}8$ m/s^2).

(iii) Two soap bubbles have radii in the ratio 4:3. What is the ratio of work done to blow these bubbles?

(iv) At what temperature will average kinetic energy of gas be exactly half of its value at N. T. P.?

(v) Define Surface Tension and Surface Energy.

(vi) Prove that $g_h = g\left(1 - \frac{2h}{R}\right)$ where g_h is the acceleration due to gravity at altitude h and $h << R$ (R is the radius of the Earth).

(vii) Explain the physical significance of radius of gyration.

(viii) Draw neat, labelled diagram showing different forces acting on a vehicle moving along a banked road.

[9]

Q. 2. Attempt any THREE :

(i) Prove Kirchhoff's law of radiation theoretically.

(ii) Within the elastic limit, find the work done by a stretching force on a wire.

(iii) A set of 12 tuning forks is arranged in order of increasing frequencies. Each fork produces 'Y' beats per second with the previous one. The last is an octave of the first. The fifth fork has a frequency of 90 Hz. Find 'Y' and frequency of the first and the last tuning forks.

(iv) A uniform solid sphere has radius 0·2m and density $8 \times 10^3 kg/m^3$. Find the moment of inertia about the tangent to its surface. ($\pi = 3 \cdot 142$)

Q. 3. Define linear simple harmonic motion. Assuming the expression for displacement of a particle starting from extreme position,

explain graphically the variation of velocity and acceleration w.r.t. time.

A clock regulated by seconds pendulum, keeps correct time. During summer, length of pendulum increases to 1·005m. How much will the clock gain or loose in one day?
($g = 9{\cdot}8\ m/s^2$ and $\pi = 3{\cdot}142$)

OR

Discuss different modes of vibrations in an air column of a pipe open at both the ends. State the cause of end correction. Find the end correction for the pipe open at both the ends in fundamental mode.

What should be tension applied to a wire of length 1m and mass 10 gram, if it has to vibrate with fundamental frequency of 50Hz?

Q. 4. Select and write the most appropriate answer from the given alternatives for each sub-question : [7]

(i) A body of mass 'm' performs uniform circular motion along a circular path of radius 'r' with velocity 'v'. If its angular momentum is L, then the centripetal force acting on it is _____ .

(a) $\frac{mL^2}{r^3}$ (b) $\frac{L^2}{mr}$

(c) $\frac{L^2}{mr^2}$ (d) $\frac{L^2}{mr^3}$

(ii) If the Earth completely loses its gravity, then for any body _____.

(a) both mass and weight become zero.

(b) neither mass nor weight become zero.

(c) weight becomes zero but not the mass.

(d) mass becomes zero but not the weight.

(iii) If a rigid body of radius 'R' starts from rest and rolls down an inclined plane of inclination 'θ' then linear acceleration of body rolling down the plane is _____.

(a) $\frac{g \sin\theta}{1+\frac{K}{R}}$

(b) $g \sin\theta\left(1+\frac{K}{R}\right)$

(c) $\frac{g \sin\theta}{1+\frac{K^2}{R^2}}$

(d) $g \sin\theta\left(1+\frac{K^2}{R^2}\right)$

(iv) 1000 tiny mercury droplets coalesce to form a bigger drop. In this process, temperature of the drop _____.

(a) increases

(b) may increase or decrease

(c) decreases

(d) does not change

(v) Doppler effect is not applicable when _____.

(a) source and observer are at rest.

(b) there is a relative motion between source and observer.

(c) both are moving in opposite directions.

(d) both are moving in same direction with different velocities.

(vi) If the total kinetic energy per unit volume of gas enclosed in a container is E, the pressure exerted by the gas is _____.

(a) E

(b) $\frac{3}{2}E$

(c) $\sqrt{3}\,E$

(d) $\frac{2}{3}E$

(vii) Two wires of the same material have radii r_A and r_B respectively. The radius of wire A is twice the radius of wire B. If they are stretched by same load then stress on wire B is _____.

(a) equal to that of A.

(b) half that of A.

(c) two times that of A.

(d) four times that of A.

SECTION – II

Q. 5. Attempt any SIX : [12]

(i) Thorium $_{90}Th^{232}$ is disintegrated into lead $_{82}Pb^{200}$. Find the number of α and β particles emitted in disintegration.

(ii) If the work function of a metal is 3eV, calculate the threshold wavelength of that metal.
(Velocity of light = 3×10^8 m/s, Planck's constant = $6{\cdot}63 \times 10^{-34}$ J.s.; 1eV = $1{\cdot}6 \times 10^{-19}$ J)

(iii) Three capacitors of capacities 8μF, 8μF and 4μF are connected in a series and a potential difference of 120 volt is maintained across the combination. Calculate the charge on capacitor of capacity 4μF.

(iv) If the total energy of radiation of frequency 10^{14} Hz is 6·63J, calculate the number of photons in the radiation. (Planck's constant = $6{\cdot}63 \times 10^{-34}$ J.s.)

(v) Distinguish between diamagnetic and paramagnetic substances.

(vi) Draw a neat, labelled diagram showing different layers of the Earth's atmosphere.

(vii) Explain the construction of plane wavefront using Huygens' principle.

(viii) Obtain an expression for electric field intensity at a point outside uniformly charged thin plane sheet.

[9]

Q. 6. Attempt any THREE :

(i) Draw a neat circuit diagram to study the characteristics of common emitter n-p-n transistor. With the help of a graph, explain the output characteristics of this transistor.

(ii) Obtain an expression for magnetic induction along the axis of toroid on the basis of Ampere's circuital law.

(iii) When a resistance of 12 ohm is connected across a cell, its terminal potential difference is balanced by 120 cm length of potentiometer wire. When the resistance of 18 ohm is connected across the same cell, the balancing length is 150 cm. Find the balancing length when the cell is in open circuit. Also calculate the internal resistance of the cell.

(iv) Find the ratio of longest wavelength in Paschen series to shortest wavelength in Balmer series.

Q. 7. State the principle of working of transformer. Explain the construction and working of a transformer. Derive an expression for e.m.f. and current in terms of turns ratio.

Find the magnetization of a bar magnet of length 10 cm and cross-sectional area 4 cm^2, if the magnetic moment is 2 Am^2.

OR

Obtain an expression for path difference and fringe width of interference pattern in Young's double slit experiment. Show

that the fringe width is same for consecutive bright and dark bands.

(19)

The refractive indices of glass and water w.r.t. air are $\frac{3}{2}$ and $\frac{4}{3}$ respectively. Determine the refractive index of glass w.r.t. water. [7]

Q.8. Select and write the most appropriate answer from the given alternatives for each sub-question :

(i) The logic gate which produces LOW output when any one of the input is HIGH and produces HIGH output only when all of its inputs are LOW is called _____.

(a) AND gate (b) OR gate

(c) NOR gate (d) NAND gate

(ii) For efficient radiation and reception of signal with wavelength λ, the transmitting antennas would have length comparable to _____.

(a) λ of frequency used (b) $\frac{\lambda}{2}$ of frequency used

(c) $\frac{\lambda}{3}$ of frequency used (d) $\frac{\lambda}{4}$ of frequency used

(iii) Cyclotron can not accelerate _____.

(a) protons (b) neutrons

(c) α - particles (d) deuterons

(iv) In series LCR circuit at resonance, phase difference between current and e.m.f. of source is _____.

(a) π rad (b) $\frac{\pi}{2}$ rad

(c) $\frac{\pi}{4}$ rad (d) zero rad

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(v) When unknown resistance is determined by meter bridge, the error due to contact resistance is minimized _____.

(a) by connecting both the resistances only in one gap.

(b) by interchanging the positions of known and unknown resistances.

(c) by using uniform wire.

(d) by obtaining the null point near the ends of the wire.

(vi) The ratio of kinetic energy of an electron in Bohr's orbit to its total energy in the same orbit is _____.

(a) -1 (b) 2

(c) $\frac{1}{2}$ (d) $-0{\cdot}5$

(vii) Using monochromatic light of wavelength λ in Young's double slit experiment, the eleventh dark fringe is obtained on the screen for a phase difference of _____.

(a) $\frac{11}{2}\pi$ rad (b) $\frac{21}{2}\pi$ rad

(c) 13π rad (d) 21π rad

◆◆◆

(14)

DAY — 05 SEAT NUMBER

2017	VII	15	1030	J - 147	(E)

CHEMISTRY (55)

Time : 3 Hrs. (7 Pages) Max. Marks : 70

Notes :

(i) All questions are compulsory.

(ii) Answers to the questions of Section - I and Section - II should be written in the same answer book.

(iii) Draw neat, labelled diagrams and write balanced chemical equations wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic table is allowed.

(vi) Answer to every new question must be started on a new page.

SECTION - I

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question : [7]

(i) Which of the following is a basic oxide?

(a) SiO_2 (b) P_4O_{10}

(c) MgO (d) Al_2O_3

(ii) In the representation of galvanic cell, the ions in the same phase are separated by a –

(a) single vertical line (b) comma

(c) double vertical line (d) semicolon

(iii) An ionic crystal lattice has limiting value of radius ratio as 0·414 to 0·732; the co-ordination number of its cation is –

(a) 6 (b) 4

(c) 3 (d) 12

(iv) The unit of rate constant for zero order reaction is –

(a) t^{-1} (b) $mol\ dm^{-3}\ t^{-1}$

(c) $mol^{-1}\ dm^{3}\ t^{-1}$ (d) $mol^{-2}\ dm^{6}\ t^{-1}$

(v) Calcium carbonate used in the extraction of iron acts as –

(a) oxidising agent (b) reducing agent

(c) gangue (d) flux

(vi) 10·0 grams of caustic soda when dissolved in 250 cm^3 of water, the resultant gram molarity of solution is –

(a) 0·25 M (b) 0·5 M

(c) 1·0 M (d) 0·1 M

(vii) 55 L atm of work is obtained when 1·0 mole of an ideal gas is compressed isothermally from a volume of 28·5 L to 18·5 L, the constant external pressure is –

(a) 5·05 atm (b) 5·5 atm

(c) 0·05 atm (d) 0·55 atm

Q. 2. Answer any SIX of the following : [12]

(i) State Henry's Law.

How does solubility of a gas in water varies with temperature?

(ii) How is nitric acid prepared by Ostwald's process?

(iii) Classify the following solids into different types :

(a) Ammonium phosphate (b) Brass

(c) S_8 molecule (d) Diamond

(iv) Construct a labelled diagram for the following cell –

$$Zn \left| Zn^{2+}(1M) \right| \left| H^{+}(1M) \right| H_{2\,(g.\,1\,atm)} \left| pt \right.$$

(v) Explain with chemical reactions, why is zinc oxide amphoteric in nature?

(vi) Write the names and chemical formulae of any 'two' minerals of aluminium.

(vii) The rate law for the reaction

$$2H_{2(g)} + 2NO_{(g)} \longrightarrow N_{2(g)} + 2H_2O_{(g)}$$

is given by rate $= K[H_2][NO]^2$.

The reaction occurs in the following two steps :

(a) $H_{2(g)} + 2NO_{(g)} \longrightarrow N_2O_{(g)} + H_2O_{(g)}$

(b) $N_2O_{(g)} + H_{2(g)} \longrightarrow N_{2(g)} + H_2O_{(g)}$

What is the rate of N_2O in the mechanism? What is the molecularity of each of the elementary steps?

(viii) Write the mathematical expression of the First Law of Thermodynamics for the following processes :

(1) Isothermal (2) Adiabatic

(3) Isochoric (4) Isobaric

Q. 3. Answer any THREE of the following : **[9]**

(i) From the following data for the liquid phase reaction $A \rightarrow B$, determine the order of reaction and calculate its rate constant :

t / s	0	600	1200	1800
$[A] / Mol\ L^{-1}$	0·624	0·446	0·318	0·226

(ii) Calculate the standard enthalpy of combustion of $CH_3COOH_{(l)}$ from the following data :

$\Delta_f H^\circ (CO_2) = -393{\cdot}3 \text{ kJ mol}^{-1}$

$\Delta_f H^\circ (H_2O) = -285{\cdot}8 \text{ kJ mol}^{-1}$

$\Delta_f H^\circ (CH_3COOH) = -483{\cdot}2 \text{ kJ mol}^{-1}$

(iii) Write the cell representation and calculate equilibrium constant for the following redox reaction :

$Ni_{(s)} + 2\,Ag^{+}_{(aq)}(1M) \longrightarrow Ni^{2+}_{(aq)}(1M) + 2Ag_{(s)}$ at 25°C

$E^{\circ}_{Ni} = -0{\cdot}25V$ and $E^{\circ}_{Ag} = 0{\cdot}799V$

(iv) What is the action of concentrated sulphuric acid on the following :

(a) phosphorous pentachloride

(b) copper

(c) potassium chlorate

Q. 4. Define : (a) Molality [7]

(b) Osmotic pressure

Write any 'two' advantages of calomel electrode.

A metal crystallises into two cubic faces namely face centered (FCC) and body centered (BCC), whose unit cell edge lengths are 3·5A° and 3·0A° respectively. Find the ratio of the densities of FCC and BCC.

Arrange the following oxyacids of chlorine - $HClO$, $HClO_2$, $HClO_3$ and $HClO_4$ with respect to –

(a) Increasing order of thermal stability.

(b) Increasing order of oxidising power.

OR

An organic substance (M = 169 gram mol^{-1}) is dissolved in 2000 cm^3 of water. Its osmotic pressure at 12°C was found to be 0·84 atm. If R = 0·0821 L atm. $K^{-1} mol^{-1}$, calculate the mass of the solute.

Calculate the number of atoms in a unit cell of a metal crystallising in face centered cubic structure.

Distinguish between isothermal process and adiabatic process.

Mention the names of various steps involved in the extraction of pure metals from their ores.

SECTION - II

Q. 5. Select and write the most appropriate answer from the given alternatives for each sub-question : [7]

(i) In the following

$$C_2H_5 - \overset{\overset{H}{|}}{C} = O + NH_2OH \rightarrow A \xrightarrow[\Delta]{Na / C_2H_5OH} B$$

the compound 'B' is –

(a) Propan–1–amine (b) Propan–2–amine

(c) Isopropylamine (d) Dimethylamine

(ii) The stability order for carbocation is –

(a) $2^\circ > 3^\circ > 1^\circ$ (b) $3^\circ > 2^\circ > 1^\circ$

(c) $3^\circ > 1^\circ > 2^\circ$ (d) $1^\circ > 3^\circ > 2^\circ$

(iii) Effective atomic number rule is used to find –

(a) geometry of complex.

(b) stability of complex.

(c) number of isomers of complex.

(d) number of possible ligands around metal ion in complex.

(iv) Which one of the following ions is coloured?

(a) Sc^{3+} (b) Zn^{2+}

(c) Ti^{4+} (d) V^{2+}

(v) When phenol is heated with conc. HNO_3 in presence of conc. H_2SO_4 it yields –

(a) o - nitrophenol (b) p - nitrophenol

(c) 2, 4, 6 - trinitrophenol (d) m - nitrophenol

(vi) The secondary structure of protein is determined by –

(a) co-ordinate bond (b) ionic bond

(c) hydrogen bond (d) covalent bond

(vii) Ethylidene dichloride when boiled with aqueous solution of NaOH yields –

(a) formaldehyde (b) acetaldehyde

(c) acetone (d) ethyl methyl ketone

Q. 6. Answer any SIX of the following : [12]

(i) How is phenol prepared from cumene?

(ii) Write a note on self oxidation - reduction reaction of aldehyde with suitable example.

(iii) Explain basic nature of amines.

(iv) What are antiseptics? Give any 'two' examples.

(v) What happens when glucose is treated with

(a) hydroxylamine (b) hydrogen cyanide

(vi) Draw the structures of chromate and dichromate ions.

(vii) How is terylene prepared?

(viii) Identify A and B in the following reaction :

$$CH_3 - Br + Mg \xrightarrow{\text{dry ether}} A + CO_2$$

$$\xrightarrow[H^+/H_2O]{\text{dry ether}} B + Mg(Br)OH$$

(17)

Q. 7. Answer any THREE of the following : [9]

(i) How ligands are classified? Explain with suitable examples.

(ii) What is lanthanoid contraction?

Explain, why lanthanum ($Z = 57$) forms La^{3+} ion, while cerium ($Z = 58$) forms Ce^{4+} ion?

(iii) What is the action of the following reagents on propanone?

(a) Phenyl hydrazine

(b) Zn – Hg / conc. HCl

(c) Sodium bisulphite

(iv) Define enzymes.

How is peptide linkage formed?

Q. 8. How is nitroethane converted into – [7]

(a) ethyl amine, (b) N-ethylhydroxyl amine, (c) acetic acid ?

Write names and chemical formulae of monomers used in preparing Buna-N.

What are soaps?

How are they prepared? [7]

OR

How will you prepare ethanol, propan-2-ol and 2-methylpropan-2-ol from Grignard's reagent?

Define optical activity.

Explain optical activity of lactic acid.

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