

# PHYSICAL SCIENCES

Name & Signature of the Invigilator

PAPER-II  
SEPT/13/02

ICR Answer Sheet No. :

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|  |  |  |  |

Roll No. :

Roll Number in words :

Time : 1.15 Minutes)

No. of Printed Pages : 20

[Maximum Marks : 100

## Instructions for the Candidates

- Write your Roll Number in the space provided on the top of this page.
- This paper consists of fifty (50) multiple choice type questions. All questions are compulsory.
- At the commencement of examination, the question booklet will be given to candidate. In the first 5 minutes, candidate is requested to open the booklet and compulsorily examine it as below :
  - To have access to the question booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
  - Truly the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of five minutes. Afterwards, neither the question booklet will be replaced nor any extra time will be given.
  - After this verification is over, the test booklet number should be entered in the ICR answer sheet and the ICR Answer Sheet number should be entered on this test booklet.
- Each item has upto four alternative responses marked (A), (B), (C) and (D). The answer should be a capital letter for the selected option. The answer letter should entirely be contained within the corresponding square.

Correct method



Wrong method



OR



- Your responses to the items for this paper are to be indicated on the ICR Answer Sheet under Paper II only.
- Read instructions given inside carefully.
- Rough work is to be done in the end of the booklet only.
- You have to return the original ICR Answer Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you (outside the examination hall). You are, however, allowed to carry duplicate copy of ICR sheet and test booklet on conclusion of the examination.
- Use black ball point pen.
- Use of any Calculators or log tables or any other electronic devices is prohibited.
- There shall be no negative marking.
- In case of any discrepancy in Gujarati and English version of questions the English version should be taken as final.

## પરીક્ષાર્થીઓ માટે સૂચનાઓ :

- આ પાનાની ટોચમાં દર્શાવેલી જગ્યામાં તમારો રોલ નંબર લખો.
- આ પ્રશ્નપત્રમાં બહુવિકલ્પિક ઉત્તરો ધરાવતા કુલ પચાસ (૫૦) પ્રશ્નો આપેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.
- પરીક્ષાની શરૂઆતમાં ઉમેદવારને પ્રશ્નપુસ્તિકા આપવામાં આવશે. પ્રથમ પ મિનિટ દરમિયાન, ઉમેદવારે પ્રશ્નપુસ્તિકા ખોલી અને ફરજિયાતપણે નીચે મુજબ પરીક્ષણ કરવું.
  - પ્રશ્નપુસ્તિકાનો વપરાશ કરવા માટે આ કવર પેજની ધાર પર આપેલ સીલ ફાડી નાખો. કોઈપણ સંજોગોમાં સીલ સ્ટીકર વગરની કે ખુલ્લી પ્રશ્નપુસ્તિકા સ્વીકાર શો નહીં.
  - કવર પૃષ્ઠ પર છપાયેલ નિર્દેશાનુસાર પ્રશ્નપુસ્તિકાના પ્રશ્નો પૃષ્ઠો અને સંખ્યાને બરાબર ચકાસી લો. ખામીયુક્ત પ્રશ્નપુસ્તિકા કે જેમાં પૃષ્ઠો/પ્રશ્નો અછેડા હોય, બે વાર છપાયા હોય, અનુક્રમમાં અથવા કોઈ અન્ય ફરક હોય અર્થાત કોઈપણ કારણે ખામીયુક્ત પ્રશ્નપુસ્તિકા સ્વીકારવી નહીં. એને જો ખામીયુક્ત પ્રશ્નપુસ્તિકા મળી હોય તો નિરીક્ષક પાસેથી તુરંત જ બીજી સારી પ્રશ્નપુસ્તિકા મેળવી લેવી. આ માટે ઉમેદવારને પાંચ મિનિટનો સમયગાળો આપવામાં આવશે. પછીથી, પ્રશ્નપુસ્તિકા બદલવામાં આવશે નહીં કે કોઈ વધારાનો સમય પણ આપવામાં આવશે નહીં.
  - આ ચકાસણી સમાપ્ત થાયપછી, ટેસ્ટ પુસ્તિકા નંબર ICR જવાબ પત્રકમાં લખવો અને ICR જવાબ પત્રક નંબર પ્રશ્નપુસ્તિકા પર લખવો.
- પ્રત્યેક પ્રશ્ન માટે ચાર (તાર વિકલ્પ (A), (B), (C) અને (D) આપવામાં આવેલ છે. પસંદગીનો જવાબ માત્ર અંગ્રેજી કેપીટલ મૂળાક્ષર દ્વારા જ આપવો. પસંદ કરેલ અંગ્રેજી કેપીટલ અક્ષર આપેલ ખાનામાં સંપૂર્ણ રીતે સમાઈ જાય તે રીતે લખવો.

સાચી રીત :



ખોટી રીત :



અથવા



- આ પ્રશ્નપુસ્તિકાના પ્રશ્નોના જવાબ આપવામાં આવેલા ICR જવાબ પત્રકમાં પેપર-2 લખેલ વિભાગમાં જ લખવો.
- અંદર આપેલ સૂચનાઓ ધ્યાનપૂર્વક વાંચો.
- આ પ્રશ્નપુસ્તિકાની અંતે આપેલ પાનું રક્ષકામ માટે છે.
- પરીક્ષા સમય દુરંદો માર્ગ નક્કી બોરોલક નાક ICR જવાબ પત્રક જે તે નિરીક્ષકને ફરજિયાત સોંપી દેવું અને કોઈપણ સંજોગોમાં પરીક્ષાખંડની બહાર જઈ શકશે નહીં. પરીક્ષા પૂર્ણ થયા બાદ ઉમેદવાર પ્રશ્નપુસ્તિકા તથા ICR જવાબપત્રની કુલિકેટ કોપી પોતાની સાથે લઈ જઈ શકે છે.
- માત્ર કાળી પેન/કાળી બોલ પેન વાપરવી.
- કેલક્યુલેટર અને અન્ય ઈલેક્ટ્રોનિક યંત્રોનો ઉપયોગ કરવાની મનાઈ છે.
- ખોટા જવાબ માટે નેગેટિવ ગુણકાંકન પ્રથા નથી.
- પ્રશ્નપુસ્તિકાના કોઈ પ્રશ્નમાં અનુવાદ અંગે કોઈ વિવાદ/મતભેદ જણાય તો અંગ્રેજી વર્ઝન યોગ્ય ગણાશે.

# LOGARITHMS

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |    |    |    |    |    |    |    |
|----|------|------|------|------|------|------|------|------|------|------|------------------|---|----|----|----|----|----|----|----|
|    |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 10 | 0000 | 0043 | 0086 | 0128 | 0170 | 0212 | 0259 | 0294 | 0334 | 0374 | 4                | 8 | 12 | 17 | 21 | 25 | 29 | 33 | 37 |
| 11 | 0414 | 0453 | 0492 | 0531 | 0569 | 0607 | 0646 | 0682 | 0719 | 0755 | 4                | 8 | 11 | 15 | 19 | 23 | 26 | 30 | 34 |
| 12 | 0792 | 0828 | 0864 | 0899 | 0934 | 0969 | 1004 | 1038 | 1072 | 1106 | 3                | 7 | 10 | 14 | 17 | 21 | 24 | 28 | 31 |
| 13 | 1139 | 1173 | 1206 | 1239 | 1271 | 1303 | 1335 | 1367 | 1399 | 1430 | 3                | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 |
| 14 | 1461 | 1492 | 1523 | 1553 | 1584 | 1614 | 1644 | 1673 | 1703 | 1732 | 3                | 6 | 9  | 12 | 15 | 18 | 21 | 24 | 27 |
| 15 | 1761 | 1790 | 1818 | 1847 | 1875 | 1903 | 1931 | 1959 | 1987 | 2014 | 3                | 6 | 8  | 11 | 14 | 17 | 20 | 22 | 25 |
| 16 | 2041 | 2068 | 2095 | 2122 | 2149 | 2175 | 2201 | 2227 | 2253 | 2279 | 3                | 5 | 8  | 11 | 13 | 16 | 18 | 21 | 24 |
| 17 | 2304 | 2330 | 2355 | 2380 | 2406 | 2430 | 2455 | 2480 | 2504 | 2529 | 2                | 5 | 7  | 10 | 12 | 15 | 17 | 20 | 22 |
| 18 | 2553 | 2577 | 2601 | 2625 | 2648 | 2672 | 2696 | 2718 | 2742 | 2765 | 2                | 5 | 7  | 9  | 12 | 14 | 16 | 19 | 21 |
| 19 | 2786 | 2810 | 2833 | 2856 | 2878 | 2900 | 2923 | 2945 | 2967 | 2989 | 2                | 4 | 7  | 9  | 11 | 13 | 15 | 18 | 20 |
| 20 | 3010 | 3032 | 3054 | 3075 | 3096 | 3118 | 3139 | 3160 | 3181 | 3201 | 2                | 4 | 6  | 8  | 11 | 13 | 15 | 17 | 19 |
| 21 | 3222 | 3243 | 3263 | 3284 | 3304 | 3324 | 3345 | 3365 | 3385 | 3404 | 2                | 4 | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 22 | 3424 | 3444 | 3464 | 3483 | 3502 | 3522 | 3541 | 3560 | 3579 | 3598 | 2                | 4 | 6  | 8  | 10 | 12 | 14 | 15 | 17 |
| 23 | 3617 | 3636 | 3655 | 3674 | 3692 | 3711 | 3729 | 3747 | 3766 | 3784 | 2                | 4 | 6  | 7  | 9  | 11 | 13 | 15 | 17 |
| 24 | 3802 | 3820 | 3838 | 3856 | 3874 | 3892 | 3909 | 3927 | 3945 | 3962 | 2                | 4 | 5  | 7  | 9  | 11 | 12 | 14 | 16 |
| 25 | 3979 | 3997 | 4014 | 4031 | 4048 | 4065 | 4082 | 4099 | 4116 | 4133 | 2                | 3 | 6  | 7  | 9  | 10 | 12 | 14 | 15 |
| 26 | 4150 | 4166 | 4183 | 4200 | 4216 | 4232 | 4249 | 4265 | 4281 | 4298 | 2                | 3 | 5  | 7  | 8  | 10 | 11 | 13 | 15 |
| 27 | 4314 | 4330 | 4346 | 4362 | 4378 | 4393 | 4409 | 4425 | 4440 | 4456 | 2                | 3 | 5  | 6  | 8  | 9  | 11 | 13 | 14 |
| 28 | 4472 | 4487 | 4502 | 4518 | 4533 | 4548 | 4564 | 4579 | 4594 | 4609 | 2                | 3 | 5  | 6  | 8  | 9  | 11 | 12 | 14 |
| 29 | 4624 | 4639 | 4654 | 4669 | 4683 | 4698 | 4713 | 4728 | 4742 | 4757 | 1                | 3 | 4  | 6  | 7  | 9  | 10 | 12 | 13 |
| 30 | 4771 | 4786 | 4800 | 4814 | 4829 | 4843 | 4857 | 4871 | 4886 | 4900 | 1                | 3 | 4  | 6  | 7  | 9  | 10 | 11 | 13 |
| 31 | 4914 | 4928 | 4942 | 4955 | 4969 | 4983 | 4997 | 5011 | 5024 | 5038 | 1                | 3 | 4  | 6  | 7  | 8  | 10 | 11 | 12 |
| 32 | 5051 | 5065 | 5079 | 5092 | 5106 | 5119 | 5132 | 5145 | 5159 | 5172 | 1                | 3 | 4  | 5  | 7  | 8  | 9  | 11 | 12 |
| 33 | 5186 | 5199 | 5211 | 5224 | 5237 | 5250 | 5263 | 5276 | 5289 | 5302 | 1                | 3 | 4  | 5  | 6  | 8  | 9  | 10 | 12 |
| 34 | 5315 | 5328 | 5340 | 5353 | 5365 | 5378 | 5391 | 5403 | 5416 | 5428 | 1                | 3 | 4  | 5  | 6  | 8  | 9  | 10 | 11 |
| 35 | 5441 | 5453 | 5465 | 5478 | 5490 | 5502 | 5514 | 5527 | 5539 | 5551 | 1                | 2 | 4  | 5  | 6  | 7  | 9  | 10 | 11 |
| 36 | 5563 | 5575 | 5587 | 5599 | 5611 | 5623 | 5635 | 5647 | 5658 | 5670 | 1                | 2 | 4  | 5  | 6  | 7  | 8  | 10 | 11 |
| 37 | 5682 | 5694 | 5706 | 5717 | 5728 | 5740 | 5752 | 5763 | 5775 | 5786 | 1                | 2 | 3  | 5  | 6  | 7  | 8  | 9  | 10 |
| 38 | 5796 | 5807 | 5818 | 5829 | 5840 | 5851 | 5862 | 5873 | 5884 | 5895 | 1                | 2 | 3  | 5  | 6  | 7  | 8  | 9  | 10 |
| 39 | 5911 | 5922 | 5933 | 5944 | 5955 | 5966 | 5977 | 5988 | 5999 | 6010 | 1                | 2 | 3  | 4  | 5  | 7  | 8  | 9  | 10 |
| 40 | 6021 | 6031 | 6042 | 6053 | 6064 | 6075 | 6085 | 6096 | 6107 | 6117 | 1                | 2 | 3  | 4  | 5  | 6  | 8  | 9  | 10 |
| 41 | 6128 | 6138 | 6149 | 6160 | 6170 | 6180 | 6191 | 6201 | 6212 | 6222 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 42 | 6232 | 6243 | 6253 | 6263 | 6274 | 6284 | 6294 | 6304 | 6314 | 6325 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 43 | 6335 | 6345 | 6355 | 6365 | 6376 | 6386 | 6395 | 6405 | 6415 | 6425 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 44 | 6435 | 6444 | 6454 | 6464 | 6474 | 6484 | 6493 | 6503 | 6513 | 6522 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 45 | 6532 | 6542 | 6551 | 6561 | 6571 | 6580 | 6590 | 6600 | 6609 | 6618 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 46 | 6628 | 6637 | 6646 | 6656 | 6665 | 6675 | 6684 | 6693 | 6702 | 6712 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 7  | 8  |
| 47 | 6721 | 6730 | 6739 | 6749 | 6758 | 6767 | 6776 | 6785 | 6794 | 6803 | 1                | 2 | 3  | 4  | 5  | 5  | 6  | 7  | 8  |
| 48 | 6812 | 6821 | 6830 | 6839 | 6848 | 6857 | 6866 | 6875 | 6884 | 6893 | 1                | 2 | 3  | 4  | 4  | 5  | 6  | 7  | 8  |
| 49 | 6902 | 6911 | 6920 | 6928 | 6937 | 6946 | 6955 | 6964 | 6972 | 6981 | 1                | 2 | 3  | 4  | 4  | 5  | 6  | 7  | 8  |
| 50 | 6990 | 6998 | 7007 | 7016 | 7024 | 7033 | 7042 | 7050 | 7059 | 7067 | 1                | 2 | 3  | 3  | 4  | 5  | 6  | 7  | 8  |
| 51 | 7076 | 7084 | 7093 | 7101 | 7110 | 7118 | 7126 | 7135 | 7143 | 7152 | 1                | 2 | 3  | 3  | 4  | 5  | 6  | 7  | 8  |
| 52 | 7160 | 7168 | 7177 | 7185 | 7193 | 7202 | 7210 | 7218 | 7226 | 7235 | 1                | 2 | 2  | 3  | 4  | 5  | 6  | 7  | 7  |
| 53 | 7243 | 7251 | 7259 | 7267 | 7275 | 7284 | 7292 | 7300 | 7308 | 7316 | 1                | 2 | 2  | 3  | 4  | 5  | 6  | 6  | 7  |
| 54 | 7324 | 7332 | 7340 | 7348 | 7356 | 7364 | 7372 | 7380 | 7388 | 7396 | 1                | 2 | 2  | 3  | 4  | 5  | 6  | 6  | 7  |

No.  $x = 3.14159$   
 $e = 2.71828$

log 0.49715  
 0.43429

$\ln x = \log_e x = (1/M) \log_{10} x$   
 $\log x = \log_{10} x = M \log_e x$

No.  $(1/M) = 2.30259$   
 $M = 0.43429$

log 0.36222  
 7.63778

## LOGARITHMS

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |   |   |   |   |   |   |   |
|----|------|------|------|------|------|------|------|------|------|------|------------------|---|---|---|---|---|---|---|---|
|    |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 55 | 7404 | 7412 | 7419 | 7427 | 7435 | 7443 | 7451 | 7459 | 7466 | 7474 | 1                | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 56 | 7482 | 7490 | 7497 | 7505 | 7513 | 7520 | 7528 | 7536 | 7543 | 7551 | 1                | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 57 | 7559 | 7566 | 7574 | 7582 | 7589 | 7597 | 7604 | 7612 | 7619 | 7627 | 1                | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 58 | 7634 | 7642 | 7649 | 7657 | 7664 | 7672 | 7679 | 7686 | 7694 | 7701 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 |
| 59 | 7709 | 7716 | 7723 | 7731 | 7738 | 7745 | 7752 | 7760 | 7767 | 7774 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 |
| 60 | 7782 | 7789 | 7796 | 7803 | 7810 | 7818 | 7825 | 7832 | 7839 | 7846 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 8 |
| 61 | 7859 | 7866 | 7868 | 7875 | 7882 | 7889 | 7896 | 7903 | 7910 | 7917 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 62 | 7924 | 7931 | 7936 | 7945 | 7952 | 7959 | 7966 | 7973 | 7980 | 7987 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 63 | 7993 | 8000 | 8007 | 8014 | 8021 | 8028 | 8035 | 8041 | 8048 | 8055 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 64 | 8062 | 8069 | 8076 | 8082 | 8089 | 8096 | 8102 | 8109 | 8116 | 8122 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 65 | 8129 | 8136 | 8142 | 8149 | 8156 | 8162 | 8169 | 8176 | 8182 | 8189 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 66 | 8195 | 8202 | 8209 | 8215 | 8222 | 8228 | 8235 | 8241 | 8248 | 8254 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 67 | 8261 | 8267 | 8274 | 8280 | 8287 | 8293 | 8299 | 8306 | 8312 | 8319 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 68 | 8325 | 8331 | 8338 | 8344 | 8351 | 8357 | 8363 | 8370 | 8376 | 8382 | 1                | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 |
| 69 | 8388 | 8395 | 8401 | 8407 | 8414 | 8420 | 8426 | 8432 | 8439 | 8445 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 |
| 70 | 8451 | 8457 | 8463 | 8470 | 8476 | 8482 | 8488 | 8494 | 8500 | 8506 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 |
| 71 | 8513 | 8519 | 8525 | 8531 | 8537 | 8543 | 8549 | 8555 | 8561 | 8567 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 72 | 8573 | 8579 | 8585 | 8591 | 8597 | 8603 | 8609 | 8615 | 8621 | 8627 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 73 | 8633 | 8639 | 8645 | 8651 | 8657 | 8663 | 8669 | 8675 | 8681 | 8686 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 74 | 8692 | 8698 | 8704 | 8710 | 8716 | 8722 | 8727 | 8733 | 8739 | 8745 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 75 | 8751 | 8756 | 8762 | 8768 | 8774 | 8779 | 8785 | 8791 | 8797 | 8802 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 |
| 76 | 8808 | 8814 | 8820 | 8825 | 8831 | 8837 | 8842 | 8848 | 8854 | 8859 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 |
| 77 | 8865 | 8871 | 8876 | 8882 | 8887 | 8893 | 8899 | 8904 | 8910 | 8915 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 78 | 8921 | 8927 | 8932 | 8938 | 8943 | 8949 | 8954 | 8960 | 8965 | 8971 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 79 | 8976 | 8982 | 8987 | 8993 | 8998 | 9004 | 9009 | 9015 | 9020 | 9025 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 80 | 9031 | 9036 | 9042 | 9047 | 9053 | 9058 | 9063 | 9069 | 9074 | 9079 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 81 | 9085 | 9090 | 9096 | 9101 | 9106 | 9112 | 9117 | 9122 | 9128 | 9133 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 82 | 9138 | 9143 | 9149 | 9154 | 9159 | 9165 | 9170 | 9175 | 9180 | 9186 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 83 | 9191 | 9196 | 9201 | 9206 | 9212 | 9217 | 9222 | 9227 | 9232 | 9238 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 84 | 9243 | 9248 | 9253 | 9258 | 9263 | 9269 | 9274 | 9279 | 9284 | 9289 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 85 | 9294 | 9299 | 9304 | 9309 | 9315 | 9320 | 9325 | 9330 | 9335 | 9340 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 86 | 9345 | 9350 | 9355 | 9360 | 9365 | 9370 | 9375 | 9380 | 9385 | 9390 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 87 | 9395 | 9400 | 9405 | 9410 | 9415 | 9420 | 9425 | 9430 | 9435 | 9440 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 88 | 9445 | 9450 | 9455 | 9460 | 9465 | 9469 | 9474 | 9479 | 9484 | 9489 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 89 | 9494 | 9499 | 9504 | 9509 | 9513 | 9518 | 9523 | 9528 | 9533 | 9538 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 90 | 9542 | 9547 | 9552 | 9557 | 9562 | 9566 | 9571 | 9576 | 9581 | 9586 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 91 | 9590 | 9595 | 9600 | 9605 | 9609 | 9614 | 9619 | 9624 | 9628 | 9633 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 92 | 9639 | 9643 | 9647 | 9652 | 9657 | 9661 | 9666 | 9671 | 9675 | 9680 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 93 | 9685 | 9689 | 9694 | 9699 | 9703 | 9708 | 9713 | 9717 | 9722 | 9727 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 94 | 9731 | 9736 | 9741 | 9745 | 9750 | 9754 | 9759 | 9763 | 9768 | 9773 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 95 | 9777 | 9782 | 9786 | 9791 | 9795 | 9800 | 9805 | 9809 | 9814 | 9818 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 96 | 9823 | 9827 | 9832 | 9835 | 9841 | 9845 | 9850 | 9854 | 9859 | 9863 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 97 | 9868 | 9872 | 9877 | 9881 | 9886 | 9890 | 9894 | 9899 | 9903 | 9908 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 98 | 9912 | 9917 | 9921 | 9925 | 9930 | 9934 | 9939 | 9943 | 9948 | 9952 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 99 | 9956 | 9961 | 9965 | 9969 | 9974 | 9978 | 9983 | 9987 | 9991 | 9995 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |

|               |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| $p$           | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
| $\log e^p$    | 0.4343 | 0.8686 | 1.3029 | 1.7372 | 2.1715 | 2.6058 | 3.0401 | 3.4744 | 3.9087 | 4.3429 |
| $\log e^{-p}$ | 1.6857 | 1.1314 | 2.6971 | 2.2628 | 3.8285 | 3.3942 | 4.9599 | 4.5256 | 4.0913 | 5.6571 |

## ANTILOGARITHMS

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |   |   |   |   |   |   |   |
|-----|------|------|------|------|------|------|------|------|------|------|------------------|---|---|---|---|---|---|---|---|
|     |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| .00 | 1000 | 1002 | 1005 | 1007 | 1009 | 1012 | 1014 | 1016 | 1019 | 1021 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .01 | 1023 | 1026 | 1028 | 1030 | 1033 | 1035 | 1038 | 1040 | 1042 | 1045 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .02 | 1047 | 1050 | 1052 | 1054 | 1057 | 1059 | 1062 | 1064 | 1067 | 1069 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .03 | 1072 | 1074 | 1078 | 1079 | 1081 | 1084 | 1086 | 1089 | 1091 | 1094 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .04 | 1096 | 1099 | 1102 | 1104 | 1107 | 1109 | 1112 | 1114 | 1117 | 1119 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .05 | 1122 | 1125 | 1127 | 1130 | 1132 | 1135 | 1138 | 1140 | 1143 | 1146 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .06 | 1148 | 1151 | 1153 | 1156 | 1159 | 1161 | 1164 | 1167 | 1169 | 1172 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .07 | 1175 | 1178 | 1180 | 1183 | 1185 | 1189 | 1191 | 1194 | 1197 | 1199 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .08 | 1202 | 1205 | 1208 | 1211 | 1213 | 1216 | 1219 | 1222 | 1225 | 1227 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| .09 | 1230 | 1233 | 1236 | 1239 | 1242 | 1245 | 1247 | 1250 | 1253 | 1256 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| .10 | 1259 | 1262 | 1265 | 1268 | 1271 | 1274 | 1276 | 1279 | 1282 | 1285 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| .11 | 1288 | 1291 | 1294 | 1297 | 1300 | 1303 | 1306 | 1309 | 1312 | 1315 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| .12 | 1318 | 1321 | 1324 | 1327 | 1330 | 1334 | 1337 | 1340 | 1343 | 1346 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| .13 | 1349 | 1352 | 1355 | 1358 | 1361 | 1365 | 1368 | 1371 | 1374 | 1377 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .14 | 1380 | 1384 | 1387 | 1390 | 1393 | 1396 | 1400 | 1403 | 1406 | 1409 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .15 | 1413 | 1416 | 1419 | 1422 | 1425 | 1429 | 1432 | 1435 | 1439 | 1442 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .16 | 1445 | 1449 | 1452 | 1455 | 1459 | 1462 | 1466 | 1469 | 1472 | 1476 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .17 | 1478 | 1483 | 1486 | 1489 | 1493 | 1496 | 1500 | 1503 | 1507 | 1510 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .18 | 1514 | 1517 | 1521 | 1524 | 1528 | 1531 | 1535 | 1538 | 1542 | 1545 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .19 | 1549 | 1552 | 1556 | 1560 | 1563 | 1567 | 1570 | 1574 | 1576 | 1581 | 0                | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| .20 | 1585 | 1589 | 1592 | 1596 | 1600 | 1603 | 1607 | 1611 | 1614 | 1618 | 0                | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| .21 | 1622 | 1626 | 1629 | 1633 | 1637 | 1641 | 1644 | 1648 | 1652 | 1656 | 0                | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| .22 | 1660 | 1663 | 1667 | 1671 | 1675 | 1679 | 1683 | 1687 | 1690 | 1694 | 0                | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| .23 | 1698 | 1702 | 1706 | 1710 | 1714 | 1718 | 1722 | 1726 | 1730 | 1734 | 0                | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| .24 | 1738 | 1742 | 1746 | 1750 | 1754 | 1758 | 1762 | 1766 | 1770 | 1774 | 0                | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| .25 | 1778 | 1782 | 1786 | 1791 | 1795 | 1799 | 1803 | 1807 | 1811 | 1816 | 0                | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| .26 | 1820 | 1824 | 1828 | 1832 | 1837 | 1841 | 1845 | 1849 | 1854 | 1858 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 |
| .27 | 1862 | 1866 | 1871 | 1875 | 1879 | 1884 | 1888 | 1892 | 1897 | 1901 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 |
| .28 | 1905 | 1910 | 1914 | 1919 | 1923 | 1928 | 1932 | 1936 | 1941 | 1945 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| .29 | 1950 | 1954 | 1959 | 1963 | 1968 | 1972 | 1977 | 1982 | 1988 | 1991 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| .30 | 1995 | 2000 | 2004 | 2009 | 2014 | 2018 | 2023 | 2026 | 2032 | 2037 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| .31 | 2042 | 2046 | 2051 | 2056 | 2061 | 2065 | 2070 | 2075 | 2080 | 2084 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| .32 | 2089 | 2094 | 2099 | 2104 | 2109 | 2113 | 2118 | 2123 | 2128 | 2133 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| .33 | 2138 | 2143 | 2148 | 2153 | 2158 | 2163 | 2168 | 2173 | 2178 | 2183 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| .34 | 2188 | 2193 | 2198 | 2203 | 2208 | 2213 | 2218 | 2223 | 2228 | 2234 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| .35 | 2239 | 2244 | 2249 | 2254 | 2259 | 2266 | 2270 | 2275 | 2280 | 2286 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| .36 | 2291 | 2296 | 2301 | 2307 | 2312 | 2317 | 2323 | 2326 | 2333 | 2339 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| .37 | 2344 | 2350 | 2356 | 2360 | 2366 | 2371 | 2377 | 2382 | 2388 | 2393 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| .38 | 2399 | 2404 | 2410 | 2415 | 2421 | 2427 | 2432 | 2438 | 2443 | 2449 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| .39 | 2455 | 2460 | 2466 | 2472 | 2477 | 2483 | 2489 | 2495 | 2500 | 2506 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| .40 | 2512 | 2518 | 2523 | 2529 | 2535 | 2541 | 2547 | 2553 | 2559 | 2564 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| .41 | 2570 | 2576 | 2582 | 2588 | 2594 | 2600 | 2606 | 2612 | 2618 | 2624 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| .42 | 2630 | 2636 | 2642 | 2649 | 2655 | 2661 | 2667 | 2673 | 2679 | 2685 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 |
| .43 | 2692 | 2698 | 2704 | 2710 | 2716 | 2723 | 2729 | 2735 | 2742 | 2748 | 1                | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 |
| .44 | 2754 | 2761 | 2767 | 2773 | 2780 | 2786 | 2793 | 2799 | 2805 | 2812 | 1                | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 |
| .45 | 2818 | 2825 | 2831 | 2838 | 2844 | 2851 | 2858 | 2864 | 2871 | 2877 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| .46 | 2884 | 2891 | 2897 | 2904 | 2911 | 2917 | 2924 | 2931 | 2938 | 2944 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| .47 | 2951 | 2958 | 2965 | 2972 | 2979 | 2985 | 2992 | 2999 | 3006 | 3013 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| .48 | 3020 | 3027 | 3034 | 3041 | 3048 | 3055 | 3062 | 3069 | 3076 | 3083 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| .49 | 3090 | 3097 | 3105 | 3112 | 3119 | 3126 | 3133 | 3141 | 3148 | 3156 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |

Antilogarithm Chart continue on page No. 17

## PHYSICAL SCIENCES

### PAPER-II

**Note :** This paper contains **FIFTY (50)** multiple-choice/Assertion and Reasoning matching questions, each question carrying **TWO (2)** marks. Attempt **All** questions.

---

- The dimension of the subspace spanned by the 6 real vectors represented by corresponding four components column matrices is :  
(A) 6 (B) 3  
(C) 4 (D) 5
- The trace of the  $10 \times 10$  unit matrix is :  
(A) 10 (B) 100  
(C) 0 (D) 5
- The Laplace transform of '1' is :  
(A) 1 (B) 0  
(C) S (D)  $\frac{1}{S}$
- Hermite functions are useful in the study of :  
(A) Electrostatic problems involving multipolar charge distribution  
(B) Hydrogen atom in quantum mechanics  
(C) Linear harmonic oscillator in quantum mechanics  
(D) Periodic potential problem in crystalline solids

5. If a coin is tossed 6 times in succession, the probability of getting at least one head is :

(A)  $\frac{1}{64}$

(B)  $\frac{3}{32}$

(C)  $\frac{1}{2}$

(D)  $\frac{63}{64}$

6. The order of the differential equation for displacement representing Newton's second law of motion is :

(A) 1

(B) 0

(C) 2

(D) 3

7. The degrees of freedom of 8 particles lying on a plane are :

(A) 16

(B) 8

(C) 64

(D) 24

8. The Hamiltonian of the mass ' $m$ ' executing simple harmonic motion in one dimension can be given as :

(A)  $\frac{p^2}{2m}$

(B)  $\frac{p^2}{2m} + \frac{1}{2}kx^2$

(C)  $\frac{p^2}{2m} - \frac{1}{2}kx^2$

(D)  $\frac{1}{2}kx^2$

9. According to special theory of relativity, the length of the rod in motion varies

as  $L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$ . Therefore, the length of the rod appears to an observer.

(A) Shorter (B) Longer

(C) Unchanged (D) Infinite

10. Considering three-dimensional case of a rigid body rotation the number of Euler's angles are :

(A) 2 (B) 6

(C) 3 (D) 9

11. A particle is released from rest in a region where there is a constant electric field and a constant magnetic field. If the two fields are parallel to each other, the path of the particle is a :

(A) circle (B) parabola

(C) straight line (D) helix

12. A cube has a constant electric potential  $V$  on its surface. If there are no charges inside the cube, the potential at the center of the cube is :

(A) zero (B)  $V$

(C)  $\frac{V}{6}$  (D)  $\frac{V}{2}$

13. The power radiated by a charge that is being accelerated is :
- (A) in the direction of acceleration
  - (B) in the direction opposite to that of the acceleration
  - (C) in a donut (toroidal shape) perpendicular about the direction of acceleration
  - (D) distributed uniformly on a sphere around the position of the charge

14.  $\frac{\vec{E}}{B}$  has the dimension of :

- (A) Velocity
- (B) Charge density
- (C) Force
- (D) Energy

15. Listed below are the Maxwell's equations of electromagnetism. If the magnetic monopoles exist, which of these equations have to be modified ?

(I)  $\text{curl } \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$

(II)  $\text{curl } \vec{E} = - \frac{\partial \vec{B}}{\partial t}$

(III)  $\text{div } \vec{D} = \rho$

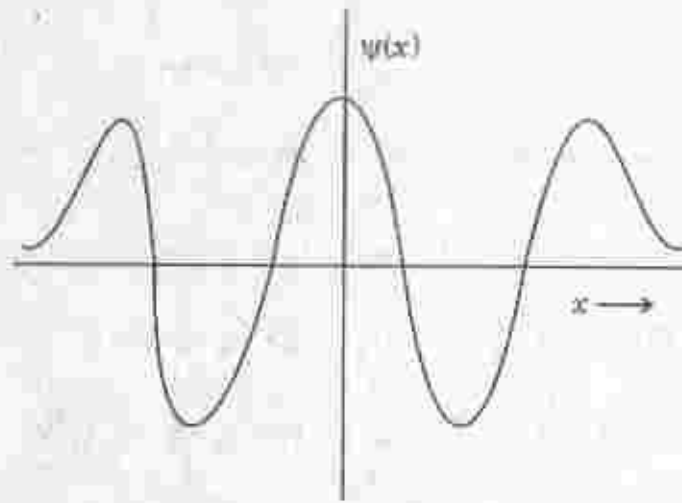
(IV)  $\text{div } \vec{B} = 0$

- (A) (IV) only
- (B) (I) and (III)
- (C) (III) and (IV)
- (D) (II) and (IV)



16. The plot of the eigenfunction of the linear harmonic oscillator is given below.  
Corresponding eigenvalue is :

- (A)  $5\hbar\omega$  (B)  $4\hbar\omega$   
(C)  $9/2\hbar\omega$  (D)  $11/2\hbar\omega$



17. The commutator bracket  $\left[ x, \frac{d}{dx} \right]$  is equal to :

- (A)  $-1$  (B)  $1$   
(C) zero (D) none of these

18. A one-dimensional harmonic oscillator is in the state  $\psi(x) = \frac{1}{\sqrt{14}} [3\psi_0(x) - 2\psi_1(x) + \psi_2(x)]$  where  $\psi_0(x)$ ,  $\psi_1(x)$  and  $\psi_2(x)$  are the wave functions of ground, first and second excited states respectively. The probability of finding the oscillator in the first excited state is :

- (A)  $\frac{4}{\sqrt{14}}$  (B)  $\frac{1}{14}$   
(C)  $\frac{2}{7}$  (D)  $\frac{3}{7}$

19. Which of the following is *not* fermion ?
- (A) A photon (B) An electron  
(C) A neutron (D) A muon
20. The angular momentum operators  $L_x$ ,  $L_y$  and  $L_z$  are :
- (A) Non-hermitian (B) Hermitian  
(C) Parity operator (D) Unitary
21. The combination of first and second law of thermodynamics is given by :
- (A)  $TdS = dU + PdV$  (B)  $dQ = TdS + PdV$   
(C)  $dU = TdS + dQ$  (D)  $TdS = dU - PdV$
22. The work done  $W$  during the isothermal process in which the one mole of ideal gas expands from initial volume  $V_1$  to the final volume  $V_2$  is given by :
- (A)  $RT \log\left(\frac{V_2}{V_1}\right)$  (B)  $RT \log\left(\frac{V_1}{V_2}\right)$   
(C)  $RT \log\left(\frac{V_2}{V_1}\right)^2$  (D)  $RT \log\left(\frac{V_1}{V_2}\right)^2$
23. Which of the following represents enthalpy ?
- (A)  $E$  (B)  $E + PV$   
(C)  $E - TS$  (D)  $E = TS + PV$

24. In a case of a monatomic ideal gas containing  $N$  molecules the specific heat at constant volume  $C_V$  of a gas at temperature  $T$  is :
- (A)  $\frac{1}{2} Nk$  (B)  $Nk$   
(C)  $2 Nk$  (D)  $\frac{3}{2} Nk$
25. Probability of occupation of state  $E_F$  at any  $T$  by electron in FD statistics is :
- (A) 0 (B)  $\frac{1}{2}$   
(C) 1 (D)  $\infty$
26. PN junction diodes are used in power supply to :
- (A) Filter AC (B) Rectify AC  
(C) Modulate AC (D) Differentiate AC
27. In a Zener diode the voltage limiting occurs at :
- (A) Forward knee voltage (B) Reverse high voltage  
(C) Breakdown voltage (D) Cut-in voltage
28. In a non-inverting amplifier, if the value of feedback resistor is zero, the resulting configuration is called :
- (A) Inverting amplifier (B) Voltage follower  
(C) Open loop amplifier (D) A comparator



33. The energy stored in a parallel plate capacitor of  $2 \mu\text{F}$ , dielectric permittivity  $\epsilon_r = 100$  and applied voltage  $1000 \text{ V}$  is :
- (A) 1 joule (B) 2 joule  
(C) 0.5 joule (D) 1.5 joule
34. Hall effect device can be used for measuring :
- (A) Pressure (B) Temperature  
(C) Magnetic field (D) Electrostatic Force
35. In order to transfer maximum power from output circuit of one stage to input circuit of next stage their output and input impedances should respectively be :
- (A)  $\infty$  and 0 (B) equal  
(C) 0 and 0 (D)  $\infty$  and  $\infty$
36. Which of the following state exists ?
- (A)  ${}^2\text{F}_{9/2}$  (B)  ${}^2\text{F}_{5/2}$   
(C)  ${}^3\text{F}_{7/2}$  (D)  ${}^3\text{F}_{5/2}$
37. The Lande  $g$  factor for  ${}^2\text{P}_{3/2}$  term is :
- (A)  $\frac{3}{4}$  (B)  $\frac{4}{3}$   
(C)  $\frac{6}{5}$  (D)  $\frac{5}{6}$

38. For case of measurements of chemical shift in NMR one of the following reference compound is added. It is :

- (A) Acetaldehyde                      (B) Alcohol  
(C) Glycol                                (D) Tetramethyl silane

39. The minimum wavelength of X-ray emitted at an operating voltage 12.37 kV is :

- (A) 0.01 Å                                (B) 0.1 Å  
(C) 1 Å                                      (D) 10 Å

40. The laser pointers used in lecture halls are :

- (A) Excimer laser                      (B) Dye laser  
(C) Ruby laser                          (D) Semiconductor laser

41. Dielectric function  $\epsilon(\omega)$  at frequency  $\omega$  for free electron gas is equal to :

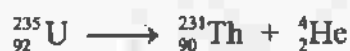
- (A)  $1 - \frac{4\pi ne^2}{m\omega^2}$                                 (B)  $1 + \frac{4\pi ne^2}{m\omega^2}$   
(C)  $\sqrt{\frac{4\pi ne^2}{m\omega^2}}$                                 (D)  $\sqrt{\frac{m\omega^2}{4\pi ne^2}}$

42. Superconductors are perfect diamagnets with susceptibility  $\chi$  in CGS units :

- (A)  $= -\frac{1}{4\pi}$                                       (B)  $\sim 10^{-6}$   
(C)  $\sim 10^6$                                       (D)  $4\pi$

43. The ratio of skin depth in copper at 1 kHz to that at 100 MHz is :
- (A) 3 (B) 30  
(C) 300 (D) 3000
44. The number of atoms per unit cell of f.c.c. structure is :
- (A) 1 (B) 2  
(C) 3 (D) 4
45. The thermal vibrations of atoms in crystals are responsible for producing :
- (A) Phonons (B) Plasmons  
(C) Photons (D) Magnons
46. Ground state spin and parity of  $^{17}\text{O}$  nucleus is :
- (A)  $\frac{3^+}{2}$  (B)  $\frac{5^+}{2}$   
(C)  $\frac{3^-}{2}$  (D)  $\frac{5^-}{2}$
47. Except for mass, the properties of muon, most closely resemble the properties of :
- (A) Electron (B) Photon  
(C) Pion (D) Proton

48. The deviation of the charge distribution of a nucleus from spherical symmetry can be estimated by measuring its :
- (A) Electric charge
  - (B) Magnetic dipole moment
  - (C) Electric quadrupole moment
  - (D) Angular momentum and parity
49. The ratio of radii of  ${}_{82}^{208}\text{Pb}$  and  ${}_{12}^{26}\text{Mg}$  is approximately :
- (A) 16
  - (B) 8
  - (C) 4
  - (D) 2
50. A uranium nucleus decays at rest into thorium nucleus and a helium nucleus :



Which of the following is *true* ?

- (A) Each decay product has the same kinetic energy
- (B) Each decay product has the same speed
- (C) The decay products tend to go in the same direction
- (D) The helium nucleus has more kinetic energy than that of the thorium nucleus



## ANTILOGARITHMS

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |   |   |    |    |    |    |    |
|-----|------|------|------|------|------|------|------|------|------|------|------------------|---|---|---|----|----|----|----|----|
|     |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .50 | 3162 | 3170 | 3177 | 3184 | 3192 | 3199 | 3206 | 3214 | 3221 | 3228 | 1                | 1 | 2 | 3 | 4  | 4  | 5  | 6  | 7  |
| .51 | 3236 | 3243 | 3251 | 3258 | 3266 | 3273 | 3281 | 3289 | 3296 | 3304 | 1                | 2 | 2 | 3 | 4  | 5  | 5  | 6  | 7  |
| .52 | 3311 | 3319 | 3327 | 3334 | 3342 | 3350 | 3357 | 3365 | 3373 | 3381 | 1                | 2 | 2 | 3 | 4  | 5  | 5  | 6  | 7  |
| .53 | 3386 | 3396 | 3404 | 3412 | 3420 | 3428 | 3436 | 3443 | 3451 | 3459 | 1                | 2 | 2 | 3 | 4  | 5  | 6  | 6  | 7  |
| .54 | 3467 | 3475 | 3483 | 3491 | 3499 | 3508 | 3516 | 3524 | 3532 | 3540 | 1                | 2 | 2 | 3 | 4  | 5  | 6  | 6  | 7  |
| .55 | 3548 | 3556 | 3564 | 3573 | 3581 | 3589 | 3597 | 3606 | 3614 | 3622 | 1                | 2 | 2 | 3 | 4  | 5  | 6  | 7  | 7  |
| .56 | 3631 | 3639 | 3648 | 3656 | 3664 | 3673 | 3681 | 3690 | 3698 | 3707 | 1                | 2 | 3 | 3 | 4  | 5  | 6  | 7  | 8  |
| .57 | 3715 | 3724 | 3733 | 3741 | 3750 | 3758 | 3767 | 3776 | 3784 | 3793 | 1                | 2 | 3 | 3 | 4  | 5  | 6  | 7  | 8  |
| .58 | 3802 | 3811 | 3819 | 3828 | 3837 | 3846 | 3855 | 3864 | 3873 | 3882 | 1                | 2 | 3 | 4 | 4  | 5  | 6  | 7  | 8  |
| .59 | 3890 | 3899 | 3908 | 3917 | 3926 | 3935 | 3945 | 3954 | 3963 | 3972 | 1                | 2 | 3 | 4 | 5  | 5  | 6  | 7  | 8  |
| .60 | 3981 | 3990 | 3999 | 4009 | 4018 | 4027 | 4036 | 4046 | 4055 | 4064 | 1                | 2 | 3 | 4 | 5  | 6  | 6  | 7  | 8  |
| .61 | 4074 | 4083 | 4093 | 4102 | 4111 | 4121 | 4130 | 4140 | 4150 | 4159 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .62 | 4169 | 4178 | 4188 | 4198 | 4207 | 4217 | 4227 | 4236 | 4246 | 4256 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .63 | 4266 | 4275 | 4285 | 4295 | 4305 | 4315 | 4325 | 4335 | 4345 | 4355 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .64 | 4366 | 4375 | 4385 | 4395 | 4405 | 4415 | 4425 | 4436 | 4446 | 4457 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .65 | 4467 | 4477 | 4487 | 4498 | 4508 | 4519 | 4529 | 4539 | 4550 | 4560 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .66 | 4571 | 4581 | 4592 | 4603 | 4613 | 4624 | 4634 | 4645 | 4656 | 4667 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 9  | 10 |
| .67 | 4677 | 4688 | 4699 | 4710 | 4721 | 4732 | 4742 | 4753 | 4764 | 4775 | 1                | 2 | 3 | 4 | 6  | 7  | 8  | 9  | 10 |
| .68 | 4786 | 4797 | 4808 | 4819 | 4831 | 4842 | 4853 | 4864 | 4875 | 4887 | 1                | 2 | 3 | 4 | 6  | 7  | 8  | 9  | 10 |
| .69 | 4898 | 4909 | 4920 | 4932 | 4943 | 4955 | 4966 | 4977 | 4989 | 5000 | 1                | 2 | 3 | 5 | 6  | 7  | 8  | 9  | 10 |
| .70 | 5012 | 5023 | 5035 | 5047 | 5058 | 5070 | 5082 | 5093 | 5105 | 5117 | 1                | 2 | 4 | 5 | 6  | 7  | 8  | 9  | 11 |
| .71 | 5129 | 5140 | 5152 | 5164 | 5176 | 5188 | 5200 | 5212 | 5224 | 5236 | 1                | 2 | 4 | 5 | 6  | 7  | 8  | 10 | 11 |
| .72 | 5248 | 5260 | 5272 | 5284 | 5297 | 5309 | 5321 | 5333 | 5345 | 5358 | 1                | 2 | 4 | 5 | 6  | 7  | 9  | 10 | 11 |
| .73 | 5370 | 5383 | 5396 | 5408 | 5420 | 5433 | 5446 | 5458 | 5470 | 5483 | 1                | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 11 |
| .74 | 5495 | 5508 | 5521 | 5534 | 5546 | 5559 | 5572 | 5585 | 5598 | 5610 | 1                | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 12 |
| .75 | 5623 | 5636 | 5649 | 5662 | 5675 | 5689 | 5702 | 5715 | 5728 | 5741 | 1                | 3 | 4 | 5 | 7  | 8  | 9  | 10 | 12 |
| .76 | 5754 | 5768 | 5781 | 5794 | 5808 | 5821 | 5834 | 5848 | 5861 | 5875 | 1                | 3 | 4 | 5 | 7  | 8  | 9  | 11 | 12 |
| .77 | 5888 | 5902 | 5916 | 5929 | 5943 | 5957 | 5970 | 5984 | 5998 | 6012 | 1                | 3 | 4 | 5 | 7  | 8  | 10 | 11 | 12 |
| .78 | 6026 | 6039 | 6053 | 6067 | 6081 | 6095 | 6109 | 6124 | 6138 | 6152 | 1                | 3 | 4 | 6 | 7  | 8  | 10 | 11 | 13 |
| .79 | 6166 | 6180 | 6194 | 6209 | 6223 | 6237 | 6252 | 6266 | 6281 | 6295 | 1                | 3 | 4 | 6 | 7  | 9  | 10 | 11 | 13 |
| .80 | 6310 | 6324 | 6338 | 6353 | 6368 | 6383 | 6397 | 6412 | 6427 | 6442 | 1                | 3 | 4 | 6 | 7  | 9  | 10 | 12 | 13 |
| .81 | 6457 | 6471 | 6486 | 6501 | 6516 | 6531 | 6546 | 6561 | 6577 | 6592 | 2                | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| .82 | 6607 | 6622 | 6637 | 6653 | 6668 | 6683 | 6699 | 6714 | 6730 | 6745 | 2                | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| .83 | 6761 | 6776 | 6792 | 6808 | 6823 | 6839 | 6855 | 6871 | 6887 | 6902 | 2                | 3 | 5 | 6 | 8  | 9  | 11 | 13 | 14 |
| .84 | 6918 | 6934 | 6950 | 6966 | 6982 | 6998 | 7015 | 7031 | 7047 | 7063 | 2                | 3 | 5 | 6 | 8  | 10 | 11 | 13 | 15 |
| .85 | 7079 | 7096 | 7112 | 7129 | 7145 | 7161 | 7178 | 7194 | 7211 | 7228 | 2                | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| .86 | 7244 | 7261 | 7278 | 7295 | 7311 | 7328 | 7345 | 7362 | 7379 | 7396 | 2                | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| .87 | 7413 | 7430 | 7447 | 7464 | 7482 | 7499 | 7516 | 7534 | 7551 | 7568 | 2                | 3 | 5 | 7 | 9  | 10 | 12 | 14 | 16 |
| .88 | 7586 | 7603 | 7621 | 7638 | 7656 | 7674 | 7691 | 7709 | 7727 | 7745 | 2                | 4 | 5 | 7 | 9  | 11 | 12 | 14 | 16 |
| .89 | 7762 | 7780 | 7798 | 7816 | 7834 | 7852 | 7870 | 7889 | 7907 | 7925 | 2                | 4 | 6 | 7 | 9  | 11 | 13 | 14 | 16 |
| .90 | 7943 | 7962 | 7980 | 7998 | 8017 | 8035 | 8054 | 8072 | 8091 | 8110 | 2                | 4 | 6 | 7 | 9  | 11 | 13 | 14 | 16 |
| .91 | 8128 | 8147 | 8166 | 8185 | 8204 | 8222 | 8241 | 8260 | 8279 | 8298 | 2                | 4 | 6 | 8 | 9  | 11 | 13 | 15 | 17 |
| .92 | 8318 | 8337 | 8356 | 8375 | 8395 | 8414 | 8433 | 8453 | 8472 | 8492 | 2                | 4 | 6 | 8 | 10 | 12 | 14 | 15 | 17 |
| .93 | 8511 | 8531 | 8551 | 8570 | 8590 | 8610 | 8630 | 8650 | 8670 | 8690 | 2                | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| .94 | 8710 | 8730 | 8750 | 8770 | 8790 | 8810 | 8831 | 8851 | 8872 | 8892 | 2                | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| .95 | 8913 | 8933 | 8954 | 8974 | 8995 | 9016 | 9036 | 9057 | 9078 | 9099 | 2                | 4 | 6 | 8 | 10 | 12 | 15 | 17 | 19 |
| .96 | 9120 | 9141 | 9162 | 9183 | 9204 | 9226 | 9247 | 9268 | 9290 | 9311 | 2                | 4 | 6 | 8 | 11 | 13 | 15 | 17 | 19 |
| .97 | 9333 | 9354 | 9376 | 9397 | 9419 | 9441 | 9462 | 9484 | 9506 | 9528 | 2                | 4 | 7 | 9 | 11 | 13 | 15 | 17 | 20 |
| .98 | 9550 | 9572 | 9594 | 9616 | 9638 | 9661 | 9683 | 9705 | 9727 | 9750 | 2                | 4 | 7 | 9 | 11 | 13 | 16 | 18 | 20 |
| .99 | 9772 | 9795 | 9817 | 9840 | 9863 | 9886 | 9908 | 9931 | 9954 | 9977 | 2                | 5 | 7 | 9 | 11 | 14 | 16 | 18 | 20 |

## ROUGH WORK

**ROUGH WORK**

**ROUGH WORK**

SEAL