

Time: 2:30 PM to 3:45 PM

Question Paper Code: 31

Roll No. of Student's															
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**Write the question paper code mentioned above on YOUR OMR Answer Sheet (in the space provided), otherwise your Answer Sheet will NOT be evaluated. Note that the same Question Paper Code appears on each page of the question paper.**

### Instructions to Candidates:

1. Use of mobile phone, smart watch, and iPad during examination is **STRICTLY PROHIBITED**.
2. In addition to this question paper, you are given OMR Answer Sheet along with candidate's copy.
3. On the OMR sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.  
**Incomplete/ incorrect/ carelessly filled information may disqualify your candidature.**
4. On the OMR Answer Sheet, use only **BLUE or BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Your **14-digit roll number and date of birth** entered on the OMR Answer Sheet shall remain your login credentials means login id and password respectively for accessing your performance / result in Indian Olympiad Qualifier in Chemistry 2021-22 (Part I).
6. Question paper has two parts. In part A-1(Q. No.1 to 24) each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as below.

**Q.No.12**

<input type="radio"/> a	<input checked="" type="radio"/>	<input type="radio"/> c	<input type="radio"/> d
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In part A-2 (Q. No. 25 to 32) each question has four alternatives out of which any number of alternative(s) (1, 2, 3, or 4) may be correct. You have to choose **all** correct alternative(s) and fill the appropriate bubble(s), as shown

**Q.No.30**

<input type="radio"/> a	<input checked="" type="radio"/>	<input type="radio"/> c	<input checked="" type="radio"/>
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7. For **Part A-1**, each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer. In **Part A-2**, you get 6 marks if all the correct alternatives are marked and no incorrect. No negative marks in this part.
8. Rough work should be done in the space provided. There are **10** printed pages in this paper
9. Use of **non- programmable scientific** calculator is allowed.
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting answer paper, take away the question paper & Candidate's copy of OMR for your reference.

**Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the OMR answer sheet.**

**OMR answer sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED. Scratching or overwriting may result in a wrong score.**

**DO NOT WRITE ON THE BACK SIDE OF THE OMR ANSWER SHEET.**

**Instructions to Candidates (Continued) :**

*You may read the following instructions after submitting the answer sheet.*

12. Comments/Inquiries/Grievances regarding this question paper, if any, can be shared on the Inquiry/Grievance column on [www.iapt.org.in](http://www.iapt.org.in) on the specified format till January 29, 2022.
13. The answers/solutions to this question paper will be available on the website: [www.iapt.org.in](http://www.iapt.org.in) by January 27, 2022.
14. **CERTIFICATES and AWARDS:**  
 Following certificates are awarded by IAPT/ACT to students, successful in the Indian Olympiad Qualifier in Chemistry 2021-22 (Part I)
  - (i) "CENTRE TOP 10 %" To be downloaded from [iapt.org.in](http://iapt.org.in) after 15.03.22
  - (ii) "STATE TOP 1 %" Will be dispatched to the examinee
  - (iii) "NATIONAL TOP 1 %" Will be dispatched to the examinee
  - (iv) "GOLD MEDAL & MERIT CERTIFICATE" to all students who attend OCSC – 2022 at HBCSE Mumbai  
 Certificate for centre toppers shall be uploaded on [iapt.org.in](http://iapt.org.in)
15. List of students (with centre number and roll number only) having score above MAS will be displayed on the website: [www.iapt.org.in](http://www.iapt.org.in) by **February 06, 2022** See the **Minimum Admissible Score Clause** on the Student's brochure on the web.
16. List of students eligible for evaluation of IOQC 2021-22 (Part II) shall be displayed on [www.iapt.org.in](http://www.iapt.org.in) by February 10, 2022.

### Useful constants

Charge of electron,  $e = 1.602 \times 10^{-19} \text{ C}$

Mass of electron,  $m_e = 9.1 \times 10^{-31} \text{ kg}$

Planck's constant,  $h = 6.626 \times 10^{-34} \text{ J s}$

Speed of light,  $c = 3.0 \times 10^8 \text{ ms}^{-1}$

Avogadro constant,  $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Molar gas constant,  $R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$   
 $= 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$

## CHEMISTRY 2021-22 (Part I) (NSEC 2021 – 22)

Time: 75 Minutes

Max. Marks: 120

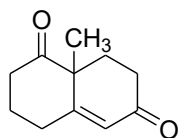
*Attempt All Thirty Two Questions*

A – 1

**ONLY ONE OUT OF FOUR OPTIONS IS CORRECT. BUBBLE THE CORRECT OPTION**

- The correct order of CFSE of the following complex ions is  
 $[\text{Zn}(\text{NH}_3)_4]^{2+}$ ,  $[\text{Co}(\text{NH}_3)_6]^{2+}$ ,  $[\text{Co}(\text{NH}_3)_6]^{3+}$ ,  $[\text{Ir}(\text{NH}_3)_6]^{3+}$ 
  - $[\text{Ir}(\text{NH}_3)_6]^{3+} > [\text{Co}(\text{NH}_3)_6]^{3+} > [\text{Co}(\text{NH}_3)_6]^{2+} > [\text{Zn}(\text{NH}_3)_4]^{2+}$
  - $[\text{Zn}(\text{NH}_3)_4]^{2+} > [\text{Co}(\text{NH}_3)_6]^{2+} > [\text{Co}(\text{NH}_3)_6]^{3+} > [\text{Ir}(\text{NH}_3)_6]^{3+}$
  - $[\text{Ir}(\text{NH}_3)_6]^{3+} > [\text{Co}(\text{NH}_3)_6]^{3+} > [\text{Zn}(\text{NH}_3)_4]^{2+} > [\text{Co}(\text{NH}_3)_6]^{2+}$
  - $[\text{Co}(\text{NH}_3)_6]^{3+} > [\text{Ir}(\text{NH}_3)_6]^{3+} > [\text{Co}(\text{NH}_3)_6]^{2+} > [\text{Zn}(\text{NH}_3)_4]^{2+}$
- Solvents are classified as polar and nonpolar based on their dipole moments.  
 Given below are some solvents.  
 (p) 1,2-dibromobenzene (q) diisopropylether (r) trans-1,2-dichloroethene  
 (s) 1,2-dichloroethane (t) N-ethyl-N-methylpropan-1-amine  
 The set in which all solvents are polar is  
 (a) p, s, t                      (b) p, q, r                      (c) r, s, t                      (d) q, r, t
- Which of the following statement/s is/are correct?
  - Half-life is 50 % of the total time taken for the completion of a reaction
  - Collision frequency (Z), which is the number of collisions per second per unit volume, is same as the rate constant of the reaction
  - A change in the activation energy of a reaction at a particular temperature will result in a proportional change in the rate and rate constant of the reaction at the same temperature
  - All first order reactions are not unimolecular
  - For a zero order reaction, slope of a plot of  $t_{1/2}$  Vs. initial concentration will be zero
 (a) I, IV                      (b) II only                      (c) IV only                      (d) II, III, V
- The orange colour of  $\text{K}_2\text{Cr}_2\text{O}_7$  and yellow colour of  $\text{K}_2\text{CrO}_4$  are, respectively, due to
  - charge transfer transitions and d-d transitions
  - d-d transitions and charge transfer transitions
  - charge transfer transitions in both
  - d-d transitions in both

5. One mole of neon (atomic mass =  $20 \text{ g mol}^{-1}$ ) and one mole of argon (atomic mass =  $40 \text{ g mol}^{-1}$ ) are stored in two separate containers I and II, at temperature T and  $2T$  respectively. If both the gases are assumed to behave ideally
- K.E. and average velocity of the gas molecules will be the same in both I and II
  - K.E. and average velocity of the gas molecules in II will be twice that of the gas molecules in I
  - K.E. of the gas molecules in II will be twice that in I and average velocity of the gas molecules in both I and II will be the same
  - Both K.E. and average velocity of the gas molecules in I will be twice that of the gas molecules in II
6. An aldehyde/ketone in the presence of a base forms a carbanion at the  $\alpha$ -position which can react with a carbonyl group in an Aldol type of reaction. It can also react with an olefinic double bond which is activated by groups like CO, CN,  $\text{NO}_2$  attached to the double bond. The latter reaction is an addition reaction across the double bond. Wieland-Miescher ketone is an important synthetic intermediate used to synthesize many compounds

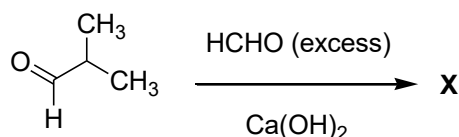


Wieland-Miescher Ketone

The pair of starting materials suitable for preparation of Wieland-Miescher ketone through a base catalysed reaction is

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

7. 'X' in the following reaction is

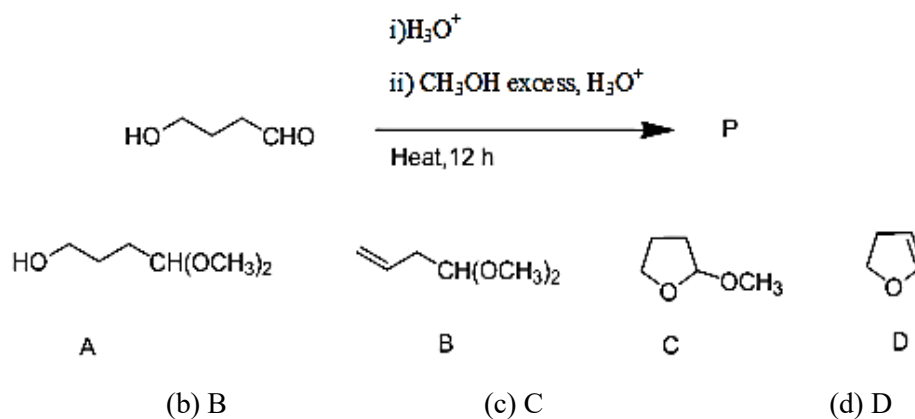


2-methylpropanal

- 2,2-Dimethyl-1,3-propanediol
- 2-Methylpropan-1-ol
- iso-butyric acid
- 3-Hydroxy-2,2-dimethylpropanal

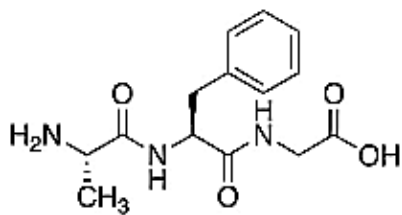
8. When 0.805 g of the potassium salt  $(\text{CH}_2)_n(\text{COOK})_2$  of a dibasic organic acid was reduced, 0.323 g of potassium was obtained. Molar mass of the acid is  
 (a) 194 (b) 116 (c) 118 (d) 156
9. Among (i)  $\text{HCl}$ , (ii)  $\text{HOClO}$ , (iii)  $\text{HOClO}_2$  and (iv)  $\text{HOClO}_3$ , which cannot undergo a disproportionation reaction?  
 (a) Only (i) (b) (ii) and (iii) (c) (i) and (iv) (d) (ii), (iii) and (iv)
10. The electronic transition in  $\text{He}^+$  ion that will occur at the same wavelength as that of the  $n = 2$  to  $n = 1$  transition in  $\text{H}$  atom is  
 (a)  $n = 2$  to  $n = 1$  (b)  $n = 3$  to  $n = 1$  (c)  $n = 3$  to  $n = 2$  (d)  $n = 4$  to  $n = 2$

11. 'P' in the following reaction is



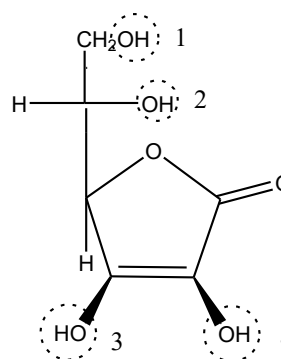
12. The number of stereoisomers is maximum for (ox =  $\text{C}_2\text{O}_4^{2-}$ )  
 (a)  $[\text{Co}(\text{ox})_3]^{3-}$  (b)  $[\text{Co}(\text{ox})_2\text{ClBr}]^{3-}$  (c)  $[\text{Co}(\text{ox})\text{Cl}_2\text{Br}_2]^{3-}$  (d)  $[\text{CoCl}_3\text{Br}_3]^{3-}$
13. Maximum number of electrons with  $m_s = \frac{1}{2}$  which can be accommodated in subshells having total three nodes is  
 (a) 10 (b) 16 (c) 20 (d) 32
14. The Hinsberg test of the compound **X** produces a solid compound **Y** that is insoluble in 10 % aq.  $\text{NaOH}$ . **Y** dissolves in 10 % aq. sulphuric acid. The compound **X** is  
 (a)  $\text{NH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)_2$  (b)  $(\text{CH}_3)_2\text{NCH}_2\text{CH}_2\text{NHCH}_3$   
 (c)  $\text{NH}_2\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}_2\text{NH}_2$  (d)  $(\text{CH}_3)_2\text{NCH}_2\text{N}(\text{CH}_3)_2$
15. An ionic species,  $\text{M}^{3+}$ , is isoelectronic with  $\text{CuCl}_2$  and has  $(Z+2)$  neutrons. The molar mass of  $\text{M}^{3+}$  is  
 (a) 128 (b) 62 (c) 68 (d) 134

16. In compound **X**, the number of chiral centres and the number of peptide linkages are, respectively

**X**

- (a) 2,3                      (b) 3,2                      (c) 2,2                      (d) 3,3
17. Which of the following reactions is *NOT* an example of Lewis acid-Lewis base reaction?
- (a)  $\text{Zn} + \text{I}_3^- \rightarrow \text{Zn}^{2+} + 3\text{I}^-$                       (b)  $\text{I}_2 + \text{I}_3^- \rightarrow \text{I}_5^-$   
 (c)  $\text{CoCl}_3 + \text{Cl}^- \rightarrow \text{CoCl}_4^-$                       (d)  $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{HSO}_4^-$
18. A student intended to prepare 1000 mL of a 10 ppm solution of  $\text{K}^+$  from KCl. He made appropriate calculations, weighed the salt accordingly and prepared the solution. However, after making the solution, he realized that the salt he used was  $\text{KNO}_3$  and not KCl. The concentration of  $\text{K}^+$  (ppm) in this prepared solution is
- (a) 7.37                      (b) 10.00                      (c) 13.55                      (d) 3.86
19. Oxide A is soluble in NaOH, oxide B in HCl and oxide C in both. The correct set of A, B and C is
- |     | A             | B                     | C                     |
|-----|---------------|-----------------------|-----------------------|
| (a) | $\text{CO}_2$ | $\text{SO}_2$         | $\text{PbO}_2$        |
| (b) | $\text{CO}_2$ | $\text{Na}_2\text{O}$ | $\text{ZnO}$          |
| (c) | $\text{SO}_2$ | $\text{ZnO}$          | $\text{SnO}_2$        |
| (d) | $\text{SO}_2$ | $\text{BaO}$          | $\text{Na}_2\text{O}$ |
20. Ascorbic acid (Vitamin C), a naturally occurring water soluble vitamin and abundantly found in lemon, shows antioxidant properties. In ascorbic acid, the OH with the lowest pKa is

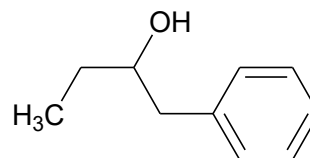
- (a) 1  
 (b) 2  
 (c) 3  
 (d) 4



Ascorbic Acid

21. Compound '**X**' ( $\text{C}_7\text{H}_{12}\text{O}_2$ ) gives - i) a positive silver mirror test and ii) a yellow precipitate on treatment with  $\text{I}_2/\text{NaOH}$ . The compound '**X**' is
- (a) 2-hydroxy-3,3-dimethylcyclopentanone                      (b) 2,5-heptanedione  
 (c) 2,2-dimethyl-3-oxopentanal                      (d) 2,2-dimethyl-4-oxopentanal

22. If the ratio of the concentrations of the oxidized and reduced forms of a species in an electrochemical reaction can be given as  $[\text{Ox}]/[\text{Red}] = 1.0 \times 10^{-3}$ , the correct expression among the following at  $25^\circ\text{C}$  is
- (a)  $E = E^\circ + \frac{1}{3}(0.0592/n)$  (b)  $E - E^\circ = 3 \times (0.0592/n)$   
 (c)  $E = E^\circ - \frac{1}{3}(0.0592/n)$  (d)  $E - E^\circ = (0.0592/n)^{1/3}$
23. Among the following numbers, the one in which all the zeros are significant is
- (a) 0.0004 (b) 0.0400 (c) 40.000 (d) 0.0040
24. Among the following sets of compounds, the one in which a reaction between them followed by hydrolysis that *does not* lead to the formation of 1-phenyl-2-butanol is
- (a) phenylacetaldehyde and ethylmagnesium bromide  
 (b) butanal and phenylmagnesium bromide  
 (c) propanal and benzylmagnesium bromide  
 (d) 1-phenyl-2-butanone and  $\text{NaBH}_4$



1-phenyl-2-butanol

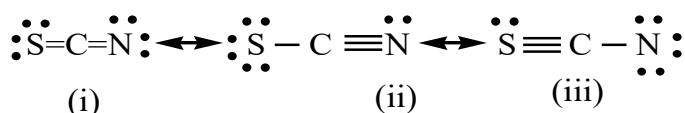
A-2

ANY NUMBER OF OPTIONS 4, 3, 2 or 1 MAY BE CORRECT

MARKS WILL BE AWARDED ONLY IF ALL CORRECT OPTIONS ARE BUBBLED, AND NO WRONG OPTION

25. At room temperature,  $\text{NaCl(s)}$  and  $\text{KCl(s)}$  were taken in equal masses and dissolved in equal volumes of water in two separate closed containers I and II respectively. Of the following, correct option/s is/are
- (a) To compare molarities in (I) and (II), masses of both the solutions need to be known
  - (b) Molalities cannot be compared without measuring the mass of water added in each case
  - (c) If (I) and (II) are completely transferred into another container (III),  $[\text{Cl}^-]$  in (III) will be sum of that in (I) and (II)
  - (d) Information given is sufficient to compare the vapour pressures in (I) and (II)
26. In a pair of isomers of molecular formula  $\text{C}_5\text{H}_8$ , both the compounds undergo catalytic hydrogenation to form compounds of molecular formula  $\text{C}_5\text{H}_{10}$ . On ozonolysis followed by oxidative workup ( $\text{H}_2\text{O}_2$ ), one of the isomers gives a diacid ( $\text{C}_5\text{H}_8\text{O}_4$ ) while the other isomer gives a ketoacid ( $\text{C}_5\text{H}_8\text{O}_3$ ). The pair/s which give/s above set of reactions is/are
- (a) 3-ethylcyclopropene and 1-pentyne
  - (b) cyclopentene and 1-methylcyclobutene
  - (c) 1-methylcyclobutene and 3-methylcyclobutene
  - (d) 1,2-dimethylcyclopropene and 3-methylcyclobutene
27. The resonance structures of  $\text{SCN}^-$  are given below along with the S-C and C-N bond lengths

	S-C (in pm)	C-N (in pm)
$\text{SCN}^-$	165	117
Single bond	181	147
Double bond	155	128
Triple bond	-----	116

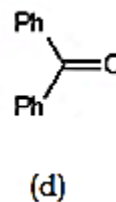
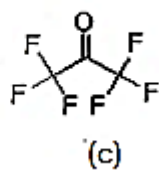
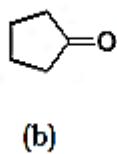
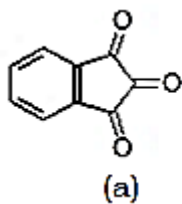


Among the following, the *incorrect* statement/s is/ are

- (a) The contribution from resonance structures (i) and (ii) is more important than that from structure (iii)
- (b) The formal charge on S in structure (iii) is zero
- (c) The degree of contribution of these structures is in the order: i > ii > iii
- (d) The formal charge on N in structure (ii) is zero



28. The compound/s which form/s stable hydrate/s is/are



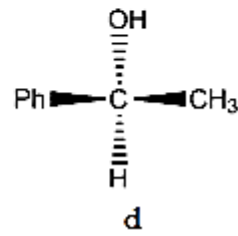
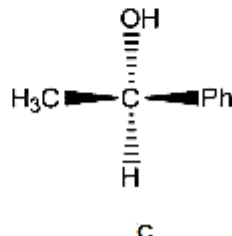
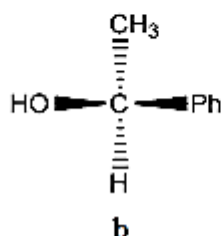
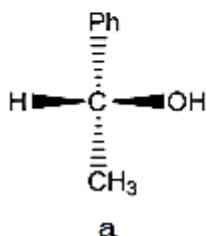
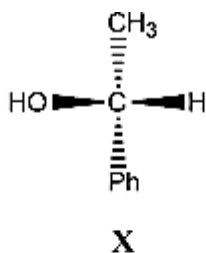
(a) a

(b) b

(c) c

(d) d

29. The formula/e which also represent/s a compound with formula **X** is/are



(a) a

(b) b

(c) c

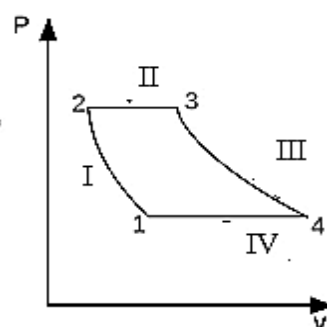
(d) d

30. Following is the  $P$  vs  $V$  plot of a cyclic process  $1 \rightarrow 2$ ,  $2 \rightarrow 3$ ,  $3 \rightarrow 4$ ,  $4 \rightarrow 1$ , denoted as I, II, III and IV respectively for a system of one mole of an ideal gas.

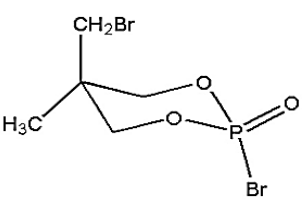
Assume that there is heat exchange between the system and surroundings only in II and IV.

Which of the following is/are correct?

- (a) In II and IV  $\Delta S$  is zero
- (b) In I and III,  $\Delta S$  is zero
- (c) I and III are isothermal and reversible
- (d) In II and IV, change in internal energy of the gas ( $\Delta U$ ) is zero

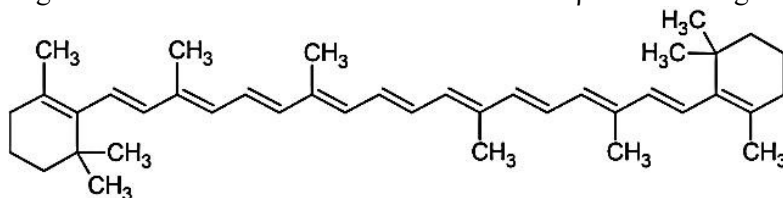


31. For the given compound, % s character of phosphorous hybrid orbitals which contribute to various bonds are given in the table below.

	Bond	% s character
	P=O	40
	P-Br	< 20
	P-O	20

This difference in % 's' character of various phosphorous bonds could be due to

- (a) The large size of bromine atom
  - (b) The large electronegativity difference between P and O
  - (c) Increased overlap of  $\sigma$ -orbitals of terminal P-O bond
  - (d) Stronger covalent character of P-O in cyclic oxygen atoms
32.  $\beta$ -carotene and related compounds are plant pigments that give red, orange and yellow vegetables their vibrant colour. The structure of  $\beta$ -carotene is given below.



It is approved as a food additive in many countries. The correct statement/s that describe/s  $\beta$ -carotene is/are

- (a) It is a strong oxidizing agent
- (b) It reacts with singlet oxygen, an excited form of  $O_2$ , to produce an epoxide
- (c) It absorbs red/yellow light of electromagnetic spectrum
- (d) It comes in the oil phase when carrots are cooked in oil and water in a curry

## IUPAC Periodic Table of the Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H hydrogen 1.00784(7)	2 He helium 4.002602(2)	3 Li lithium 6.941(1)	4 Be beryllium 9.012182(2)	5 B boron 10.811(7)	6 C carbon 12.0107(8)	7 N nitrogen 14.00643(6)	8 O oxygen 15.999(7)	9 F fluorine 18.9984032(5)	10 Ne neon 20.1797(6)	11 Na sodium 22.98976928(2)	12 Mg magnesium 24.304(6)	13 Al aluminum 26.9815385(3)	14 Si silicon 28.0855(3)	15 P phosphorus 30.973761998(5)	16 S sulfur 32.059(5)	17 Cl chlorine 35.45(3)	18 Ar argon 39.948(1)
19 K potassium 39.0983(1)	20 Ca calcium 40.078(4)	21 Sc scandium 44.955912(2)	22 Ti titanium 47.867(1)	23 V vanadium 50.9415(1)	24 Cr chromium 51.9961(6)	25 Mn manganese 54.938044(3)	26 Fe iron 55.845(2)	27 Co cobalt 58.933194(6)	28 Ni nickel 58.6934(4)	29 Cu copper 63.546(3)	30 Zn zinc 65.38(4)	31 Ga gallium 69.723(1)	32 Ge germanium 72.630(8)	33 As arsenic 74.921595(6)	34 Se selenium 78.9718(8)	35 Br bromine 79.904(1)	36 Kr krypton 83.798(2)
37 Rb rubidium 85.468(4)	38 Sr strontium 87.62(3)	39 Y yttrium 88.90584(2)	40 Zr zirconium 91.224(2)	41 Nb niobium 92.90638(2)	42 Mo molybdenum 95.94(1)	43 Tc technetium 98.9062(1)	44 Ru ruthenium 101.07(2)	45 Rh rhodium 102.9055(3)	46 Pd palladium 106.42(1)	47 Ag silver 107.8682(4)	48 Cd cadmium 112.411(8)	49 In indium 114.818(8)	50 Sn tin 118.710(7)	51 Sb antimony 121.757(3)	52 Te tellurium 127.603(3)	53 I iodine 126.905(5)	54 Xe xenon 131.29(4)
55 Cs caesium 132.905451962(2)	56 Ba barium 137.327(7)	57-71 lanthanoids	72 Hf hafnium 178.49(2)	73 Ta tantalum 180.94788(2)	74 W tungsten 183.84(1)	75 Re rhenium 186.207(1)	76 Os osmium 190.23(4)	77 Ir iridium 192.222(3)	78 Pt platinum 195.084(3)	79 Au gold 196.966569(4)	80 Hg mercury 200.59(7)	81 Tl thallium 204.384(3)	82 Pb lead 207.2(3)	83 Bi bismuth 208.9804(1)	84 Po polonium [209]	85 At astatine [210]	86 Rn radon [222]
87 Fr francium [223]	88 Ra radium [226]	89-103 actinoids	104 Rf rutherfordium [261]	105 Db dubnium [262]	106 Sg seaborgium [266]	107 Bh bohrium [264]	108 Hs hassium [277]	109 Mt meitnerium [268]	110 Ds darmstadtium [271]	111 Rg roentgenium [272]	112 Cn copernicium [285]	113 Nh nihonium [284]	114 Fl flerovium [289]	115 Mc moscovium [288]	116 Lv livermorium [293]	117 Ts tennessine [294]	118 Og oganesson [294]
113 Nh nihonium [284]	114 Fl flerovium [289]	115 Mc moscovium [288]	116 Lv livermorium [293]	117 Ts tennessine [294]	118 Og oganesson [294]	119 Uue unbinilium [295]	120 Uuh ununilium [296]	121 Uus unununium [297]	122 Uuq ununquadium [298]	123 Uub ununbium [299]	124 Uut ununtrium [301]	125 Uuq ununquadium [302]	126 Uub ununbium [303]	127 Uut ununtrium [304]	128 Uuq ununquadium [305]	129 Uub ununbium [306]	130 Uut ununtrium [307]
131 Uus unununium [307]	132 Uuq ununquadium [308]	133 Uub ununbium [309]	134 Uut ununtrium [310]	135 Uuq ununquadium [311]	136 Uub ununbium [312]	137 Uut ununtrium [313]	138 Uuq ununquadium [314]	139 Uub ununbium [315]	140 Uut ununtrium [316]	141 Uuq ununquadium [317]	142 Uub ununbium [318]	143 Uut ununtrium [319]	144 Uuq ununquadium [320]	145 Uub ununbium [321]	146 Uut ununtrium [322]	147 Uuq ununquadium [323]	148 Uub ununbium [324]
149 Uut ununtrium [325]	150 Uuq ununquadium [326]	151 Uub ununbium [327]	152 Uut ununtrium [328]	153 Uuq ununquadium [329]	154 Uub ununbium [330]	155 Uut ununtrium [331]	156 Uuq ununquadium [332]	157 Uub ununbium [333]	158 Uut ununtrium [334]	159 Uuq ununquadium [335]	160 Uub ununbium [336]	161 Uut ununtrium [337]	162 Uuq ununquadium [338]	163 Uub ununbium [339]	164 Uut ununtrium [340]	165 Uuq ununquadium [341]	166 Uub ununbium [342]
167 Uut ununtrium [343]	168 Uuq ununquadium [344]	169 Uub ununbium [345]	170 Uut ununtrium [346]	171 Uuq ununquadium [347]	172 Uub ununbium [348]	173 Uut ununtrium [349]	174 Uuq ununquadium [350]	175 Uub ununbium [351]	176 Uut ununtrium [352]	177 Uuq ununquadium [353]	178 Uub ununbium [354]	179 Uut ununtrium [355]	180 Uuq ununquadium [356]	181 Uub ununbium [357]	182 Uut ununtrium [358]	183 Uuq ununquadium [359]	184 Uub ununbium [360]
185 Uut ununtrium [361]	186 Uuq ununquadium [362]	187 Uub ununbium [363]	188 Uut ununtrium [364]	189 Uuq ununquadium [365]	190 Uub ununbium [366]	191 Uut ununtrium [367]	192 Uuq ununquadium [368]	193 Uub ununbium [369]	194 Uut ununtrium [370]	195 Uuq ununquadium [371]	196 Uub ununbium [372]	197 Uut ununtrium [373]	198 Uuq ununquadium [374]	199 Uub ununbium [375]	200 Uut ununtrium [376]	201 Uuq ununquadium [377]	202 Uub ununbium [378]
203 Uut ununtrium [379]	204 Uuq ununquadium [380]	205 Uub ununbium [381]	206 Uut ununtrium [382]	207 Uuq ununquadium [383]	208 Uub ununbium [384]	209 Uut ununtrium [385]	210 Uuq ununquadium [386]	211 Uub ununbium [387]	212 Uut ununtrium [388]	213 Uuq ununquadium [389]	214 Uub ununbium [390]	215 Uut ununtrium [391]	216 Uuq ununquadium [392]	217 Uub ununbium [393]	218 Uut ununtrium [394]	219 Uuq ununquadium [395]	220 Uub ununbium [396]
221 Uut ununtrium [397]	222 Uuq ununquadium [398]	223 Uub ununbium [399]	224 Uut ununtrium [400]	225 Uuq ununquadium [401]	226 Uub ununbium [402]	227 Uut ununtrium [403]	228 Uuq ununquadium [404]	229 Uub ununbium [405]	230 Uut ununtrium [406]	231 Uuq ununquadium [407]	232 Uub ununbium [408]	233 Uut ununtrium [409]	234 Uuq ununquadium [410]	235 Uub ununbium [411]	236 Uut ununtrium [412]	237 Uuq ununquadium [413]	238 Uub ununbium [414]
239 Uut ununtrium [415]	240 Uuq ununquadium [416]	241 Uub ununbium [417]	242 Uut ununtrium [418]	243 Uuq ununquadium [419]	244 Uub ununbium [420]	245 Uut ununtrium [421]	246 Uuq ununquadium [422]	247 Uub ununbium [423]	248 Uut ununtrium [424]	249 Uuq ununquadium [425]	250 Uub ununbium [426]	251 Uut ununtrium [427]	252 Uuq ununquadium [428]	253 Uub ununbium [429]	254 Uut ununtrium [430]	255 Uuq ununquadium [431]	256 Uub ununbium [432]
257 Uut ununtrium [433]	258 Uuq ununquadium [434]	259 Uub ununbium [435]	260 Uut ununtrium [436]	261 Uuq ununquadium [437]	262 Uub ununbium [438]	263 Uut ununtrium [439]	264 Uuq ununquadium [440]	265 Uub ununbium [441]	266 Uut ununtrium [442]	267 Uuq ununquadium [443]	268 Uub ununbium [444]	269 Uut ununtrium [445]	270 Uuq ununquadium [446]	271 Uub ununbium [447]	272 Uut ununtrium [448]	273 Uuq ununquadium [449]	274 Uub ununbium [450]
275 Uut ununtrium [451]	276 Uuq ununquadium [452]	277 Uub ununbium [453]	278 Uut ununtrium [454]	279 Uuq ununquadium [455]	280 Uub ununbium [456]	281 Uut ununtrium [457]	282 Uuq ununquadium [458]	283 Uub ununbium [459]	284 Uut ununtrium [460]	285 Uuq ununquadium [461]	286 Uub ununbium [462]	287 Uut ununtrium [463]	288 Uuq ununquadium [464]	289 Uub ununbium [465]	290 Uut ununtrium [466]	291 Uuq ununquadium [467]	292 Uub ununbium [468]
293 Uut ununtrium [469]	294 Uuq ununquadium [470]	295 Uub ununbium [471]	296 Uut ununtrium [472]	297 Uuq ununquadium [473]	298 Uub ununbium [474]	299 Uut ununtrium [475]	300 Uuq ununquadium [476]	301 Uub ununbium [477]	302 Uut ununtrium [478]	303 Uuq ununquadium [479]	304 Uub ununbium [480]	305 Uut ununtrium [481]	306 Uuq ununquadium [482]	307 Uub ununbium [483]	308 Uut ununtrium [484]	309 Uuq ununquadium [485]	310 Uub ununbium [486]
311 Uut ununtrium [487]	312 Uuq ununquadium [488]	313 Uub ununbium [489]	314 Uut ununtrium [490]	315 Uuq ununquadium [491]	316 Uub ununbium [492]	317 Uut ununtrium [493]	318 Uuq ununquadium [494]	319 Uub ununbium [495]	320 Uut ununtrium [496]	321 Uuq ununquadium [497]	322 Uub ununbium [498]	323 Uut ununtrium [499]	324 Uuq ununquadium [500]	325 Uub ununbium [501]	326 Uut ununtrium [502]	327 Uuq ununquadium [503]	328 Uub ununbium [504]
329 Uut ununtrium [505]	330 Uuq ununquadium [506]	331 Uub ununbium [507]	332 Uut ununtrium [508]	333 Uuq ununquadium [509]	334 Uub ununbium [510]	335 Uut ununtrium [511]	336 Uuq ununquadium [512]	337 Uub ununbium [513]	338 Uut ununtrium [514]	339 Uuq ununquadium [515]	340 Uub ununbium [516]	341 Uut ununtrium [517]	342 Uuq ununquadium [518]	343 Uub ununbium [519]	344 Uut ununtrium [520]	345 Uuq ununquadium [521]	346 Uub ununbium [522]
347 Uut ununtrium [523]	348 Uuq ununquadium [524]	349 Uub ununbium [525]	350 Uut ununtrium [526]	351 Uuq ununquadium [527]	352 Uub ununbium [528]	353 Uut ununtrium [529]	354 Uuq ununquadium [530]	355 Uub ununbium [531]	356 Uut ununtrium [532]	357 Uuq ununquadium [533]	358 Uub ununbium [534]	359 Uut ununtrium [535]	360 Uuq ununquadium [536]	361 Uub ununbium [537]	362 Uut ununtrium [538]	363 Uuq ununquadium [539]	364 Uub ununbium [540]
365 Uut ununtrium [541]	366 Uuq ununquadium [542]	367 Uub ununbium [543]	368 Uut ununtrium [544]	369 Uuq ununquadium [545]	370 Uub ununbium [546]	371 Uut ununtrium [547]	372 Uuq ununquadium [548]	373 Uub ununbium [549]	374 Uut ununtrium [550]	375 Uuq ununquadium [551]	376 Uub ununbium [552]	377 Uut ununtrium [553]	378 Uuq ununquadium [554]	379 Uub ununbium [555]	380 Uut ununtrium [556]	381 Uuq ununquadium [557]	382 Uub ununbium [558]
383 Uut ununtrium [559]	384 Uuq ununquadium [560]	385 Uub ununbium [561]	386 Uut ununtrium [562]	387 Uuq ununquadium [563]	388 Uub ununbium [564]	389 Uut ununtrium [565]	390 Uuq ununquadium [566]	391 Uub ununbium [567]	392 Uut ununtrium [568]	393 Uuq ununquadium [569]	394 Uub ununbium [570]	395 Uut ununtrium [571]	396 Uuq ununquadium [572]	397 Uub ununbium [573]	398 Uut ununtrium [574]	399 Uuq ununquadium [575]	400 Uub ununbium [576]
401 Uut ununtrium [577]	402 Uuq ununquadium [578]	403 Uub ununbium [579]	404 Uut ununtrium [580]	405 Uuq ununquadium [581]	406 Uub ununbium [582]	407 Uut ununtrium [583]	408 Uuq ununquadium [584]	409 Uub ununbium [585]	410 Uut ununtrium [586]	411 Uuq ununquadium [587]	412 Uub ununbium [588]	413 Uut ununtrium [589]	414 Uuq ununquadium [590]	415 Uub ununbium [591]	416 Uut ununtrium [592]	417 Uuq ununquadium [593]	418 Uub ununbium [594]
419 Uut ununtrium [595]	420 Uuq ununquadium [596]	421 Uub ununbium [597]	422 Uut ununtrium [598]	423 Uuq ununquadium [599]	424 Uub ununbium [600]	425 Uut ununtrium [601]	426 Uuq ununquadium [602]	427 Uub ununbium [603]	428 Uut ununtrium [604]	429 Uuq ununquadium [605]	430 Uub ununbium [606]	431 Uut ununtrium [607]	432 Uuq ununquadium [608]	433 Uub ununbium [609]	434 Uut ununtrium [610]	435 Uuq ununquadium [611]	436 Uub ununbium [612]
437 Uut ununtrium [613]	438 Uuq ununquadium [614]	439 Uub ununbium [615]	440 Uut ununtrium [616]	441 Uuq ununquadium [617]	442 Uub ununbium [618]	443 Uut ununtrium [619]	444 Uuq ununquadium [620]	445 Uub ununbium [621]	446 Uut ununtrium [622]	447 Uuq ununquadium [623]	448 Uub ununbium [624]	449 Uut ununtrium [625]	450 Uuq ununquadium [626]	451 Uub ununbium [627]	452 Uut ununtrium [628]	453 Uuq ununquadium [629]	454 Uub ununbium [630]
455 Uut ununtrium [631]	456 Uuq ununquadium [632]	457 Uub ununbium [633]	458 Uut ununtrium [634]	459 Uuq ununquadium [635]	460 Uub ununbium [636]	461 Uut ununtrium [637]	462 Uuq ununquadium [638]	463 Uub ununbium [639]	464 Uut ununtrium [640]	465 Uuq ununquadium [641]	466 Uub ununbium [642]	467 Uut ununtrium [643]	468 Uuq ununquadium [644]	469 Uub ununbium [645]	470 Uut ununtrium [646]	471 Uuq ununquadium [647]	472 Uub ununbium [648]
473 Uut ununtrium [649]	474 Uuq ununquadium [650]	475 Uub ununbium [651]	476 Uut ununtrium [652]	477 Uuq ununquadium [653]	478 Uub ununbium [654]	479 Uut ununtrium [655]	480 Uuq ununquadium [656]	481 Uub ununbium [657]	482 Uut ununtrium [658]	483 Uuq ununquadium [659]	484 Uub ununbium [660]	485 Uut ununtrium [661]	486 Uuq ununquadium [662]	487 Uub ununbium [663]	488 Uut ununtrium [664]	489 Uuq ununquadium [665]	490 Uub ununbium [666]
491 Uut ununtrium [667]	492 Uuq ununquadium [668]	493 Uub ununbium [669]	494 Uut ununtrium [670]	495 Uuq ununquadium [671]	496 Uub ununbium [672]	497 Uut ununtrium [673]	498 Uuq ununquadium [674]	499 Uub ununbium [675]	500 Uut ununtrium [676]	501 Uuq ununquadium [677]	502 Uub ununbium [678]	503 Uut ununtrium [679]	504 Uuq ununquadium [680]	505 Uub ununbium [681]	506 Uut ununtrium [682]	507 Uuq ununquadium [683]	508 Uub ununbium [684]
509 Uut ununtrium [685]	510 Uuq ununquadium [686]	511 Uub ununbium [687]	512 Uut ununtrium [688]	513 Uuq ununquadium [689]	514 Uub ununbium [690]	515 Uut ununtrium [691]	516 Uuq ununquadium [692]	517 Uub ununbium [693]	518 Uut ununtrium [694]	519 Uuq ununquadium [695]	520 Uub ununbium [696]	521 Uut ununtrium [697]	522 Uuq ununquadium [698]	523 Uub ununbium [699]	524 Uut ununtrium [700]	525 Uuq ununquadium [701]	526 Uub ununbium [702]
527 Uut ununtrium [703]	528 Uuq ununquadium [704]	529 Uub ununbium [705]	530 Uut ununtrium [706]	531 Uuq ununquadium [707]	532 Uub 												

## **ROUGH WORK**