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| **Entrance Examination**  **March 2022** |
| **CHEMISTRY**  Time allowed: 1.5 hours (90 minutes)  **Answer TWO questions**  You may use a calculator and a periodic table |

1. This question is associated with alkenes and alkynes.
2. Describe and provide a diagram showing the different types of bonding present in 1,1,2,2-tetrachloroethene (PerkloneTM, a solvent used in dry cleaning). Give the shape and approximate bond angles for the carbon atoms.
3. Give the shape and approximate bond angles for the carbon atoms in trichloro­ethene (TrikloneTM, a solvent used in the chemical industry). How many isomers are possible?
4. How many isomers are possible for dichloroethene?
5. How many isomers are possible for chloroethene (vinyl chloride, the monomer for PVC)?
6. In 1971, a major chemical company found that the trichloroethene that it was using in a large-scale process was degrading to dichloroethyne, a highly unstable compound. Describe and provide a diagram showing the different types of bonding present in dichloroethyne. Give the shape and approximate bond angles for the carbon atoms.
7. You have a 21.90 cm3 (mL) of 0.00400 M solution of potassium permanganate (KMnO4). This was titrated with 20.0 cm3 of a solution of Fe (II) sulfate. The two half-reactions are:

MnO4- + 8 H+ + 5 e- → Mn2+ + 4 H2O

Fe2+ → Fe3+ + e-

1. Give the ionic redox equation for the reaction of the permanganate ion (MnO4-) and Fe2+.
2. Work out the concentration of the Fe2+ solution in molar (M) units.
3. The Fe2+ was present as Fe (II) sulfate (FeSO4). What mass of FeSO4 had been dissolved in the 20.0 cm3 of Fe (II) sulfate solution?
4. Define chirality and, with the use of diagrams and/or examples, explain its importance in chemistry and biochemistry.
5. Write an essay about the chemistry of water.

Period

1

2

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3

4

(1091-01A)

5

6

7

**THE PERIODIC TABLE**

**1 2 Group 3 4 5 6 7 0**

s Block

Key

relative atomic

4.00

He

Helium

2

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| --- |
|  |
| 1.01  H  Hydrogen  1 |

p Block

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| *A*r |  |  |
| Symbol Name  Z | |  |
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| 6.94  Li  Lithium  3 | 9.01  Be  Beryllium 4 | mass  atomic number  d Block | | | | | | | | | | 10.8  B  Boron  5 | 12.0  C  Carbon  6 | 14.0  N  Nitrogen  7 | 16.0  O  Oxygen  8 | 19.0  F  Fluorine  9 | 20.2  Ne  Neon  10 |
| 23.0  Na  Sodium  11 | 24.3  Mg  Magnesium  12 | 27.0  Al  Aluminium  13 | 28.1  Si  Silicon  14 | 31.0  P  Phosphorus  15 | 32.1  S  Sulfur  16 | 35.5  Cl  Chlorine  17 | 40.0  Ar  Argon  18 |
| 39.1  K  Potassium  19 | 40.1  Ca  Calcium  20 | 45.0  Sc  Scandium  21 | 47.9  Ti  Titanium  22 | 50.9  V  Vanadium  23 | 52.0  Cr  Chromium  24 | 54.9  Mn  Manganese  25 | 55.8  Fe  Iron  26 | 58.9  Co  Cobalt  27 | 58.7  Ni  Nickel  28 | 63.5  Cu  Copper  29 | 65.4  Zn  Zinc  30 | 69.7  Ga  Gallium  31 | 72.6  Ge  Germanium  32 | 74.9  As  Arsenic  33 | 79.0  Se  Selenium  34 | 79.9  Br  Bromine  35 | 83.8  Kr  Krypton  36 |
| 85.5  Rb  Rubidium  37 | 87.6  Sr  Strontium  38 | 88.9  Y  Yttrium  39 | 91.2  Zr  Zirconium  40 | 92.9  Nb  Niobium  41 | 95.9  Mo  Molybdenum  42 | 98.9  Tc  Technetium  43 | 101  Ru  Ruthenium  44 | 103  Rh  Rhodium  45 | 106  Pd  Palladium  46 | 108  Ag  Silver  47 | 112  Cd  Cadmium  48 | 115  In  Indium  49 | 119  Sn  Tin  50 | 122  Sb  Antimony  51 | 128  Te  Tellurium  52 | 127  I  Iodine  53 | 131  Xe  Xenon  54 |
| 133  Cs  Caesium  55 | 137  Ba  Barium  56 | 139 ‣  La  Lanthanum  57 | 179  Hf  Hafnium  72 | 181  Ta  Tantalum  73 | 184  W  Tungsten  74 | 186  Re  Rhenium  75 | 190  Os  Osmium  76 | 192  Ir  Iridium  77 | 195  Pt  Platinum  78 | 197  Au  Gold  79 | 201  Hg  Mercury  80 | 204  Tl  Thallium  81 | 207  Pb  Lead  82 | 209  Bi  Bismuth  83 | (210)  Po  Polonium  84 | (210)  At  Astatine  85 | (222)  Rn  Radon  86 |
| (223)  Fr  Francium  87 | (226)  Ra  Radium  88 | (227)  Ac ‣‣  Actinium  89 | f Block | | | | | | | | | | | | | | |

* Lanthanoid elements

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 140  Ce  Cerium 58 | 141  Pr  Praseodymium  59 | 144  Nd  Neodymium  60 | (147)  Pm  Promethium  61 | 150  Sm  Samarium  62 | (153)  Eu  Europium  63 | 157  Gd  Gadolinium  64 | 159  Tb  Terbium 65 | 163  Dy  Dysprosium  66 | 165  Ho  Holmium 67 | 167  Er  Erbium 68 | 169  Tm  Thulium 69 | 173  Yb  Ytterbium 70 | 175  Lu  Lutetium 71 |

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elements

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| 232  Th  Thorium 90 | (231)  Pa  Protactinium  91 | 238  U  Uranium 92 | (237)  Np  Neptunium  93 | (242)  Pu  Plutonium  94 | (243)  Am  Americium  95 | (247)  Cm  Curium 96 | (245)  Bk  Berkelium 97 | (251)  Cf  Californium  98 | (254)  Es  Einsteinium  99 | (253)  Fm  Fermium 100 | (256)  Md  Mendelevium  101 | (254)  No  Nobelium 102 | (257)  Lr  Lawrencium  103 |

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