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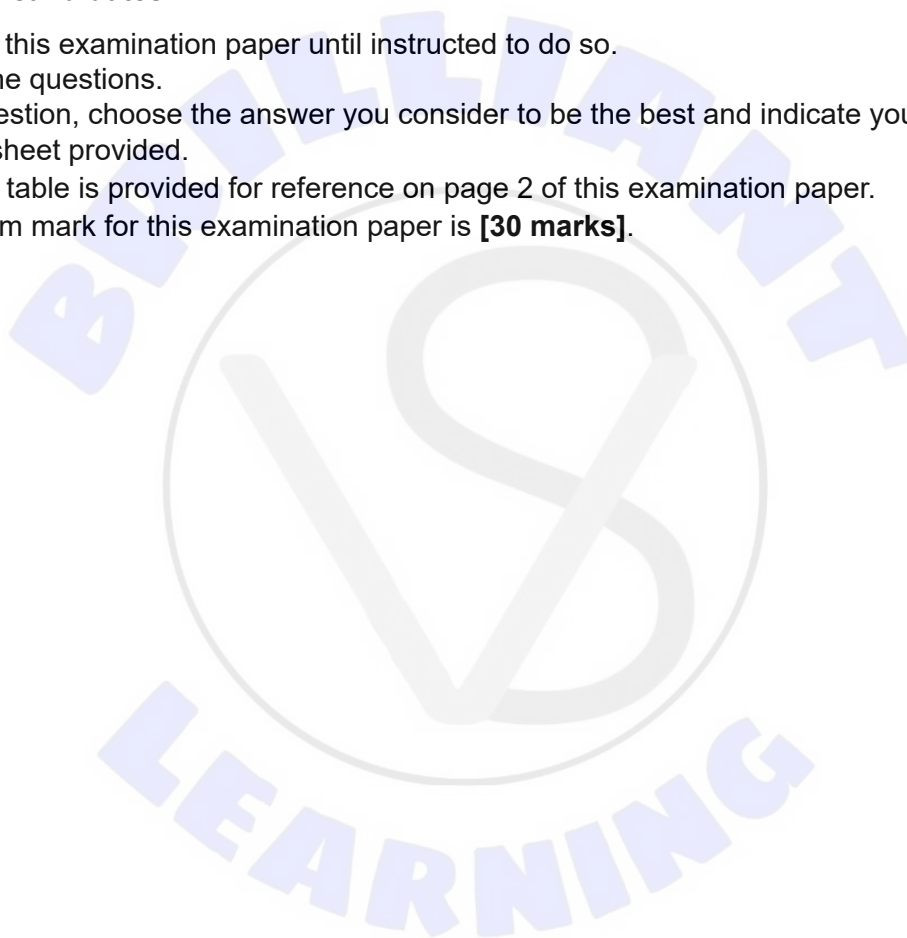
Chemistry
Standard level
Paper 1

Wednesday 22 May 2019 (afternoon)

45 minutes

Instructions to candidates

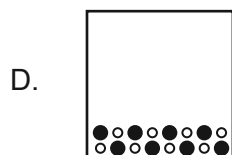
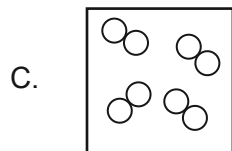
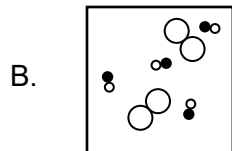
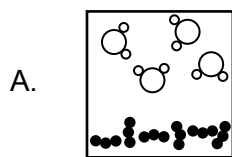
- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The periodic table is provided for reference on page 2 of this examination paper.
- The maximum mark for this examination paper is **[30 marks]**.



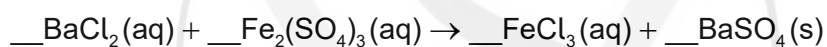
The Periodic Table

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |
|---|---------------------------|---------------------------|-----------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--|
| 1 | 1 H 1.01 | Atômico number | | | | | | | | | | | | | | | | | |
| 2 | 3 Li 6.94 | 4 Be 9.01 | Element | | | | | | | | | | | | | | | | |
| 3 | 11 Na 22.99 | 12 Mg 24.31 | Relative atomic mass | | | | | | | | | | | | | | | | |
| 4 | 19 K 39.10 | 20 Ca 40.08 | 21 Sc 44.96 | 22 Ti 47.87 | 23 V 50.94 | 24 Cr 52.00 | 25 Mn 54.94 | 26 Fe 55.85 | 27 Co 58.93 | 28 Ni 58.69 | 29 Cu 63.55 | 30 Zn 65.38 | 31 Ga 69.72 | 32 Ge 72.63 | 33 As 74.92 | 34 Se 78.96 | 35 Br 79.90 | 36 Kr 83.90 | |
| 5 | 37 Rb 85.47 | 38 Sr 87.62 | 39 Y 88.91 | 40 Zr 91.22 | 41 Nb 92.91 | 42 Mo 95.96 | 43 Tc (98) | 44 Ru 101.07 | 45 Rh 102.91 | 46 Pd 106.42 | 47 Ag 107.87 | 48 Cd 112.41 | 49 In 114.82 | 50 Sn 118.71 | 51 Sb 121.76 | 52 Te 127.60 | 53 I 126.90 | 54 Xe 131.29 | |
| 6 | 55 Cs 132.91 | 56 Ba 137.33 | 57 † La 138.91 | 72 Hf 178.49 | 73 Ta 180.95 | 74 W 183.84 | 75 Re 186.21 | 76 Os 190.23 | 77 Ir 192.22 | 78 Pt 195.08 | 79 Au 196.97 | 80 Hg 200.59 | 81 Tl 204.38 | 82 Pb 207.2 | 83 Bi 208.98 | 84 Po (209) | 85 At (210) | 86 Rn (222) | |
| 7 | 87 Fr (223) | 88 Ra (226) | 89 † Ac (227) | 104 Rf (267) | 105 Db (268) | 106 Sg (269) | 107 Bh (270) | 108 Hs (269) | 109 Mt (278) | 110 Ds (281) | 111 Rg (281) | 112 Cn (285) | 113 Unt (286) | 114 Uug (289) | 115 Uup (288) | 116 Uuh (293) | 117 Uus (294) | 118 Uuo (294) | |
| | | | † | 58 Ce 140.12 | 59 Pr 140.91 | 60 Nd 144.24 | 61 Pm (145) | 62 Sm 150.36 | 63 Eu 151.96 | 64 Gd 157.25 | 65 Tb 158.93 | 66 Dy 162.50 | 67 Ho 164.93 | 68 Er 167.26 | 69 Tm 168.93 | 70 Yb 173.05 | 71 Lu 174.97 | | |
| | | | ‡ | 90 Th 232.04 | 91 Pa 231.04 | 92 U 238.03 | 93 Np (237) | 94 Pu (244) | 95 Am (243) | 96 Cm (247) | 97 Bk (247) | 98 Cf (251) | 99 Es (252) | 100 Fm (257) | 101 Md (258) | 102 No (259) | 103 Lr (262) | | |

1. Which diagram represents a heterogeneous mixture?



2. What is the sum of the coefficients when the equation is balanced with the smallest whole numbers?



- A. 4
- B. 6
- C. 8
- D. 9

3. What is the empirical formula of a hydrocarbon with 75% carbon and 25% hydrogen by mass?

- A. C_3H
- B. CH_2
- C. C_2H_6
- D. CH_4

Turn over

4. Which graph would **not** show a linear relationship for a fixed mass of an ideal gas with all other variables constant?
- P against V
 - P against $\frac{1}{V}$
 - P against T
 - V against T
5. Bromine consists of two stable isotopes that exist in approximately a 1 : 1 ratio. The relative atomic mass, A_r , of bromine is 79.90. Which are the stable isotopes of bromine?
- ^{79}Br and ^{81}Br
 - ^{80}Br and ^{81}Br
 - ^{78}Br and ^{80}Br
 - ^{79}Br and ^{80}Br
6. What is the ground state electron configuration of an atom of chromium, Cr ($Z = 24$)?
- $[\text{Ar}]3d^6$
 - $[\text{Ar}]4s^23d^4$
 - $[\text{Ar}]4s^13d^5$
 - $[\text{Ar}]4s^24p^4$
7. Which describes an atom of bismuth, Bi ($Z = 83$)?

| | Principal energy level number | Number of valence electrons |
|----|-------------------------------|-----------------------------|
| A. | 5 | 3 |
| B. | 5 | 5 |
| C. | 6 | 5 |
| D. | 6 | 15 |

8. What are typical characteristics of metals?

| | Ionization energy | Electron affinity |
|----|-------------------|-------------------|
| A. | low | low |
| B. | high | high |
| C. | high | low |
| D. | low | high |

9. What is the order of increasing boiling point?

- A. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 < \text{CH}_3\text{CH}(\text{OH})\text{CH}_3 < \text{CH}_3\text{COCH}_3 < \text{CH}_3\text{CO}_2\text{H}$
- B. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 < \text{CH}_3\text{COCH}_3 < \text{CH}_3\text{CH}(\text{OH})\text{CH}_3 < \text{CH}_3\text{CO}_2\text{H}$
- C. $\text{CH}_3\text{CO}_2\text{H} < \text{CH}_3\text{COCH}_3 < \text{CH}_3\text{CH}(\text{OH})\text{CH}_3 < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- D. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 < \text{CH}_3\text{COCH}_3 < \text{CH}_3\text{CO}_2\text{H} < \text{CH}_3\text{CH}(\text{OH})\text{CH}_3$

10. Which species does **not** have resonance structures?

- A. C_6H_6
- B. NH_4^+
- C. CO_3^{2-}
- D. O_3

11. Which describes an ionic compound?

| | Melting point | Electrical conductivity of solid |
|----|---------------|----------------------------------|
| A. | high | high |
| B. | high | low |
| C. | low | high |
| D. | low | low |

Turn over

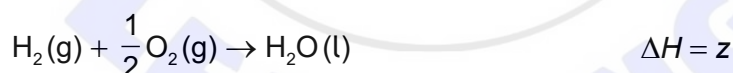
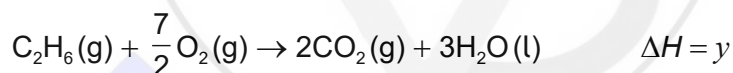
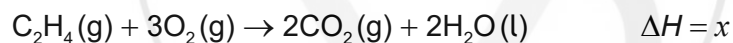
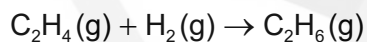
12. Which combination corresponds to a strong metallic bond?

| | Charge on the metal ion | Radius of ion |
|----|-------------------------|---------------|
| A. | large | large |
| B. | large | small |
| C. | small | small |
| D. | small | large |

13. When equal masses of X and Y absorb the same amount of energy, their temperatures rise by 5°C and 10°C respectively. Which is correct?

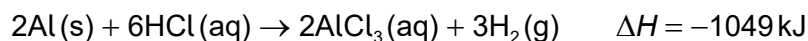
- A. The specific heat capacity of X is twice that of Y.
- B. The specific heat capacity of X is half that of Y.
- C. The specific heat capacity of X is one fifth that of Y.
- D. The specific heat capacity of X is the same as Y.

14. What is the enthalpy change of reaction for the following equation?



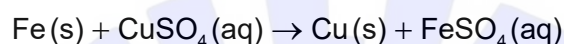
- A. $x + y + z$
- B. $-x - y + z$
- C. $x - y - z$
- D. $x - y + z$

15. Which is correct for the reaction?



- A. Reactants are less stable than products and the reaction is endothermic.
- B. Reactants are more stable than products and the reaction is endothermic.
- C. Reactants are more stable than products and the reaction is exothermic.
- D. Reactants are less stable than products and the reaction is exothermic.

16. Which properties can be monitored to determine the rate of the reaction?



- I. change in volume
- II. change in temperature
- III. change in colour

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

17. Which will increase the rate of reaction between calcium carbonate and hydrochloric acid?

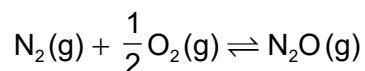
- I. an increase in temperature
- II. an increase in concentration of hydrochloric acid
- III. an increase in particle size of calcium carbonate

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

Turn over

18. K_c for $2\text{N}_2\text{O}(\text{g}) \rightleftharpoons 2\text{N}_2(\text{g}) + \text{O}_2(\text{g})$ is 7.3×10^{34} .

What is K_c for the following reaction, at the same temperature?



- A. 7.3×10^{34}
- B. $\frac{1}{\sqrt{7.3 \times 10^{34}}}$
- C. $\frac{2}{7.3 \times 10^{34}}$
- D. $\frac{1}{2 \times 7.3 \times 10^{34}}$
19. Which solution is basic at 25°C ?

$$K_w = 1.0 \times 10^{-14}$$

- A. $[\text{H}^+] = 1.0 \times 10^{-3} \text{ mol dm}^{-3}$
- B. $[\text{OH}^-] = 1.0 \times 10^{-13} \text{ mol dm}^{-3}$
- C. solution of $\text{pH} = 4.00$
- D. $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-13} \text{ mol dm}^{-3}$
20. Which is **not** a source of oxides of sulfur and nitrogen?
- A. burning coal
- B. internal combustion engines
- C. burning methane
- D. volcanic eruptions

21. Where does oxidation occur in a voltaic cell?
- A. positive electrode and anode
- B. negative electrode and anode
- C. positive electrode and cathode
- D. negative electrode and cathode

22. Which is the species oxidized and the oxidizing agent in the reaction?

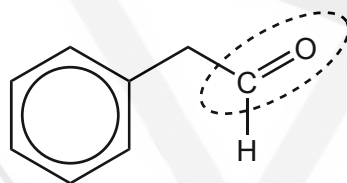


| | Species oxidized | Oxidizing agent |
|----|------------------|-----------------|
| A. | Cl^- | HCl |
| B. | MnO_2 | MnO_2 |
| C. | MnO_2 | HCl |
| D. | Cl^- | MnO_2 |

23. Which product will be obtained at the anode (positive electrode) when molten NaCl is electrolysed?

- A. Na(l)
 B. Cl(g)
 C. $\text{Cl}_2(\text{g})$
 D. Na(s)

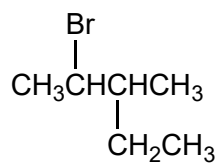
24. Which functional group is surrounded in the molecule?



- A. hydroxyl
 B. carboxyl
 C. carbonyl
 D. ether

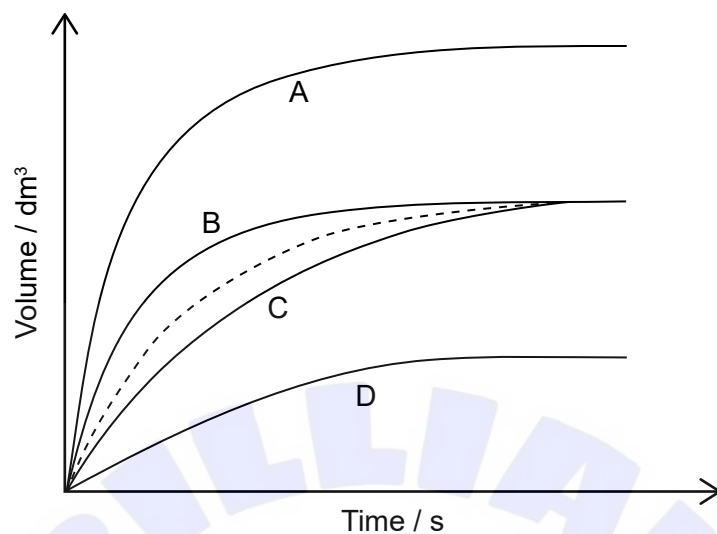
Turn over

25. What is the IUPAC name of the following molecule?



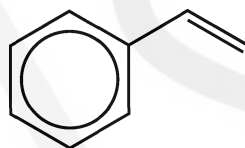
- A. 2-bromo-3-ethylbutane
- B. 3-methyl-4-bromopentane
- C. 2-ethyl-3-bromobutane
- D. 2-bromo-3-methylpentane
26. What is the mechanism of the reaction between alkenes and halogens in the absence of light?
- A. radical substitution
- B. electrophilic substitution
- C. electrophilic addition
- D. nucleophilic substitution
27. Which alcohol would produce a carboxylic acid when heated with acidified potassium dichromate(VI)?
- A. propan-2-ol
- B. butan-1-ol
- C. 2-methylpropan-2-ol
- D. pentan-3-ol
28. How should a measurement of 5.00 g from a balance be recorded?
- A. $5.00 \pm 0.1 \text{ g}$
- B. $5.00 \pm 0.01 \text{ g}$
- C. $5.00 \pm 1 \text{ g}$
- D. $5.00 \pm 0.001 \text{ g}$

29. The dotted line represents the formation of oxygen, $O_2(g)$, from the uncatalysed complete decomposition of hydrogen peroxide, $H_2O_2(aq)$.



Which curve represents a catalysed reaction under the same conditions?

30. What is the degree of unsaturation (index of hydrogen deficiency) for the molecule?



- A. 1
- B. 2
- C. 4
- D. 5