

962/1
CHEMISTRY
PAPER 1
2006
1 ¾ hours

PERSIDANGAN KEBANGSAAN PENGETUA-PENGETUA
SEKOLAH MENGENGAH CAWANGAN MELAKA

PEPERIKSAAN PENGESANAN SIJIL TINGGI PERSEKOLAHAN MALAYSIA 2006

CHEMISTRY (KIMIA)

PAPER 1 (KERTAS 1)

MULTIPLE-CHOICE (ANEKA PILIHAN)

one hour and forty-five minutes (satu jam empat puluh lima minit)

Instructions to candidates:

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.]

There are FIFTY questions in this paper. For each question, four suggested answers are given.

Choose ONE correct answer and indicate it on the multiple-choice answer sheet provided.

Read the instructions on the multiple-choice answer sheet very carefully.

Answer ALL questions. Marks will not be deducted for wrong answers.

This question paper consists of 12 printed pages.
© Hak Cipta PKPSMCM 2006

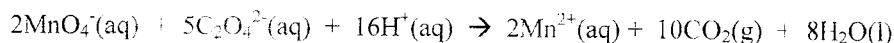
962/1

2

Section A

Four suggested answers labeled **A**, **B**, **C**, and **D** are given for each question. Choose **one** correct answer.

1. Ethanedioate ions, $\text{C}_2\text{O}_4^{2-}$ are oxidized by acidified, aqueous potassium manganate(VII) according to the equation:



What volume of $0.020 \text{ mol dm}^{-3}$ potassium manganate(VII) is required to oxidize completely $1.0 \times 10^{-3} \text{ mol}$ of the salt $\text{KHC}_2\text{O}_4 \cdot \text{H}_2\text{C}_2\text{O}_4$?

- A 20 cm^3 B 40 cm^3 C 50 cm^3 D 125 cm^3

2. Which quantity would best indicate the relative strengths of the hydrogen bond between the molecules in liquid hydrogen halides?

- A bond dissociation energies
B enthalpy changes of solution
C enthalpy changes of formation
D enthalpy changes of vaporization

3. Which of the following exerts the highest pressure?

- A 1 mol of N_2 at 0°C in 11.2 dm^3
B 1 mol of N_2 at 27°C in 22.4 dm^3
C 1 mol of H_2O at 27°C in 1 dm^3
D 1 mol of C_4H_{10} at its normal boiling point

4. In which of the following do the two species represented have the same shape?

- A BH_3 and PH_3
B CO_2 and SiO_2
C SO_3 and CO_3^{2-}
D PCl_4^+ and CH_3^+

5. A substance **cannot** exist as a liquid under room conditions if

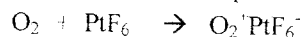
- A its critical pressure is above atmospheric pressure
B its critical pressure is below atmospheric pressure
C its triple point pressure is above atmospheric pressure
D its triple point pressure is below atmospheric pressure

STPM trial 2006 Melaka - CHEMISTRY 1

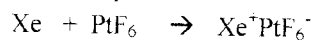
962/1

3

6. Oxygen reacts with platinum(VI) fluoride, PtF_6 as follows:



It was suggested that xenon should react similarly, and in this way, the first noble gas compound was produced.



What is the most likely reason for the suggestion being made?

- A O and Xe have similar atomic radii
- B O and Xe have similar electron affinities
- C O and Xe have similar electron configurations
- D O and Xe have similar first ionization energies

7. Which of the following statements is **true** for a standard cell set up using the half-cells below?

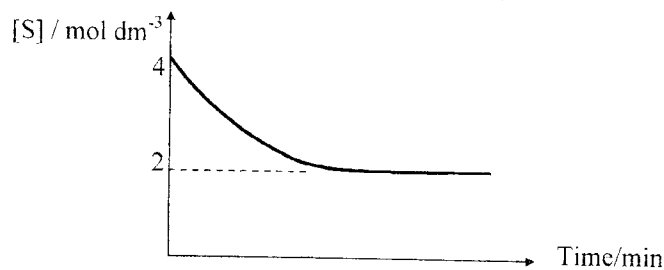
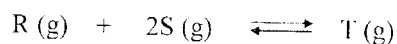


- A Electrons flow in the external circuit from Ni to Sn
- B Reduction occurs at the Ni terminal
- C Concentration of $\text{Sn}^{2+}(\text{aq})$ will increase
- D E.m.f. of the cell will increase on increasing concentration of Ni^{2+}

8. The standard enthalpy changes of formation of carbon dioxide and water are -394 kJmol^{-1} and -286 kJmol^{-1} respectively. If the standard enthalpy change of combustion of propyne, C_3H_4 , is -1938 kJmol^{-1} , what is the standard enthalpy change of formation of C_3H_4 ?

- | | |
|------------------------------|-----------------------------|
| A $+1258 \text{ kJmol}^{-1}$ | B -184 kJmol^{-1} |
| C $+184 \text{ kJmol}^{-1}$ | D -689 kJmol^{-1} |

9. The reaction between R and S was studied using 3 mol dm^{-3} solution of R and 4 mol dm^{-3} solution of S. From the graph below, determine the equilibrium constant, K_c , of the reaction:



- | | |
|---------------------------------------|---------------------------------------|
| A $1/8 \text{ mol}^{-2} \text{ dm}^6$ | B $1/2 \text{ mol}^{-2} \text{ dm}^6$ |
| C $1/4 \text{ mol}^{-2} \text{ dm}^6$ | D $1 \text{ mol}^{-2} \text{ dm}^6$ |

962/1

4

10. The solubility product of calcium fluoride in water at 20°C is $3.2 \times 10^{-11} \text{ mol}^3 \text{ dm}^{-9}$. Calculate the solubility of calcium fluoride in 0.2 mol dm^{-3} sodium fluoride solution.

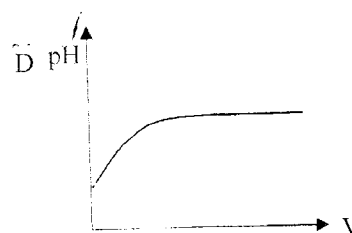
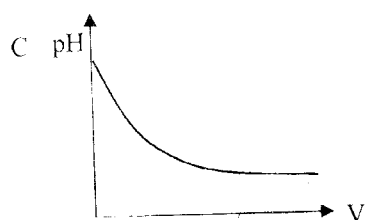
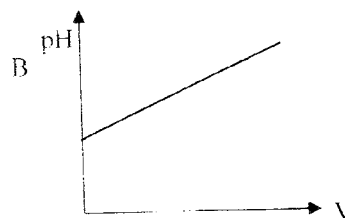
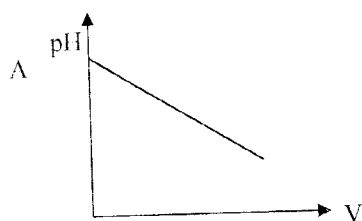
A $2.0 \times 10^{-10} \text{ mol dm}^{-3}$

B $2.0 \times 10^{-4} \text{ mol dm}^{-3}$

C $8.0 \times 10^{-10} \text{ mol dm}^{-3}$

D $3.2 \times 10^{-4} \text{ mol dm}^{-3}$

11. A sample of 1 mol of ethanoic acid is diluted at constant temperature to a volume of V. Which diagram shows the correct change of pH against V?



12. Stomach juice has a pH of 1.0. Aspirin is a monobasic acid represented by HA ($K_a = 10^{-4} \text{ mol dm}^{-3}$) which dissociates into ions of H^+ and A^- . What are the relative concentration of H^+ , A^- and HA when aspirin from a tablet enters the stomach?

A $[\text{H}^+] > [\text{HA}] > [\text{A}^-]$

B $[\text{H}^+] > [\text{A}^-] > [\text{HA}]$

C $[\text{HA}] > [\text{H}^+] = [\text{A}^-]$

D $[\text{H}^+] = [\text{A}^-] > [\text{HA}]$

13. At 300K, the rate constant for a reaction is 8.78 s^{-1} . At 310K, the rate constant is 22.9 s^{-1} . The activation energy of this reaction is (gas constant, $R = 8.31 \text{ JK}^{-1} \text{ mol}^{-1}$, Arrhenius equation: $k = Ae^{-E/RT}$)

A 54.1 kJmol^{-1}

B 74.1 kJmol^{-1}

C -54.1 kJmol^{-1}

D -74.1 kJmol^{-1}

14. At 95°C, the vapour pressure of water is 84.5 kPa and the vapour pressure of bromobenzene, $\text{C}_6\text{H}_5\text{Br}$ is 15.5 kPa. Calculate the mass of water required to steam distill 10.0 g of bromobenzene when the atmospheric pressure is 100.0 kPa. (r.a.m of: C, 12; H, 1; Br, 80; O, 16)

A 16.0g

B 8.00g

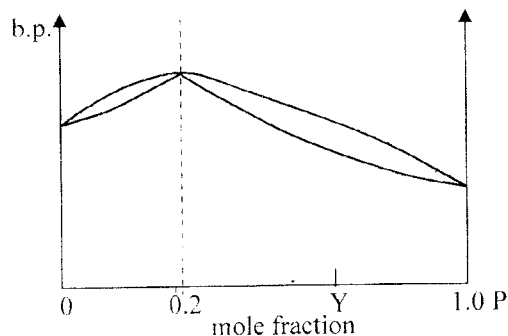
C 7.25g

D 6.25g

962/1

5

15. A liquid mixture P and Q has the b.p-composition diagram as shown below.



Which of the following is **true** of the liquid mixture above ?

- A The solution shows positive deviation from Raoult's law .
 B Upon mixing of P and Q, volume slightly increases.
 C When solution Y is fractionally distilled, the distillate is pure P.
 D Vapour pressure of pure Q is higher than that of pure P.
16. Which property of the first six elements of Period 3 (sodium to sulphur) continuously increases numerically?
- A Atomic radius
 B First ionisation energy
 C Maximum oxidation number in oxide
 D Melting point
17. Which of the following sets of physical properties is that of an element in Group 2 of the Periodic Table?

	Melting point / °C	Density / gcm ⁻³	Electrical Conductivity / ohm ⁻¹ m ⁻¹
A	98	0.97	2.4 x 10 ⁷
B	113	2.07	5.0 x 10 ⁻¹⁶
C	649	1.74	2.2 x 10 ⁷
D	1744	11.30	6.0 x 10 ⁷

18. The chloride of an element X is a liquid which has a boiling point of 76°C and fumes in air. After mixing 0.010 mol of the chloride with water, the resulting solution required 100 cm³ of 0.30 moldm⁻³ silver nitrate for complete precipitation of the chloride ion. In which group in the Periodic Table is element X likely to be located?
- A Group 1
 B Group 13
 C Group 15
 D Group 17

STPM trial 2006 Melaka - CHEMISTRY 1

962/1

6

19. AlCl_3 reacts with LiAlH_4 and $(\text{CH}_3)_3\text{N}$ to give $(\text{CH}_3)_3\text{NAlH}_3$. Which of the following statements is **true** about $(\text{CH}_3)_3\text{NAlH}_3$?

- A The Al atom is tetrahedrally coordinated
- B The Al atom is electron deficient
- C It is optically active
- D It contains hydrogen bonding

20. Solder is an alloy of tin and lead. A sample of solder is heated in an excess of oxygen and is then allowed to cool at room temperature. The residue will contain

- A Sn and PbO
- B SnO and PbO_2
- C SnO_2 and PbO
- D SnO_2 and PbO_2

21. Which of the following does **not** involve the lone pair of electrons on the nitrogen atom of the ammonia molecule?

- A The formation of NH_4^+ ions in aqueous ammonia
- B The dissolving of silver chloride in aqueous ammonia
- C The formation of NH_2^- ions during the reaction of ammonia with sodium
- D The hydrogen bonding that occurs between molecules of ammonia

22. Which of the following statements explains the observation that magnesium hydroxide dissolves in aqueous ammonium chloride, but not in aqueous sodium chloride?

- A The ammonium ion acts as an acid
- B Ammonium chloride dissociates less fully than sodium chloride
- C The ammonium ion changes the solubility product of magnesium hydroxide
- D Ammonium hydroxide is first formed, and then acts through a common ion effect

23. Which of the following compounds reacts with chlorine under specific condition to give two products in which chlorine has different oxidation numbers?

- A Sulphuric acid
- B Sodium hydroxide
- C Potassium iodide
- D Potassium iodate(V)

24. Which of the following compounds would give coloured fumes on warming with concentrated sulphuric acid?

- A Sodium bromide
- B Sodium carbonate
- C Sodium chloride
- D Sodium ethanoate

STPM trial 2006 Melaka - CHEMISTRY 1

962/1

7

25. The table below shows the possible oxidation states of five d-block elements in the Periodic Table. The elements are represented by letters which are **not** their symbols.

Element	Possible oxidation numbers						
W	-	-	3	-	-	-	-
X	1	2	3	4	5	-	-
Y	-	-	3	4	5	6	-
Z	-	2	-	4	5	6	7

Which of the following ions is likely to exist?

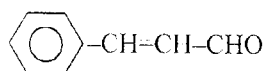
- A WO_2^-
- B XO_4^{2-}
- C YO_4
- D ZO_2^{2+}

26. Letters written on paper using aqueous ammonium thiocyanate are invisible until turned blood-red by brushing the paper with aqueous iron(III) chloride. If the ammonium thiocyanate is first made alkaline, the letters are brown and less clear.

Which of the following substances, when formed on the paper in these reactions, best explains these observations?

- | | With aqueous ammonium thiocyanate | With alkaline aqueous ammonium thiocyanate |
|---|-----------------------------------|--|
| A | Fe-NH_3 complex | Fe(OH)_3 |
| B | Fe-SCN^- complex | Fe-NH_3 complex |
| C | Fe-SCN^- complex | Fe(OH)_3 |
| D | Fe-SCN^- complex | Fe-OH^- complex |

27. The odour of cinnamon oil is due to cinnamaldehyde, $\text{C}_9\text{H}_8\text{O}$. What is the hybridisation of each carbon atom in cinnamaldehyde? How many σ bonds and how many π bonds does cinnamaldehyde have?



structure of cinamaldehyde

- | | hybridisation | σ | π |
|---|---------------|----------|-------|
| A | sp^3 | 12 | 7 |
| B | sp^2 | 12 | 5 |
| C | sp | 18 | 5 |
| D | sp^2 | 18 | 5 |

962/1

7

25. The table below shows the possible oxidation states of five d-block elements in the Periodic Table. The elements are represented by letters which are **not** their symbols.

Element	Possible oxidation numbers						
W	-	-	3	-	-	-	-
X	1	2	3	4	5	-	-
Y	-	-	3	4	5	6	-
Z	-	2	-	4	5	6	7

Which of the following ions is likely to exist?

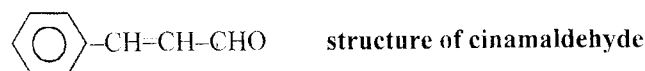
- A WO_2^-
- B XO_4^{2-}
- C YO_4
- D ZO_2^{2+}

26. Letters written on paper using aqueous ammonium thiocyanate are invisible until turned blood-red by brushing the paper with aqueous iron(III) chloride. If the ammonium thiocyanate is first made alkaline, the letters are brown and less clear.

Which of the following substances, when formed on the paper in these reactions, best explains these observations?

- | | With aqueous ammonium thiocyanate | With alkaline aqueous ammonium thiocyanate |
|---|-----------------------------------|--|
| A | Fe-NH_3 complex | Fe(OH)_3 |
| B | Fe-SCN^- complex | Fe-NH_3 complex |
| C | Fe-SCN^- complex | Fe(OH)_3 |
| D | Fe-SCN^- complex | Fe-OH^- complex |

27. The odour of cinnamon oil is due to cinnamaldehyde, $\text{C}_9\text{H}_8\text{O}$. What is the hybridisation of each carbon atom in cinnamaldehyde? How many σ bonds and how many π bonds does cinnamaldehyde have?

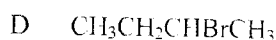
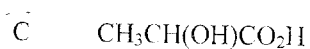
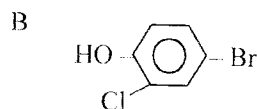
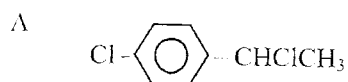


- | | hybridisation | σ | π |
|---|---------------|----------|-------|
| A | sp^3 | 12 | 7 |
| B | sp^2 | 12 | 5 |
| C | sp | 18 | 5 |
| D | sp^2 | 18 | 5 |

962/1

8

28. Which of the following is a chiral compound and is also soluble in water?



29. Which of the following order of nitration, alkylation and bromination is expected to give the best yield for the synthesis of 2-bromo-4-nitromethylbenzene, from benzene?

- A alkylation, nitration, bromination
 B alkylation, bromination, nitration
 C nitration, alkylation, bromination
 D nitration, bromination, alkylation

30. When aqueous potassium hydroxide solution is added separately to compounds P and Q and then refluxed; liquids Y and liquid Z are produced respectively. Liquid Y does not give effervescence with sodium metal, while 0.1 mol of liquid Z produces 2.24 dm³ of hydrogen gas under standard temperature and pressure. What are the possible structural formulae for P and Q? (1 mol of gas occupies a volume of 22.4 dm³ at s.t.p.)

	P	Q
A	$\text{CH}_3\text{CH}_2\text{Cl}$	CH_3CCl_3
B	CH_3CHCl_2	$\text{CH}_2\text{ClCH}_2\text{Cl}$
C	$\text{CH}_3\text{CH}_2\text{Cl}$	$\text{CH}_2\text{ClCH}_2\text{Cl}$
D	$\text{CH}_2\text{ClCH}_2\text{Cl}$	CH_3CHCl_2

31. A compound Q has the following composition according to mass: carbon 64.3%, hydrogen 7.1%; oxygen 28.6%. Q reduces Fehling's solution to copper(I) oxide. 0.1 mol Q reacts completely with 4480 cm³ of hydrogen gas (measured at s.t.p.) in the presence of nickel as catalyst. (1 mol of gas occupies a volume of 22.4 dm³ at s.t.p.) Compound Q possibly is?

- A $\text{CH}_2=\text{CH}-\text{CHO}$ B $\text{CH}_3\text{CH}=\text{CH}-\text{CH}=\text{CH}-\text{CHO}$
 C $\text{CH}=\text{C}-\text{CH}_2-\text{OH}$ D $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}-\text{CH}_2-\text{COOH}$

32. Which of the following statements is **not** true about glucose?

- A Cellulose is a polymer of glucose
 B Glucose can reduce Fehling's solution and Tollens' reagent
 C Glucose reacts with 2,4-dinitrophenylhydrazine to form a yellow precipitate.
 D Glucose molecule has a ketone group

962/1

9

33. 4-methylpentan-2-one, MIBK, is a solvent used in glue



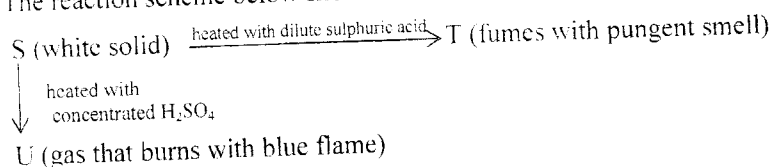
When the glue is tested, which of the following result could be due to the presence of MIBK?

- A It gives a reddish brown precipitate on boiling with Fehling's solution
- B It is oxidised and gives a green colouration on warming with alkaline aqueous potassium dichromate(IV)
- C It gives a yellow precipitate on warming with alkaline aqueous iodine
- D It gives a sweet-smelling liquid on warming with benzoic acid

34. Which one of the following procedures would give the highest yield of ethyl ethanoate, $\text{CH}_3\text{COOC}_2\text{H}_5$, starting from ethanoic acid, CH_3COOH , and ethanol, $\text{C}_2\text{H}_5\text{OH}$?

- A Reacting CH_3COOH with SOCl_2 , then adding $\text{C}_2\text{H}_5\text{OH}$.
- B Reacting $\text{C}_2\text{H}_5\text{OH}$ with SOCl_2 , then adding CH_3COOH .
- C Refluxing a mixture of CH_3COOH and $\text{CH}_3\text{CH}_2\text{OH}$ with NaOH .
- D Refluxing $\text{C}_2\text{H}_5\text{OH}$ with concentrated H_2SO_4 , then adding CH_3COOH .

35. The reaction scheme below shows a few reactions of salt S



What could S be?

- A CH_3COONa
- B HCOONa
- C $\text{Na}_2\text{C}_2\text{O}_4$
- D Na_2CO_3

36. A digital watch needs a liquid crystal that

- (i) is stable towards acidic hydrolysis
- (ii) is stable towards alkaline hydrolysis, and
- (iii) has chiral carbon centre

Which of the following compounds fulfils the above conditions?

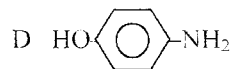
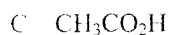
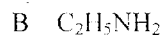
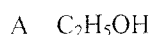
- A $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{O}-\text{C}_6\text{H}_4-\text{COO}-\text{C}_6\text{H}_4-\text{C}_6\text{H}_4-\text{CH}_3$
- B $\text{CH}_3\text{CH}_2\text{CH}_2\text{O}-\text{C}_6\text{H}_4-\text{COO}-\text{C}_6\text{H}_4-\text{C}_6\text{H}_4-\text{CN}$
- C $\text{CH}_3\text{O}-\text{C}_6\text{H}_4-\text{C}_6\text{H}_4-\text{CH}_2\text{CH}(\text{CH}_3)_2$
- D $\text{CH}_3\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2-\text{C}_6\text{H}_4-\text{C}_6\text{H}_4-\text{CH}_3$

STPM trial 2006 Melaka - CHEMISTRY 1

962/1

10

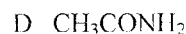
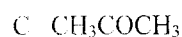
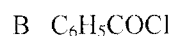
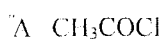
37. Which of the following would form an aqueous solution with the highest pH?



38. "Phenacetin" is used as an anesthetic. It is prepared from compound X and reagent Y according to the equation below:



Which of these could be reagent Y ?



39. GABA is a neuro-transmitter released by red algae which encourages shellfish larvae to settle on the ocean bed. The structure of GABA is $\text{H}_2\text{NCH}_2\text{CH}_2\text{CH}_2\text{COOH}$. In what way does GABA differ from amino acids obtained by hydrolysis of protein?

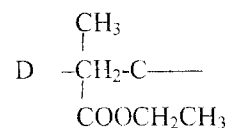
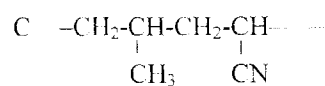
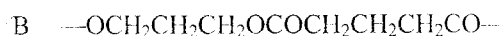
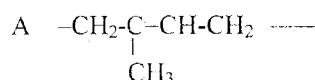
A It does not form a zwitterion

B It is not soluble in water

C It is not a 2-aminocarboxylic acid

D It does not form a polyamide linkage

40. Which of the following formulae represents a condensation polymer?



962/1

11

Section B

For each of the questions in this section, one or more of the three numbered statements 1 to 3 may be correct. The responses **A** to **D** should be selected as follows

A	B	C	D
only 1 is correct	only 1 and 2 are correct	only 2 and 3 are correct	1, 2 and 3 are correct

41. Gaseous particle X has proton number n and a charge of $+1$.
Gaseous particle Y has proton number $n+1$ and is isoelectronic with X.
Which of the following statements correctly describes X and Y?
- X has a larger radius than Y
 - X requires more energy than Y when a further electron is removed from each particle
 - X releases more energy than Y when an electron is added to each particle
42. When a sample of a gas is compressed at constant temperature from 15 atm to 60 atm, its volume changes from 76.0 cm^3 to 20.5 cm^3 . Which of the following statements is/are possible explanation(s) of this behaviour?
- The gas behaves non-ideally
 - The gas dimerises
 - The gas is adsorbed on the vessel walls
43. The rate equation for the reaction : $A \longrightarrow 2B$ is given as
Rate = $k[A]$
Which of the followings is/are true for the reaction shown above ?
- When concentration of A is increased, reaction rate increases.
 - At a constant temperature, half life of this reaction is a constant.
 - When temperature increases, half life of the reaction decreases.
44. For the following reaction, $2A(g) + B(s) \rightleftharpoons C(g) + 3D(g)$ $\Delta H = -ve$
Which of the following will cause the equilibrium position to shift to the right ?
- decreasing volume of the system
 - decreasing temperature of the system
 - adding inert gas to the system at constant pressure

962/1

12

45. Anhydrous barium nitrate and anhydrous magnesium nitrate both decompose on heating, evolving nitrogen dioxide and oxygen and forming an oxide.

Which of the following statements concerning these decompositions is/are correct?

- 1 Nitrogen dioxide is evolved at a lower temperature from magnesium nitrate than from barium nitrate.
- 2 For both nitrates the volume of nitrogen dioxide evolved is four times greater than the volume of oxygen.
- 3 The numerical value of the lattice energy of magnesium nitrate is greater than that of barium nitrate.

46. The Group 14 element germanium is widely used in the manufacture of semiconductors and other electronic components. The existence of this element in Group 14 between silicon and tin was predicted by Mandeleev some years before it was discovered. From its position in the group, what properties of germanium may be predicted?

- 1 Its most stable oxide has the formula GeO_2 .
- 2 The oxide GeO_2 forms ion GeO_3^{2-}
- 3 The bonding in GeCl_4 is covalent

47. Which of the following are pollutants if released into the atmosphere?

- 1 Nitrogen dioxide
- 2 Sulphur dioxide
- 3 Aerosol particles containing lead(II) oxide

48. 10.00g of an acid R was dissolved in 1 dm³ of water. 25.00 cm³ of the resulting solution required 23.10 cm³ of hydroxide ion solution of 2.50 g per dm³ for complete neutralisation. Which of the following could be the molecular formula of R ?

- 1 $\text{CH}_3\text{CH}_2\text{COOH}$
- 2 $(\text{CH}_2)_4(\text{COOH})_2$
- 3 $\text{CH}_3(\text{CH}_2)_6\text{COOH}$

49. Compound Z reacts with hot alkaline aqueous iodine solution to produce iodoform and a sodium salt, sodium 2-methylpropanoate, $(\text{CH}_3)_2\text{CHCOONa}$. What could Z be?

- 1 $(\text{CH}_3)_2\text{-CH-CO-CH}_3$
- 2 $(\text{CH}_3)_2\text{-CH-CH(OH)-CH}_3$
- 3 $\text{Cl}_3\text{-CO-CH-(CH}_3)_2$

50. When 1,2-dichloroethane is refluxed with aqueous sodium hydroxide solution, compound X is formed. Compound X reacts with compound Y to produce a polymer. Y could be

- 1 $\text{HOOC}-\text{C}_6\text{H}_4-\text{COOH}$
- 2 $\text{ClOC}(\text{CH}_2)_4\text{COCl}$
- 3 $\text{HO}-\text{C}_6\text{H}_4-\text{OH}$