

962/1

TRIAL STPM 2009
(PEPERIKSAAN PERCUBAAN STPM 2009)

CHEMISTRY (KIMIA)

PAPER 1 (KERTAS 1)

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.

Arahan kepada calon:

JANGAN BUKA BUKU SOALAN INI SEHINGGA ANDA DIBENARKAN BERBUAT DEMIKIAN.

Ada lima puluh soalan dalam kertas ini. Bagi setiap soalan, empat cadangan jawapan diberikan. Pilih satu jawapan yang betul dan tandakan jawapan itu pada helaian jawapan aneka pilihan yang dibekalkan.

Baca arahan pada helaian jawapan aneka pilihan itu dengan teliti.

Jawab semua soalan. Markah tidak akan ditolak bagi jawapan yang salah.

This question paper consists of 12 printed pages and blank page.

(Kertas soalan ini terdiri daripada halaman bercetak dan 1 halaman kosong.)

TRIAL STPM 962/1

*This question paper is CONFIDENTIAL until the examination is over.

*Kertas soalan ini SULIT sehingga peperiksaan kertas ini tamat.

[Turn over (Lihat sebelah)

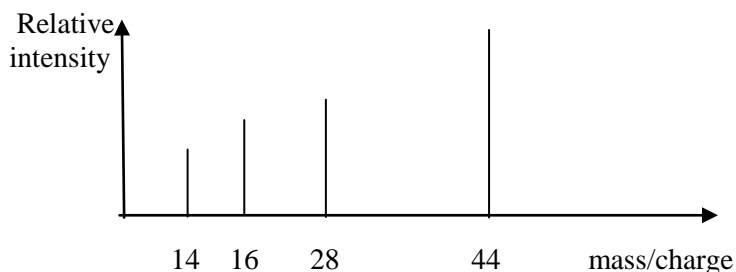
CONFIDENTIAL*

SULIT*

CONFIDENTIAL

- 2 -

1. A mass spectrum is shown below.



Which of the following gives the complete mass spectrum illustrated ?

- A. CO_2 B. C_3H_8 C. N_2O D. N_2
2. A solid will sublime at room conditions if its
- A. critical temperature is above room temperature
B. critical pressure is above atmospheric pressure
C. triple point is above atmospheric pressure
D. triple point pressure is below atmospheric pressure
3. Gallium has the electronic configuration $[\text{Ar}] 3d^{10} 4s^2 4p^1$, where $[\text{Ar}]$ represents the configuration of argon.
In which order are the electrons lost in forming the Ga^{4+} ion ?

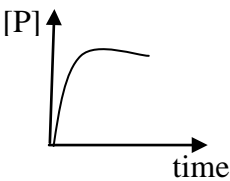
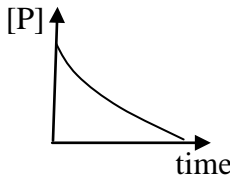
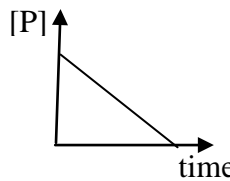
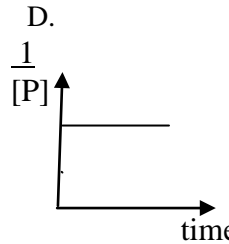
	1st	2nd	3rd	4th
A.	3d	4p	4s	4s
B.	3d	4s	4s	4p
C.	4s	4s	4p	3d
D.	4p	4s	4s	3d

4. Which of the following equations relates to the first ionization energy of aluminum ?
- A. $\text{Al}(\text{g}) \rightarrow \text{Al}^+(\text{g}) + \text{e}$
B. $\text{Al}(\text{p}) \rightarrow \text{Al}^+(\text{g}) + \text{e}$
C. $\text{Al}^+(\text{g}) \rightarrow \text{Al}^{2+}(\text{g}) + \text{e}$
D. $\text{Al}^+(\text{p}) \rightarrow \text{Al}^{2+}(\text{g}) + \text{e}$
5. Which of the following elements would be expected to form the smallest ion with a rare gas electron structure ?
- A. Sodium
B. Chlorine
C. Oxygen
D. Phosphorus

6. The electronegativity of V, W, X, Y and Z are given below :

Element	V	W	X	Y	Z
Electronegativity	1.0	1.4	2.1	3.0	3.5

Which pair of elements would give a compound with the greatest ionic character ?

- A. X and Z
B. W and Y
C. V and X
D. V and Y
7. All of the following molecules are linear except
- A. HCN
B. H₂S
C. CO₂
D. BeCl₂
8. Which of the following molecules has the weakest intermolecular forces in the liquid phase ?
- A. CO₂ B. PCl₅ C. SO₂ D. CCl₄
9. Which one of the following graphs represents a reaction which is first order with respect to a particular reactant P assuming that all other reactants present are in excess.
[P] = concentration of P in mol dm⁻³
- A. 
- B. 
- C. 
- D. 
10. Which one of the following equations corresponds to the definition of standard enthalpy change of formation of carbon monoxide ?
- A. C (g) + O (g) → CO (g)
B. C (g) + 1/2 O₂ (g) → CO (g)
C. C (s) + 1/2 O₂ (g) → CO (g)
D. C (s) + O (g) → CO (g)

11. A nitrogen-hydrogen mixture, initially in the mole ratio of 1 : 3 , reached equilibrium with ammonia when 50 % of the nitrogen had reacted. The total final pressure was p.



What was the partial pressure of ammonia in the equilibrium mixture ?

- A. $p/8$ B. $p/6$ C. $p/3$ D. $p/2$
12. The pH of 0.01 mol dm^{-3} solution of a weak monobasic acid is 5.
What is the dissociation constant of the acid ?

- A. $10^{-5} \text{ mol dm}^{-3}$
B. $10^{-7} \text{ mol dm}^{-3}$
C. $10^{-6} \text{ mol dm}^{-3}$
D. $10^{-8} \text{ mol dm}^{-3}$

13. pH ranges over which the color change for 3 indicators is as follows :

Indicator	pH range	colour change
methyl orange	3.0 - 4.0	red \rightarrow yellow
bromothymol blue	6.0 - 8.0	yellow \rightarrow blue
phenolphthalein	8.0 - 10.0	colourless \rightarrow red

Which of the following gives the correct sequence colour change when a buffer solution of pH = 7 is tested with methyl orange, bromothymol blue and phenolphthalein consecutively ?

- A. red, yellow, colorless
B. yellow, blue, red
C. orange, yellow, colorless
D. yellow, green, colorless
14. Which of the following is correct for an ideal mixture of two liquids?
- A. its formation on mixing is exothermic
B. its vapor obeys Dalton's Law
C. it is a solution which obeys Raoult's Law
D. its vapor shows ideal behavior
15. When 500 cm^3 of an aqueous solution which contains 10 g of Y is shaken with 50 cm^3 of an organic solvent, 2 g of Y is extracted by the organic solvent. What is the partition coefficient of Y between the organic solvent and water ?
- A. 0.4 B. 2.5 C. 4.0 D. 5.0

16. The following table shows observations obtained when Period 3 elements react with oxygen.

Element	Observation
Na	Very vigorous
Mg	Very vigorous
Al	Vigorous
Si	Slow
P	Slow
S	Slow
Cl	No reaction
Ar	No reaction

The observations show that when moving across Period 3

- A. the elements become more inert
- B. ease of elements donating electrons decreases
- C. the strength of elements as oxidising agents decreases
- D. the reaction of elements with oxygen becomes more exothermic

17. The following table shows the lattice energy and the hydration energy of three sulphates salts X, Y and Z for three elements in Group 2 of the Periodic Table.

Sulphate salt	Lattice energy/kJ mol ⁻¹	Hydration energy/kJ mol ⁻¹
X	-2489	- 1650
Y	-2374	-1360
Z	-2484	-1480

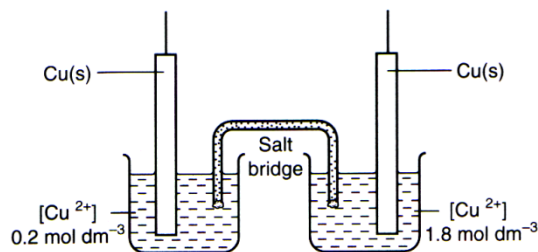
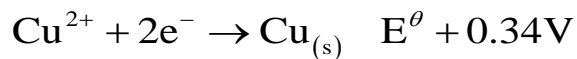
Which of the following sulphates salts are arranged according to solubility in descending order?

- A. X, Y, Z
- B. X, Z, Y
- C. Y, Z, X
- D. Z, X, Y

18. The decomposition temperature of beryllium carbonate is lower than that of barium carbonate. Which of the following statements could explain the above observation?

- A. Beryllium ion has higher charge density
- B. The size of carbonate ion in beryllium carbonate is larger.
- C. The charge density of carbonate ion in beryllium carbonate is lower.
- D. The electrovalent bond in beryllium carbonate is weaker.

19. Most of the chemical properties of aluminium metal is caused by the high polarising power of the Al^{3+} ion. Which of the following properties of aluminium compounds cannot be explained by the high polarising power of Al^{3+} ion ?
- A. A solution containing $\text{Al}(\text{H}_2\text{O})_6^{3+}$ ions is acidic
 - B. The enthalpy of hydration of the Al^{3+} ion is very high
 - C. The Al^{3+} ion can form complexes
 - D. The lattice energy of aluminium fluoride is very high
20. Aluminium is a very reactive metal and this is shown in its negative standard electrode potential of -1.66 V . Nevertheless, this metal is resistant to corrosion. Which of the following statements explains the above ?
- A. The Al^{3+} ion has a high charge density
 - B. Aluminium atoms are arranged in a closely packed manner
 - C. Aluminium atoms are held together by strong forces
 - D. Aluminium forms an oxide layer on its surface
21. Consider the E^θ value and the diagram below.



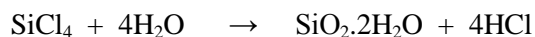
Select the correct e.m.f of the cell.

- A +3.12 V
 - B +2.0 V
 - C +1.6 V
 - D +0.028 V
22. Which statements about the properties of the tetrachlorides of Group 14, CCl_4 to SnCl_4 is correct ?
- A. Tin(IV) chloride is the only ionic tetrachloride.
 - B. Their melting points increase down the group
 - C. Their boiling points decrease down the group
 - D. They are all polar molecules

23. Carbon fibre is one of the components of a composite substance which is used to make bullet-proof jackets. Which of the following is not a property of carbon fibre?

- A. Elastic
- B. Low density
- C. Stable at high temperatures
- D. Inert towards chemical substances

24. Stoppers of bottles containing SiCl_4 often become sealed due to $\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ being deposited around the stopper. This is formed by the following reaction:



Why does this reaction occur with SiCl_4 and not with CCl_4 ?

- A. The atomic radius of silicon is greater than that of carbon.
- B. The ionisation energies of silicon are lower than those of carbon
- C. Silicon atoms have 3d orbitals available for bonding
- D. The +4 oxidation state becomes less stable on descending Group 14.

25. The method used to prepare nitrogen gas in industry is by

- A. decomposition of ammonia in air
- B. fractional distillation of liquefied air
- C. thermal decomposition of ammonium nitrite
- D. fractional distillation of liquefied air

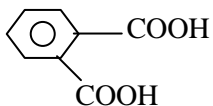
26. The reaction of chlorine with aqueous sodium hydroxide can be represented by equation




- A. The reaction occurs in hot conditions.
- B. The chlorine molecule undergoes disproportionation.
- C. A dilute solution of sodium hydroxide is used in the reaction
- D. The oxidation state of chlorine is highest in sodium chlorate, NaClO_3 .





27. Most of the transition elements are useful heterogeneous catalysts for various reactions. Which of the following explains the catalytic properties of transition elements ?

- A. The magnetic properties of the elements.
- B. The ability of the elements to act as reducing agents.
- C. The ability of the elements to lower the enthalpy of reaction.
- D. The ability of the elements to adsorb molecules on their surfaces.

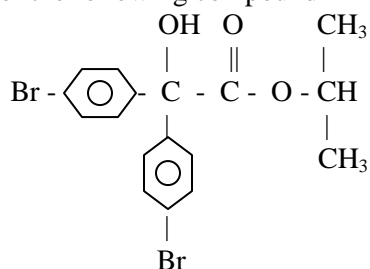
28. The cyanide ligand in complex ion $[\text{Cu}(\text{CN})_4]^{2-}$ can be replaced by other ligands to form complex ion Z which is dark blue. The complex ion Z could be
- $[\text{CuCl}_2]^-$
 - $[\text{Cu}(\text{Cl})_4]^{2-}$
 - $[\text{Cu}(\text{NH}_3)_4]^{2+}$
 - $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$
29. Which of these compounds can exist as a pair of *cis-trans* isomers?
- $(\text{CH}_3)_2\text{C}=\text{CH}_2$
 - $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$
 - $\text{CH}_3\text{CH}=\text{CHCH}_3$
 - 
30. Oxidation of an of an alkene X produces a diol; further oxidation produces a diketone. X is probably
- $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$
 - $(\text{CH}_3)_2\text{CHCH}=\text{CH}_2$
 - $\text{C}_6\text{H}_5\text{CH}=\text{CHC}_6\text{H}_5$
 - $(\text{C}_6\text{H}_5)_2\text{C}=\text{CHCH}_3$
31. Hydrogen chloride reacts with ethene to form chloroethane. What is the best description of the organic intermediate formed in this reaction?
- It is a free radical.
 - It is an electrophile
 - It is a negatively charged species
 - It consists of carbon, hydrogen and chlorine
32. In the upper atmosphere, chlorofluoroalkanes, are broken down to give chlorine radicals but not fluorine radicals. This is because
- Fluorine is more electronegative than chlorine
 - The C-F bond is longer than the C-Cl bond
 - The C-F bond is stronger than the C-Cl bond
 - Fluorine atom is smaller than chlorine atom
33. Which correct reagent is used to distinguish the following pairs of organic compounds?

	Reagent	Organic compounds
A.	sodium metal	$(\text{CH}_3)_3\text{COH}$ and $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$
B.	bromine water	$\text{CH}_3\text{CH}_2\text{OH}$ and $\text{C}_6\text{H}_5\text{OH}$
C.	phosphorous pentachloride	$\text{CH}_3\text{CH}_2\text{OH}$ and CH_3COOH
D.	dilute sodium hydroxide solution	$\text{C}_6\text{H}_5\text{OH}$ and CH_3COOH


34. Compound P reacts with a reagent Q to produce -CH₂CN
Compounds P and Q could be

	P	Q
A.	 -CH ₂ Cl	NaCN in alcohol
B.	 -CH ₂ OH	NaCN(aq)
C.	 -CH ₂ NH ₂	HCN(aq)
D.	 -CH ₂ Cl	HCN(aq)

35. Preparation of the following compound R involves an esterification reaction in the final stage.



Which of the following alcohol can be used to produce R?

- A. ethanol
B. di(4-bromophenyl)methanol
C. methanol
D. propan-2-ol
36. Which of the following substance would form an aqueous solution with the highest pH?
- A. CH₃CH₂OH
B. CH₃CH₂NH₂
C. CH₃COOH
D. HO -  - NH₂
37. An ester T was refluxed with aqueous sodium hydroxide and the resulting mixture distilled. The distillate gave a positive triiodomethane test. Acidification of the residue left in the distillation flask produced a white precipitate.
T is probably

- A. C₆H₅COOCH₃
B. CH₃COOC₆H₅
C. C₆H₅COOCH₂CH₃
D. C₆H₅COOCH₂CH₂CH₃

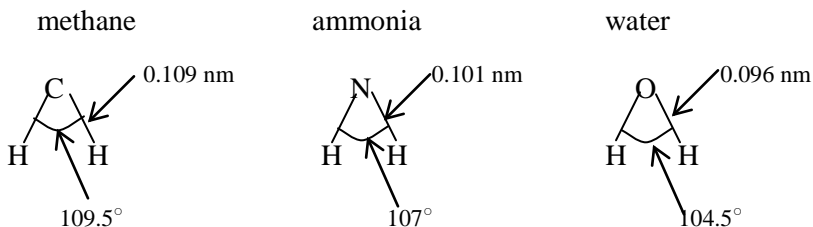
38. Which of the following compounds produces
 (a) white fumes with PCl_5 ;
 (b) an alkaline gas when boiled with NaOH(aq) ?
- A. $\text{HOCH}_2\text{CH}_2\text{NH}_2$ C. $\text{HOCH}_2\text{CH}(\text{NH}_2)\text{COOH}$
 B. $\text{HOCH}_2\text{CONH}_2$ D. $\text{NH}_2\text{CH}_2\text{COOH}$
39. Phenylamine and phenol undergo electrophilic substitution with the following reagent.
- A. $\text{Br}_2(\text{aq})$ B. HCl(aq) C. $\text{HNO}_2(\text{aq})$ D. NaOH(aq)
40. Which polymer can form hydrogen bonds between its molecules?
- A. nylon-6,6 B. polyvinyl chloride C. poly(phenylethene) D. Terylene

Section B

For each question 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
1 only is correct	1 and 2 only are correct	2 and 3 only are correct	1,2 and 3 are correct

41. What is/are the assumptions made in the kinetic theory about an ideal gas?
- The size of the molecules is negligible.
 - There are no forces of attraction between molecules
 - The molecules are in a state of continuous, random motion.
42. Part of the geometry of the methane, ammonia and water molecules are shown below.

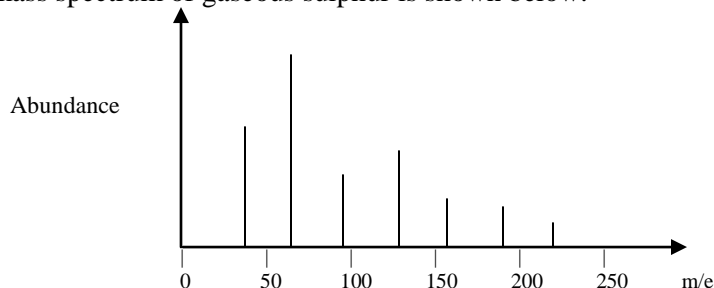


The difference in the values of the bond angles in the above molecules is caused by

- the number of non-bonding electron pairs in the molecule.
- a non-bonding electron pair having a greater repulsive force than a bonding electron pair.
- increasing repulsion between hydrogen atoms as the bond length decreases.

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

43. A mass spectrum of gaseous sulphur is shown below.



Which of the following statements can be inferred from this mass spectrum?

- 1 The most abundant species in the vapour is S_2 .
 - 2 The relative molecular mass of gaseous sulphur is 64.
 - 3 Sulphur has seven isotopes.
44. When 193 C of electricity is passed through a molten compound of a metal, 1.00×10^{-3} mol of atoms of the metal is deposited at the cathode. This metal could be [Faraday constant is $9.65 \times 10^4 \text{ C mol}^{-1}$]
- 1 copper
 - 2 lead
 - 3 silver
45. Decomposition of water occurs according to the equation :
- $$H_2O(l) \rightleftharpoons H^+(aq) + OH^-(aq)$$
- The ionic product of water, K_w , is $0.11 \times 10^{-14} \text{ mol}^2\text{dm}^{-6}$ at 0°C and $1.00 \times 10^{-14} \text{ mol}^2\text{dm}^{-6}$ at 25°C .
- Which statement(s) about the reaction is/are true?
- 1 The pH of pure water is less than 7 at 95°C .
 - 2 The electrical conductivity of water increases with increasing temperature.
 - 3 The decomposition of water is an exothermic reaction.
46. The Group 2 metals have higher melting points than Group 1 metals. This observation is most probably due to
- 1 smaller interatomic distance in the metallic lattice of the Group 2 metals.
 - 2 availability of two valence electrons in the Group 2 metal atom.
 - 3 Group 2 metals have higher first ionisation energy.

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

47. Astatine (proton number 85) is a member of the halogen family. Which of the following statements is/are consistent with its position in Group 17?

- 1 It is a black solid at room temperature and pressure.
- 2 Hydrogen astatide is more thermally stable than hydrogen iodide.
- 3 Silver astatide is soluble in aqueous ammonia.

48. The structural formula of compound G is shown below.

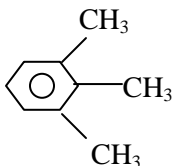


Which statement(s) is/are true about compound G?

- 1 It exists as cis-trans isomer.
 - 2 It is hydrolysed by aqueous hydrochloric acid to ethanoic acid
 - 3 It undergoes electrophilic addition reactions.
49. Hydrocarbon Z has a molecular formula of C_9H_{12} . It does not decolourise bromine water.

Which of the following statement(s) is/are true about hydrocarbon Z?

- 1 All the carbon atoms in hydrocarbon Z undergo sp^3 hybridisation.
- 2 It gives a positive reaction with hot acidified KMnO_4 solution.
- 3 One of its isomers has the following structure.



50. Which of the following polymers have the —CONH— linkage?

- 1 Nylon-6,10
- 2 Orlon
- 3 Terylene

END OF QUESTION PAPER