SAMPEL PERCUMA

Modul G-CAKNA STPM 2021 Kimia Semester 1 (Set 1)

Set penuh: Kertas Percubaan STPM

Sem 1 · Kimia

Sampel ini: 8 muka surat. Set penuh ada:

- 3 fail PDF
- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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(Nombor kad pengenalan) (Nombor pusat/angka giliran)

962/1 STPM 2021

MODUL G-CAKNA

CHEMISTRY 1 (KIMIA)
SET 1
One and a half hours (Satu jam setengah)

SIJIL TINGGI PERSEKOLAHAN MALAYSIA
(MALAYSIA HIGHER SCHOOL CERTIFICATE)

Instructions to candidates:
DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.
There are **fifteen** *questions in Section A. For each question, four choices of 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.*
Answer **all** *questions in Section B. Write your answers in the spaces provided. Answer any* **two** *questions in Section C. All essential working should be shown. For numerical answers, unit should be quoted wherever appropriate.*
Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.
Answers may be written in either English or Bahasa Malaysia.

Arahan kepada calon

JANGAN BUKA KERTAS SOALAN INI SEHINGGA ANDA DIBENARKAN BERBUAT DEMIKIAN
Ada **lima belas** *soalan dalam Bahagian A. Bagi setiap soalan, empat pilihan jawapan diberikan.Pilih* **satu** *jawapan yang betul dan tandakan jawapan itu pada Borang Jawapan Aneka Pilihan yang dibekalkan. Baca arahan pada Borang Jawapan Aneka Pilihan itu dengan teliti. Jawab* **semua** *soalan.*
Markah tidak akan ditolak bagi jawapan yang salah.
Jawab **semua** *soalan dalam Bahagian B. Tulis jawapan anda di ruang yang disediakan.*
Jawab mana-mana **dua** *soalan dalam Bahagian C. Semua jalan kerja yang sesuai hendaklah ditunjukkan. Bagi jawapan berangka, unit hendaklah dinyatakan di mana-mana yang sesuai. Mulakan setiap jawapan pada helaian kertas jawapan yang baharu dan susun jawapan anda mengikut tertib berangka.*
Jawapan boleh ditulis dalam bahasa Inggeris atau Bahasa Malaysia.

For examiner"s use (Untuk kegunaan pemeriksa)	
Section A	
Section B (*Bahagian B*)	
16	
17	
Section C (*Bahagian C*)	
Total (Jumlah)	

This question paper consists of 10 printed pages
(Kertas soalan ini terdiri daripada 10 halaman bercetak)

Section A [15 *marks*]
Answer **all** *questions in this section.*

1 $^{28}_{14}Si$ and $^{30}_{14}Si$ are two isotopes of silicon. The relative atomic mass of Si is 28.1. Which statement is **true** about these isotopes?

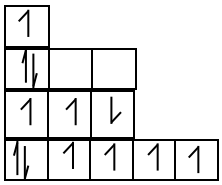
A $^{28}_{14}Si$ is smaller than $^{30}_{14}Si$
B $^{28}_{14}Si$ and $^{30}_{14}Si$ are radioactive
C $^{28}_{14}Si$ is more abundant than $^{30}_{14}Si$
D The total number of sub-atomic particles in $^{28}_{14}Si$ and $^{30}_{14}Si$ is the same

2 An element Y with a relative atomic mass of 28.1 consists of isotopes ^{28}Y, ^{29}Y and ^{30}Y. If the percentage abundance of ^{29} Y and ^{30} Y are the same , what is the percentage abundance of ^{28} Y ?

A 0.32
B 3.33
C 93.4
D 96.7

3 Which orbital diagram shows the filling of electrons based on Hund's rule?

A
B
C
D



4 Which compound has an ionic bond?

A HCl
B $BeCl_2$
C $AlBr_3$
D $C_6H_5NH_3Br$

5 The shapes of molecules and polyatomic ions could be determined using the VSEPR theory. Which species has the smallest bond angle?

A $BeCl_2$
B BF_3
C CO_3^{2-}
D SO_4^{2-}

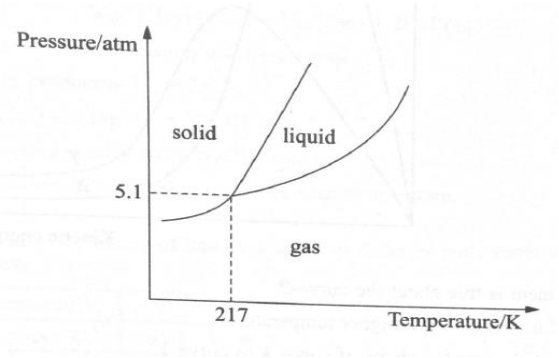
6 Compounds **P** and **Q** are simple molecules. The boiling point of P is higher than the boiling point of Q. The compounds P and Q are :

	P	**Q**
A	HF	HCl
B	$CHCl_3$	CCl_4
C	PH_3	SbH_3
D	$HCOOCH_3$	CH_3COOOH

7 Gas X of mass 0.118 g was filled into a 250cm^3 flask at 298 K and 73.5 kPa. What is the molar mass of the gas? [Universal gas constant is 8.31 J K^{-1} mol^{-1}]

A 7.42 g mol^{-1}
B 11.3 g mol^{-1}
C 14.6 g mol^{-1}
D 15.9 g mol^{-1}

8 The phase diagram for carbon dioxide is shown below.



Which statement explains the use of solid carbon dioxide to produce fog for special effects in concerts?

A Carbon dioxide is a white gas
B Solid carbon dioxide is denser than liquid carbon dioxide
C Solid carbon dioxide sublimes under ambient conditions
D Liquid carbon dioxide and carbon dioxide gas are in equilibrium at room temperature

9 NO_2, which causes the formation of acid rain, is formed from air oxidation of NO. The reaction equation is as follows:

$$2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$$

The rate of reaction is first order with respect to the concentration of O_2 and second order with respect to the concentration of NO. Which statement is **true** about the reaction above?

A The unit for the rate constant is dm^3 mol^{-1} s^{-1}
B The rate of disappearance of NO is the same as that of O_2
C The graphs of concentration against time for NO and O_2 are linear
D The rate of reaction increase eight times when the concentration of NO and O_2 increase two times

10 The kinetic data for reaction P + Q ⟶ R + S is shown below.

Experiment	[P]/mol dm^{-3}	[Q]/mol dm^{-3}	Initial rate/mol dm^{-3} s^{-1}
1	0.5	0.4	1.2×10^{-3}
2	1.0	0.8	4.8×10^{-3}
3	1.0	1.6	1.92×10^{-2}

What is the rate law for the reaction?

A Rate = $k[P]^2$
B Rate = $k[Q]^2$
C Rate = $k[P][Q]^2$
D Rate = $k[P]^2[Q]$

11 The reaction of acidified aqueous potassium iodide with aqueous hydrogen peroxide is as follow:

$$2I^-_{(aq)} + H_2O_{2(aq)} + 2H^+_{(aq)} \longrightarrow I_{2(aq)} + 2H_2O_{(l)}$$

The following steps may be involved in the mechanism of the reaction.

$$H_2O_2 + I^- \xrightarrow{\text{slow}} H_2O + OI^-$$

$$OI^- + H^+ \xrightarrow{\text{fast}} HOI$$

$$HOI + H^+ + I^- \xrightarrow{\text{fast}} I_2 + H_2O$$

What could be the rate law for the reaction ?

A rate = $k [H_2O_2]$
B rate = $k [H_2O_2][I^-]$
C rate = $k [H_2O_2][OI^-]$
D rate = $k [H_2O_2][I^-]^2$

.

17 a) Ozone (an allotrope of oxygen) , found in the stratosphere is responsible for filtering harmful ultraviolet radiation from reaching the Earth's surface. 2.41g of ozone gas occupies a volume of 1.23 dm^3 at 298K and 101 kPa.

i) Define allotrope [1]

---

ii) Determine the molecular formula of ozone . [4]

b) State one allotrope of carbon [1]

---

c) State two properties of carbon allotrope stated in (b) [2]

Section C [30 marks]

Answer any **two** *questions in this section*.

18. (a) Peroxyacylnitrate (PAN) is one of the components of smog containing C,H,N and O. Analysis of 1.00 g of PAN was found to contain 0.198 g C, 0.0250 g of H and 0.116 g of N. Determine the molecular formula of PAN.
[Molar mass of PAN is 121 g mol^{-1}] [5]

(b) A sample of chlorine dioxide is analysed in a mass spectrometer. The chlorine dioxide molecule, ClO_2, consists of ^{16}O, ^{35}Cl and ^{37}Cl isotopes. Give the formulae of all the species that produce the lines in the mass spectrum. [3]

(c) Atom X has one electron and its mass is 1/6 mass of an atom of carbon-12.

(i) Determine the relative atomic mass of X and write its chemical symbol. [3]

(ii) Compare the behaviour of a beam of X^+ ions with a beam of protons in the same magnetic field. [4]

19. (a) Iron may lose two or three electrons to form Fe (II) and Fe (III) ions, respectively.

(i) State the valence orbitals of Fe (II) and Fe (III) ions. Which ion is more stable? Explain your answer. [4]

(ii) How many unpaired electrons are there in iron atom? Explain your answer. [4]

(b) Elements X and Y are in Period 4 of the Periodic Table. X is a *p* block element and Y is a *d* block element. Atom X and Y^{2+} ion, each has three valence electrons. Atom X has one unpaired electron, while a Y^{2+} has three unpaired electrons.

Identify X and Y, and explain your answer. [7]

ANSWER SCHEME SET 1

SECTION A (OBJECTIVE)

<table>
<tr><td>1</td><td>C</td><td>The size of an atom is not controlled by the nucleon number. We cannot predict whether an atom is radioactive or not from the proton or nucleon number. The average of 28 And 30 is 29 if the composition of the isotopes is 1:1. Since the actual atomic mass is 28.1, which is less than 29, there should be more ^{28}Si atoms than ^{30}Si atoms. ^{30}Si has 2 more neutrons than ^{28}Si</td></tr>
<tr><td>2</td><td>C</td><td>Let the relative abundance of ^{29}X and ^{30}X = a
The relative abundance of ^{28}X=1-2a
29a+30a+28(1-2a) = 28.1
3a+28 = 28.1
a= 0.033
Relative abundance of ^{28}X = 1-2(0.033)
= 0.934
Percentage abundance of ^{28}X = 93.4%</td></tr>
<tr><td>3</td><td>D</td><td>Hund’s rule states that if two or more orbitals with equal energy are available, the orbitals are filled with one electron each, with the electrons having parallel spins, before electron of the opposite spin is added.</td></tr>
<tr><td>4</td><td>D</td><td>$C_6H_5NH_3Br$ exists as $[C_6H_5NH_3^+]Br^-$ and is called phenylammonium bromide.</td></tr>
<tr><td>5</td><td>D</td><td>
<table>
<tr><td></td><td>shape</td><td>Bond angle(°)</td></tr>
<tr><td>$BeCl_2$</td><td>linear</td><td>180</td></tr>
<tr><td>BF_3</td><td>Trigonal planar</td><td>120</td></tr>
<tr><td>CO_3^{2-}</td><td>Trigonal planar</td><td>120</td></tr>
<tr><td>SO_4^{2-}</td><td>tetrahedral</td><td>109.5</td></tr>
</table>
</td></tr>
<tr><td>6</td><td>A</td><td>
<table>
<tr><td>molecule</td><td>forces</td></tr>
<tr><td>HF</td><td>Hydrogen bonding</td></tr>
<tr><td>HCl</td><td>Van der Waals</td></tr>
<tr><td>$CHCl_3$</td><td>Van der Waals</td></tr>
<tr><td>CCl_4</td><td>Van der Waals</td></tr>
<tr><td>PH_3</td><td>Van der Waals</td></tr>
<tr><td>SbH_3</td><td>Van der Waals</td></tr>
<tr><td>$HCOOCH_3$</td><td>Van der Waals</td></tr>
<tr><td>CH_3COOOH</td><td>Hydrogen bonding</td></tr>
</table>
</td></tr>
<tr><td>7</td><td>D</td><td>Assuming ideal behavior:

pV = nRT
$(73.5 \times 10^3)(250 \times 10^{-6}) = n \times 8.31 \times 298$
$n = 7.42 \times 10^{-3}$ mol

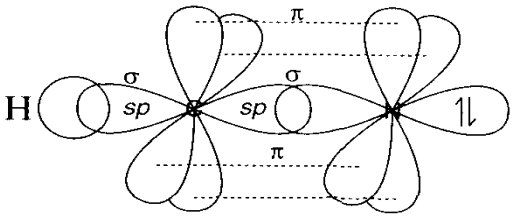
molar mass of the gas = $\frac{0.118}{7.42 \times 10^{-3}}$ g mol^{-1}
=15.9 g mol^{-1}</td></tr>
</table>

ANSWER SCHEME SET 1
SECTION B

16.(a)

Hydrogen Halides, *HX*	**Boiling point of** *HX*	**Reason**
HF	Exceptionally high//The highest **[1]**	The presence of stronger hydrogen bond between HF molecules . **[1]**
Descending the group from HCl, HBr to HI.	Increase from HCl to HI **[1]**	Increase in the molecular mass of *HX* result in stronger van der Waals force between molecules **[1]**

16 (b)



Label + shape of orbitals - [1]

Overlap+ sigma and pi bond [1]

Type of hybridization,sp [1]

TOTAL : 7M

TAMAT SAMPEL

Suka sampel ini?

Set penuh: Kertas Percubaan STPM

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- Semester 1: kertas percubaan (trial) negeri, subjek yang dipilih + skema
- Blueprint 30 hari Semester 1 (setiap subjek)
- Semester 3: percubaan 2024, 10 subjek, banyak negeri, soalan + skema dalam satu fail

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