أسئلة الامتحان لدبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة) الدور الثاني مع نموذج الإجابة

التواصل الاجتماعي بحسب الصف الثاني عشر					
صفحة المناهج العمانية على فيسبوك					

المزيد من الملفات بحسب الصف الثاني عشر والمادة كيمياء في الفصل الأول	
أسئلة الامتحان لدبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة) الدور الأول مع نموذج الإجابة	1
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امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

الفصل الدراسي الأول - الدور الثاني

للعام الدراسي ١٤٤٦ - ١٤٤٧ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الكيمياء.
- الأسئلة في (١٥) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س - عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

■ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (■) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ■ **غير صحيح** ▭ ◉ ◔ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

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Question 1: Multiple Choice Items (14 marks)

There are 14 multiple-choice items worth one mark each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Which of the following mixtures is an acidic buffer solution?

- ⬭ Strong base and weak acid.
- ⬭ Strong acid and weak base.
- ⬭ Weak base and its conjugate acid.
- ⬭ Weak acid and its conjugate base.

2) Which of the following is not a reaction of a Brønsted - Lowry acid and base?

- ⬭ $CH_3Cl(aq) + OH^-(aq) \rightleftharpoons CH_3OH(aq) + Cl^-(aq)$
- ⬭ $NH_3(aq) + HCl(aq) \rightleftharpoons NH_4^+(aq) + Cl^-(aq)$
- ⬭ $H_2O(l) + HSO_4^-(aq) \rightleftharpoons H_2SO_4(aq) + OH^-(aq)$
- ⬭ $HCO_3^-(aq) + H_2O(l) \rightleftharpoons CO_3^{2-}(aq) + H_3O^+(aq)$

3) Which expression describes the relationship between solubility product, K_{sp}, and the solubility, s, of $Ca(OH)_2$?

- ⬭ $K_{sp} = 2S^2$
- ⬭ $K_{sp} = 4S^2$
- ⬭ $K_{sp} = 2S^3$
- ⬭ $K_{sp} = 4S^3$

4) A buffer solution is made of 0.20 mol dm^{-3} $NaNO_2$ and 0.20 mol dm^{-3} HNO_2. Which of the following statements is correct?

- ⬭ If NaOH is added, the OH^- ions react with the $NaNO_2$.
- ⬭ If HCl is added, the H^+ ions react with the NO_2^- ions.
- ⬭ If a small amount of HCl is added, the pH increases very slightly.
- ⬭ If a small amount of NaOH is added, the pH decreases very slightly.

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Question 1 continued

5) Which of the following terms describes the voltage produced when a standard half-cell is connected to a standard hydrogen electrode under standard conditions?

- ☐ Electrolysis.
- ☐ Half cell.
- ☐ Voltage cell.
- ☐ Standard electrode potential.

6) Which one of the following describes the standard hydrogen electrode?

	Hydrogen gas pressure (atm)	**H^+ ions concentration** ($mol\ dm^{-3}$)	**The half – equation for the hydrogen electrode**
☐	1.00	1.00	$\frac{1}{2} H_2(g) + e^- \rightleftharpoons H^+(aq)$
☐	101	0.50	$\frac{1}{2} H_2(g) + e^- \rightleftharpoons H^+(aq)$
☐	1 .00	1.00	$H^+(aq) + e^- \rightleftharpoons \frac{1}{2} H_2(g)$
☐	101	0.50	$H^+(aq) + e^- \rightleftharpoons \frac{1}{2} H_2(g)$

7) Which of the following options is correct about the following reaction?

$$Cr(s) + Ca^{2+}(aq) \longrightarrow Cr^{2+}(aq) + Ca(s)$$

	The feasibility of the reaction	E^{Θ}/ V
☐	Feasible	+ 1.96
☐	Not feasible	- 1.96
☐	Feasible	+ 3.78
☐	Not feasible	- 3.78

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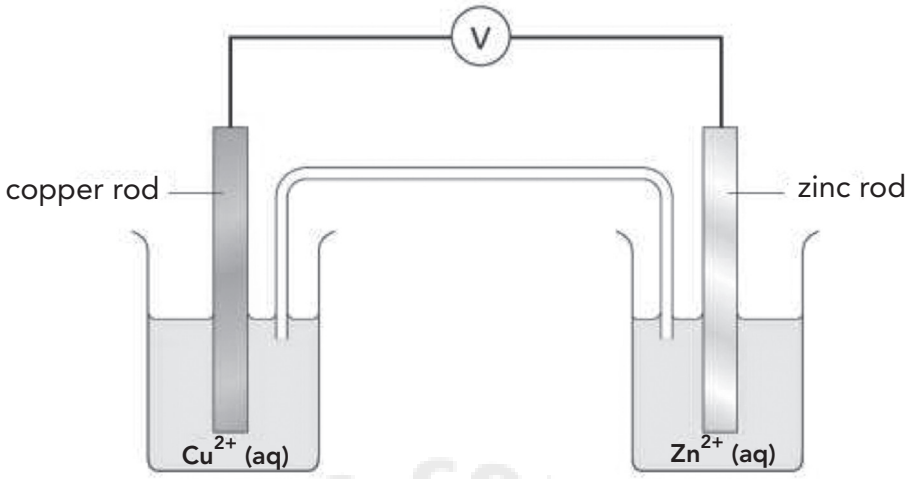
Question 1 continued

8) Which of the following options is not correct about the following cell?



- ☐ The Zinc rod is reduced.
- ☐ The voltage generated by this cell is +1.10 V.
- ☐ The Zn metal will lose electrons to the Cu^{2+} / Cu half-cell.
- ☐ The electron flow is from the Zn^{2+} / Zn half-cell to the Cu^{2+} / Cu half-cell.

9) Which of the following statements is correct about electron affinity?

- ☐ It is the energy required to add an electron to a cation.
- ☐ It is the energy released when an electron is removed from a cation.
- ☐ It is the energy released when an electron is added to a gaseous atom.
- ☐ It is the energy required to remove an electron from a gaseous atom.

10) Which of the following equations represents the enthalpy of hydration of sodium chloride (NaCl)?

- ☐ $Na(s) + \frac{1}{2}Cl_2(g) \longrightarrow NaCl(s)$.
- ☐ $Na^+(g) + Cl^-(g) \longrightarrow NaCl(s)$.
- ☐ $NaCl(s) \longrightarrow Na^+(aq) + Cl^-(aq)$.
- ☐ $Na^+(g) + Cl^-(g) \longrightarrow Na^+(aq) + Cl^-(aq)$.

Question 1 continued

11) Using the data in the table below. What is the enthalpy change of hydration of Ba^{2+} ion in kJ mol^{-1}?

Type of enthalpy change	Value of enthalpy change ($kJ\,mol^{-1}$)
Enthalpy change of hydration of OH^- ion	– 460
Lattice energy of $Ba(OH)_2$ (s)	– 2230
Enthalpy of solution of $Ba(OH)_2$ (s)	– 50

- ▢ –1260
- ▢ –1360
- ▢ –1820
- ▢ –3200

12) Which of the following options is correct about benzene?

	Bonds angle	Hybridization
▢	108°	sp^2
▢	108°	sp
▢	120°	sp^2
▢	120°	sp

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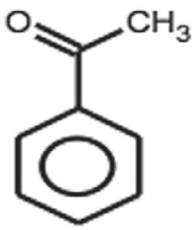
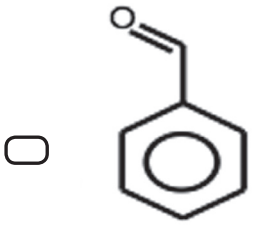
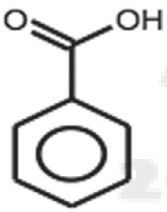
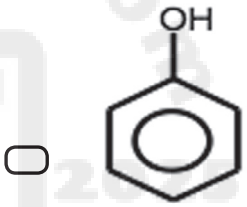
Do not write in this space

13) Which of the following is the electrophile in the nitration of benzene?

- ▢ NO_2^+
- ▢ NO_2^-
- ▢ NO_3^-
- ▢ NO^+

14) Which product is formed in the Friedel-Crafts acylation of benzene with ethanoyl chloride, CH_3COCl ?

- ▢ 
- ▢ 
- ▢ 
- ▢ 

Question 2: Extended responses (56 marks)

Write your answer for each of the following questions in the space provided.
Be sure to show all your work, including the correct units where applicable.

15) The following table shows equilibrium reactions and acid dissociation constants (Ka) in aqueous solutions. Use them to answer the following questions.

No.	Equilibrium in aqueous solutions	Ka / mol dm^{-3}
1	$CO_2 + H_2O \rightleftharpoons H^+ + HCO_3^-$	4.5×10^{-7}
2	$HSiO_3^- \rightleftharpoons H^+ + SiO_3^{2-}$	1.3×10^{-12}
3	$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$	1.7×10^{-5}
4	$HF \rightleftharpoons H^+ + F^-$	5.6×10^{-4}

a. For equilibrium **No.1**: (2 marks)

The hydrogencarbonate ion (HCO_3^-) is a conjugate base:

(i) Define the term conjugate base.

_____

(ii) What is the role of (HCO_3^-) in the blood?

_____

b. For equilibrium **No.2**: (2 marks)

(i) What are the acid and its conjugate base for the forward reaction?

The acid: _____

Its conjugate base: _____

(ii) Calculate the pK_a value?

_____

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c. What other component should be added to CH_3COOH to make a buffer solution? (1 mark)

d. A buffer solution consists of (0.0100 mol dm^{-3}) HF and (0.0200 mol dm^{-3}) NaF

(3 marks)

(i) Define the term buffer solution.

(ii) Calculate the pH of this buffer solution.

16) The solubility of lead(II) bromide, $PbBr_2$ is 2.17×10^{-3} mol dm^{-3} at a certain temperature.

a. Write equilibrium expressions for the solubility products for ($PbBr_2$). (1 mark)

b. Calculate the solubility product, K_{sp} of ($PbBr_2$) in mol^3 dm^{-9}. (1 mark)

Question 2 continued

c. If sodium bromide is added to the lead(II) bromide solution, the solubility of lead(II) bromide will. (2 marks)

☐ Increase ☐ Decrease ☐ No change **(shade your answer)**

Explain your answer.

17) The following table shows values of E^{Θ} for some half cells. Use them to answer the following questions:

Half cells	E^{Θ}/ V
$Fe^{3+}(aq) / Fe(s)$	+ 0.77
$Mg^{2+}(aq) / Mg(s)$	– 2.38
$Cr^{3+}(aq) / Cr(s)$	– 0.74
$Ag^{+}(aq) / Ag(s)$	+ 0.80

a. Name the reference electrode used to measure the above standard electrode potential? (1 mark)

b. Define the term standard cell potential. (1 mark)

c. Which metal in the table is the strongest reducing agent? (1 mark)

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Do not write in this space

Question 2 continued

d. Which metal ion in the table is the easiest to reduce? (1 mark)

_____

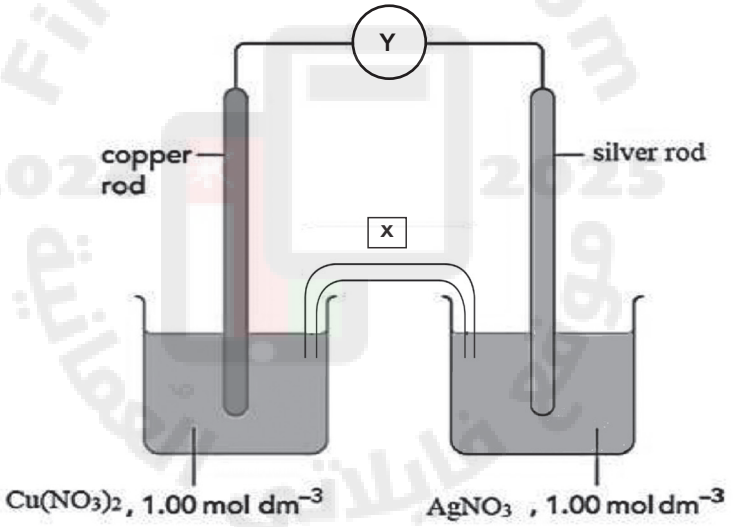
e. What is the direction of electron flow in the external circuit represented by the following pairs of half-equations $Mg^{2+}(aq)$ / Mg (s) and $Ag^{+}(aq)$ / Ag (s)? (1 mark)

_____

f. Write the whole equation that takes place in an electrochemical cell consisting of $Fe^{3+}(aq)$ /Fe(s) half-cell and Cr^{3+} (aq)/Cr(s) half-cell? (1 mark)

_____

18) Study the following figure which is about an electrochemical cell under standard conditions, to answer the questions below.



a. What type is this cell? (1 mark)

_____

b. Name the following labelled: (2 marks)

(X): _____

(Y): _____

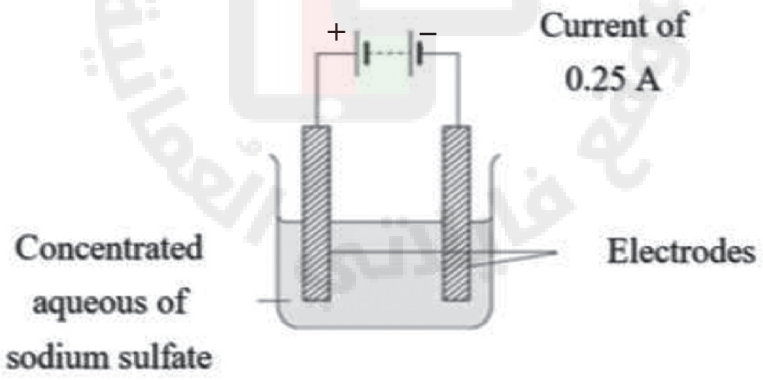
Question 2 continued

c. Calculate the cell voltage for this cell. (1 mark)

d. Calculate the value of the electrode potential at 298 K of Ag(s) /Ag^+(aq)electrode if the concentration of Ag^+ (aq) ions increases to (2.00) mol dm^{-3}
(E^{Θ} = + 0.80 V) (3 marks)

19) Study the following cell that shows the electrolysis of a concentrated aqueous solution of sodium sulfate, Na_2SO_4 for 15.0 min.

(F = 96500 C mol^{-1}, 1mole of gas occupies 24.0 dm^3 at r.t.p)



a. What substance will form at the cathode? (1 mark)

b. Write a half-equation for the reaction occurring at the anode. (1 mark)

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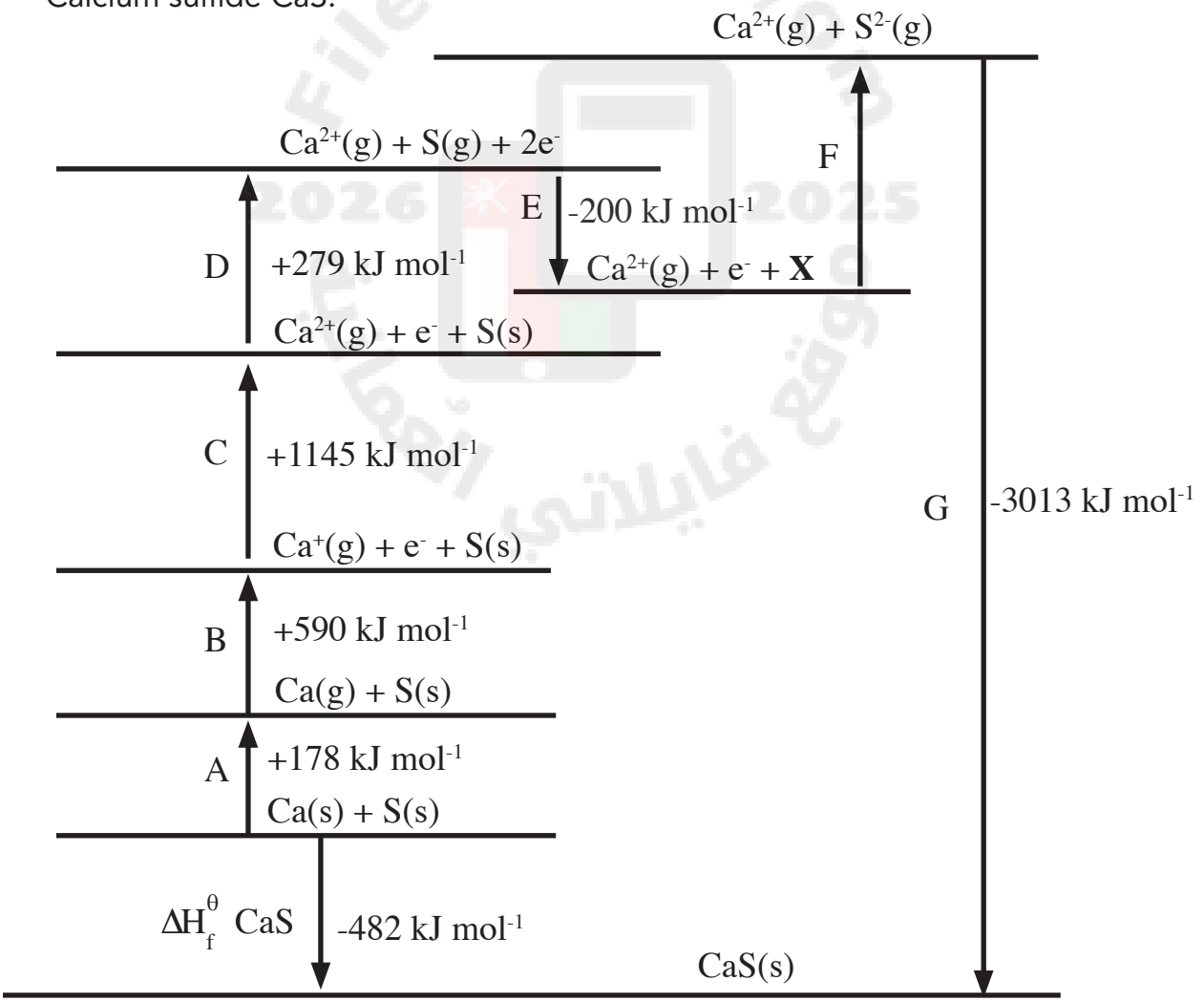
Question 2 continued

c. Calculate the charge transferred during the electrolysis. (1 mark)

d. Calculate the volume of the substance that is produced at the anode at r.t.p . (3 marks)

20) The Born–Haber cycle below can be used to determine the lattice energy of Calcium sulfide CaS.



Question 2 continued

a. Define the term atomization energy. (1 mark)

b. Identify the substance (X) with state produced in step E. (1 mark)

c. Identify the enthalpy change in step (B) in the cycle. (1 mark)

d. Calculate the enthalpy change labelled by (F). (2 marks)

e. Explain why the enthalpy change (C) is greater than the enthalpy change (B). (1 mark)

21) Use the data in the table to answer the questions below:

Reactions	Enthalpy change ($kJmol^{-1}$)
$K^+(g) + I^-(g) \longrightarrow KI(s)$	−629
$K^+(g) \longrightarrow K^+(aq)$	−322
$I^-(g) \longrightarrow I^-(aq)$	−293

a. Define the term standard enthalpy change of solution. (1 mark)

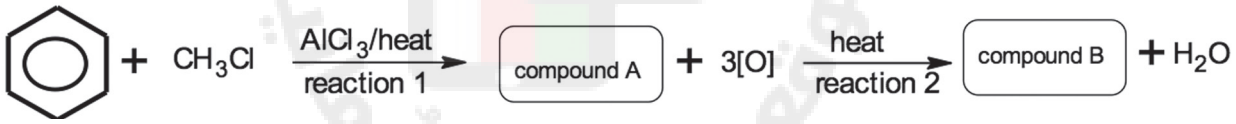
Question 2 continued

b. Calculate the enthalpy of solution for potassium iodide. (2 marks)

c. State two factors that affect lattice energy. (2 marks)

d. What is the order of the lattice energies of group 1 iodides (LiI, NaI, KI) from the greatest to the smallest? (1 mark)

22) Study the reactions sequence below, to answer the following questions:



a. For reaction 1: (4 marks)

(i) Draw compound A.

(ii) Name of the reaction.

Question 2 continued

(iii) The reaction is:

▭ Elimination reaction ▭ Substitution reaction ▭ redox reaction

(shade your answer)

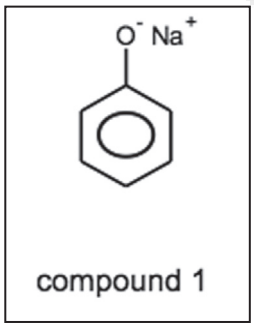
Explain your answer.

b. For reaction 2: (2 marks)

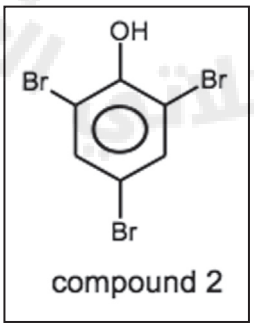
(i) Draw compound B.

(ii) Name the oxidizing agent used?

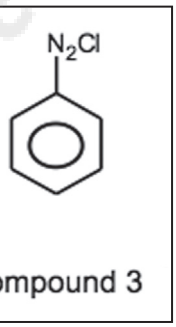
23) Study the compounds given below to answer the following questions:



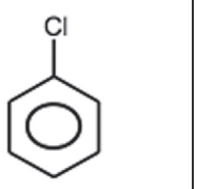
compound 1



compound 2



compound 3



compound 4

compound 5

compound 6

Question 2 continued

a. Name the following compounds: (2 marks)

Compound 1: _____

Compound 2: _____

b. Which organic compound from the above is produced for the following reactions: (2 marks)

(i) Compound 6 reacts with Na.

_____

(ii) Compound 5 reacts with HNO_2 and HCl.

_____

c. Draw the chemical equation for producing compound 2, showing all the reagents used. (2 marks)

d. Why is chloroethane more reactive than compound 4. (1 mark)

_____

_____

[End of the Examination]

Standard electrde potentals

Electrde reaction	$E^{\ominus}$/V
$F_2(g) + 2e^- \rightleftharpoons 2F^-(aq)$	+ 2.87
$S_2O_8^{2-}(aq) + 2e^- \rightleftharpoons 2SO_4^{2-}(aq)$	+ 2.01
$H_2O_2(l) + 2H^+(aq) + 2e^- \rightleftharpoons 2H_2O(l)$	+ 1.77
$Pb^{4+}(aq) + 2e^- \rightleftharpoons Pb^{2+}(aq)$	+ 1.69
$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightleftharpoons Mn^{2+}(aq) + 4H_2O(l)$	+ 1.52
$PbO_2(s) + 4H^+(aq) + 2e^- \rightleftharpoons Pb^{2+}(aq) + 2H_2O(l)$	+ 1.47
$Cl_2(g) + 2e^- \rightleftharpoons 2Cl^-(aq)$	+ 1.36
$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightleftharpoons 2Cr^{3+}(aq) + 7H_2O(l)$	+ 1.33
$O_2(g) + 4H^+(aq) + 4e^- \rightleftharpoons 2H_2O(l)$	+ 1.23
$Br_2(aq) + 2e^- \rightleftharpoons 2Br^-(aq)$	+ 1.07
$VO_2^+(aq) + 2H^+(aq) + e^- \rightleftharpoons VO^{2+}(aq) + H_2O(l)$	+ 1.00
$VO_3^-(aq) + 4H^+(aq) + e^- \rightleftharpoons VO^{2+}(aq) + 2H_2O(l)$	+ 1.00
$ClO^-(aq) + H_2O(l) + 2e^- \rightleftharpoons Cl^-(aq) + 2OH^-(aq)$	+ 0.89
$NO_3^-(aq) + 10H^+(aq) + 8e^- \rightleftharpoons NH_4^+(aq) + 3H_2O(l)$	+ 0.87
$NO_3^-(aq) + 2H^+(aq) + e^- \rightleftharpoons NO_2(g) + H_2O(l)$	+ 0.81
$Ag^+(aq) + e^- \rightleftharpoons Ag(s)$	+ 0.80
$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$	+ 0.77
$I_2(s) + 2e^- \rightleftharpoons 2I^-(aq)$	+ 0.54
$Cu^+(aq) + e^- \rightleftharpoons Cu(s)$	+ 0.52
$O_2(g) + 2H_2O(l) + 4e^- \rightleftharpoons 4OH^-(aq)$	+ 0.40
$Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s)$	+ 0.34
$VO^{2+}(aq) + 2H^+(aq) + e^- \rightleftharpoons V^{3+}(aq) + H_2O(l)$	+ 0.34

Electrde reaction	$E^{\ominus}$/V
$SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightleftharpoons SO_2(g) + 2H_2O(l)$	+ 0.17
$Cu^{2+}(aq) + e^- \rightleftharpoons Cu^+(aq)$	+ 0.15
$Sn^{4+}(aq) + 2e^- \rightleftharpoons Sn^{2+}(aq)$	+ 0.15
$S_4O_6^{2-}(aq) + 2e^- \rightleftharpoons 2S_2O_3^{2-}(aq)$	+ 0.09
$2H^+(aq) + 2e^- \rightleftharpoons H_2(g)$	0.00
$Fe^{3+}(aq) + 3e^- \rightleftharpoons Fe(s)$	− 0.04
$Pb^{2+}(aq) + 2e^- \rightleftharpoons Pb(s)$	− 0.13
$Sn^{2+}(aq) + 2e^- \rightleftharpoons Sn(s)$	− 0.14
$Ni^{2+}(aq) + 2e^- \rightleftharpoons Ni(s)$	− 0.25
$V^{3+}(aq) + e^- \rightleftharpoons V^{2+}(aq)$	− 0.26
$Co^{2+}(aq) + 2e^- \rightleftharpoons Co(s)$	− 0.28
$Fe^{2+}(aq) + 2e^- \rightleftharpoons Fe(s)$	− 0.44
$Cr^{3+}(aq) + 3e^- \rightleftharpoons Cr(s)$	− 0.74
$Zn^{2+}(aq) + 2e^- \rightleftharpoons Zn(s)$	− 0.76
$2H_2O(l) + 2e^- \rightleftharpoons H_2(g) + 2OH^-(aq)$	− 0.83
$Cr^{2+}(aq) + 2e^- \rightleftharpoons Cr(s)$	− 0.91
$Mn^{2+}(aq) + 2e^- \rightleftharpoons Mn(s)$	− 1.18
$V^{2+}(aq) + 2e^- \rightleftharpoons V(s)$	− 1.20
$Mg^{2+}(aq) + 2e^- \rightleftharpoons Mg(s)$	− 2.38
$Na^+(aq) + e^- \rightleftharpoons Na(s)$	− 2.71
$Ca^{2+}(aq) + 2e^- \rightleftharpoons Ca(s)$	− 2.87
$K^+(aq) + e^- \rightleftharpoons K(s)$	− 2.92

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Periodic Table

Key: Atomic number — 11; Element symbol — Na; Mass number — 22.99

1 H 1.01																	2 He 4.00
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 40.00
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	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 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226	89 Ac (227)															

Lanthanides	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
Actinides	90 Th 232.0	91 Pa (231)	92 U 238	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 (260)

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MARKING GUIDE

GENERAL EDUCATION DIPLOMA

BILINGUAL PRIVATE SCHOOLS

SEMESTER ONE - SECOND SESSION

CHEMISTRY

2024 / 2025

General Education Diploma, Semester One, Second Session
Bilingual Private Schools, Chemistry, 2024/2025

Exam Specification for Chemistry (Grade 12 - Bilingual) – Semester One (2024/2025)

Topic of the Units	Weighting %	Multiple Choice (20%)					Extended Response (80%)					Total Mark
		No. of Questions	Marks	Cognitive Levels			No. of Questions	Marks	Cognitive Levels			
				Knowing (30%)	Applying (50%)	Reasoning (20%)			Knowing (30%)	Applying (50%)	Reasoning (20%)	
Quantitative Equilibria	23%	14	4	1	2	1	10	12	4	6	2	16
Electrochemistry	33%		4	1	2	1		19	5	10	4	23
Lattice energy	21%		3	1	2	-		12	4	6	2	15
Arenes , Phenols	23%		3	1	1	1		13	4	6	3	16
Total	100 %		14	4	7	3		56	17	28	11	70

General Education Diploma, Semester One, Second Session
Bilingual Private Schools, Chemistry, 2024/2025

Distribution of cognitive domains and marks.

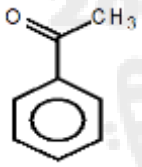
Item	Mark	Unit	Cognitive domain	Output
1	1	Quantitative Equilibria	Knowing	1.1.g
2	1	Quantitative Equilibria	Application	1.1.a
3	1	Quantitative Equilibria	Application	1.1.n
4	1	Quantitative Equilibria	Reasoning	1.1.h
5	1	Electrochemistry	Knowing	2.1. c
6	1	Electrochemistry	Application	2.1. e
7	1	Electrochemistry	Application	2.1 h i
8	1	Electrochemistry	Reasoning	2.1.i
9	1	Lattice energy	Knowing	3.1.b
10	1	Lattice energy	Application	3.1.b
11	1	Lattice energy	Application	3.2.a
12	1	Arenes and Phenols	Knowing	4.1.a
13	1	Arenes and Phenols	Application	4.1.d
14	1	Arenes and Phenols	Reasoning	4.1.c.iii
15.a.i	1	Quantitative Equilibria	Knowing	1.1.a
15.a.ii	1	Quantitative Equilibria	Knowing	1.1.i
15.b.i	1	Quantitative Equilibria	Application	1.1.b
15.b.ii	1	Quantitative Equilibria	Application	1.1.c
15.c	1	Quantitative Equilibria	Knowing	1.1.g
15.d.i	1	Quantitative Equilibria	Knowing	1.1.f
15.d.ii	2	Quantitative Equilibria	Application	1.1.j
16.a	1	Quantitative Equilibria	Application	1.1.m
16.b	1	Quantitative Equilibria	Application	1.1.n
16.c	2	Quantitative Equilibria	Reasoning	1.1.o
17.a	1	Electrochemistry	Knowing	2.1 d
17.b	1	Electrochemistry	Knowing	2.1 a ii
17.c	1	Electrochemistry	Application	2.1 j
17.d	1	Electrochemistry	Application	2.1 j
17.e	1	Electrochemistry	Application	2.1
17.f	1	Electrochemistry	Reasoning	2.1 hii + k
18.a	1	Electrochemistry	Knowing	2.1
18.b	2	Electrochemistry	Knowing	2.1 c iv. 2.1 c vii.
18.c	1	Electrochemistry	Application	2.1 g
18.d	3	Electrochemistry	Application	2.1 m
19.a	1	Electrochemistry	Application	2.2 a
19.b	1	Electrochemistry	Application	2.2 a
19.c	1	Electrochemistry	Application	2.2 c i
19 .d	3	Electrochemistry	Reasoning	2.2 cii

20.a	1	Lattice energy	Knowing	3.1.a
20.b	1	Lattice energy	Application	3.1.b
20.c	1	Lattice energy	Application	3.1.e
20.d	2	Lattice energy	Application	3.1.f
20.e	1	Lattice energy	Reasoning	3.1.b
21.a	1	Lattice energy	Knowing	3.2.a
21.b	2	Lattice energy	Application	3.2.c
21.c	2	Lattice energy	Knowing	3.1.g
21.d	1	Lattice energy	Application	3.1.g
22.a.i	1	Arenes and Phenols	Knowing	4.1.c.ii
22.a.ii	1	Arenes and Phenols	Knowing	4.1.c.ii
22.a.iii	2	Arenes and Phenols	Reasoning	4.1.c
22.b.i	1	Arenes and Phenols	Knowing	4.1.c.iii
22.b.ii	1	Arenes and Phenols	Knowing	4.1.c.iii
23.a	2	Arenes and Phenols	Application	4.1.b
23.b	2	Arenes and Phenols	Application	4.2.b
23.c	2	Arenes and Phenols	Application	4.1.c.i
23.d	1	Arenes and Phenols	Reasoning	4.1.e

TOTAL MARKS: 70 **PAGES: 5**

Question One (14 Marks)

There are 14 multiple-choice items. Each correct answer is worth ONE mark.

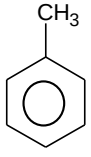
Item	Correct option	
1	D	Weak acid and its conjugate base.
2	A	$CH_3Cl(aq) + OH^-(aq) \rightleftharpoons CH_3OH(aq) + Cl^-(aq)$
3	D	$K_{sp} = 4S^3$
4	B	If HCl is added, the H^+ ions react with the NO_2^- ions.
5	D	Standard electrode potential
6	C	1 .00 1.00 $H^+(aq) + e^- \rightleftharpoons \frac{1}{2} H_2(g)$
7	B	Not feasible − 1.96
8	A	The Zinc rod is reduced.
9	C	It is the energy released when an electron is added to a gaseous atom
10	D	$Na^+(g) + Cl^-(g) \rightarrow Na^+(aq) + Cl^-(aq)$
11	B	-1360
12	C	120^o sp^2
13	A	NO_2^+
14	A	

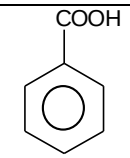
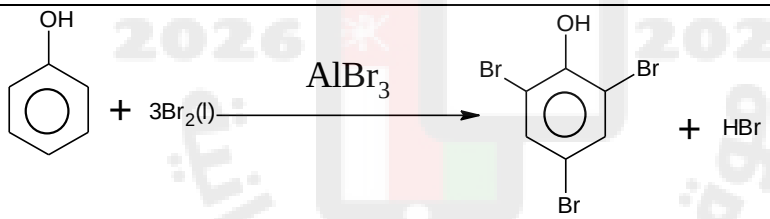
Question Two (56 Marks)

Part	Section	The answer	The mark
15	a. (i)	A conjugate base is an acid that lost its hydrogen ion (proton). **OR** A conjugate base contains one less H atom than the acid that formed it.	1
	a. (ii)	Controlling pH in blood.	1
	b. (i)	The acid: $HSiO_3^-$ Its conjugate base: SiO_3^{2-} (the student should write the acid and Its conjugate base to get the mark)	1
	b. (ii)	$pk_a = -\log(1.3\times10^{-12}) = \underline{11.89}$	1
	c	The large reserve supply of <u>its conjugate base CH_3COO^-</u> **Or** <u>the salt of CH_3COOH</u>	1
	d. (i)	A solution that minimizes changes in pH when moderate amounts of acid or base are added.	1
	d. (ii)	$K_a = \frac{[H^+][F^-]}{[HF]}$, $5.6 \times 10^{-4} = \frac{[H^+](0.0200)}{(0.0100)}$ $[H^+] = 2.8 \times 10^{-4}$ mol dm^{-3} [1 mark] $pH = -\log_{10}[H^+] = -\log_{10}[2.8 \times 10^{-4}] = 3.55$ [1 mark] **Or** $pH = pK_a + \log\frac{(0.02)}{(0.01)}$ [1 mark] pH = 3.55 [1 mark]	2
16	a	$K_{sp}=[Pb^{2+}][Br^-]^2$	1
	b	Let solubility be "s" $[Pb^{2+}]$= s, $[Br^-]$=2s , $K_{sp}=4s^3$ Substituting s = 2.17×10^{-3} $K_{sp} = 4s^3 = 4(2.17 \times 10^{-3})^3$ $= 4.10 \times 10^{-8}$ mol^3 dm^{-9} [1 mark]	1
	c	Decrease [1 mark] The bromide ion is common to both sodium bromide and lead(II) bromide. The addition of the common ion, Br^-, will reduce the solubility of the lead(II) bromide because <u>the added bromide ions shift the position of equilibrium to the left, and the lead(II) bromide is precipitated.</u> [1 mark]	2

Part	Section	The answer	The mark
17		The standard hydrogen electrode	1
	b	The difference in standard electrode potential between two specified half cells	1
	c	Mg	1
	d	Ag^+	1
	e	From $Mg^{2+}(aq)$ / Mg (s) to Ag^+ (aq) / Ag (s) **Or** From Mg to Ag	1
	f	$Cr(s) + Fe^{3+}(aq) \longrightarrow Cr^{3+}(aq) + Fe(s)$	1
18	a	Voltage cell	1
	b	(X): The salt bridge (Y): The voltmeter	1 1
	c	$E^{\ominus} = +0.80 - (+0.34)$ $= 0.46$ V	1
	d	$E = E^{\ominus} + 0.059/z \log_{10} [Ag^+(aq)]$ [1mark for z =1] $= 0.80 + 0.059/1 \log_{10} [2.00]$ [1mark] $= 0.98$ V [1 mark]	3

Part	Section	The answer	The mark
19	a	Hydrogen (H_2)	1
	b	$4OH^-(aq) \longrightarrow O_2(g) + 2H_2O(l) + 4e^-$	1
	c	Q= It = 0.25X 15 X 60 = 225 C	1
	d	Find the number of coulombs required to produce 1 mole of gas. 4 moles of electrons are released per mole of O_2 formed = 4F [1 mark] $=4 \times 96500$ $= 386000$ C mol^{-1} 225 C produces $225/386000 \times 24.0$ [1 mark] $= 0.0140$ dm^3 O_2 at r.t.p. [1 mark]	3

Part	Section	The answer	The mark
20	a	The enthalpy changes when one mole of gaseous atoms is formed from the element in its standard state under standard conditions	1
	b	$S^-(g)$	1
	c	$IE_1(Ca)$ **Or** First ionization energy.	1
	d	$\Delta H^{\ominus}_{latt} = \Delta H^{\ominus}_f[CaS] - (\Delta H^{\ominus}_{at}[Ca] + IE_1[Ca] + IE_2[Ca] + \Delta H^{\ominus}_{at}[S] + EA_1[S] + EA_2[S])$ [1 mark] $-3013 = -482 - (178 + 590 + 1145 + 279 - 200 + F)$ $F = +539\ kJ\ mol^{-1}$ [1 mark]	2
	e	After the first electron is removed, the atom becomes a positively charged ion. This increases the effective nuclear charge experienced by the remaining electrons, making them more tightly bound to the nucleus	1
21	a	The standard enthalpy change of solution: the enthalpy changes when one mole of a substance dissolves in a solvent to form an infinitely dilute solution under standard conditions	1
	b	$\Delta H^0_{latt} + \Delta H^0_{sol} = \Delta H^0_{hyd}(K^+) + \Delta H^0_{hyd}(I^-)$ $-629 + \Delta H^0_{sol} = (-322) + (-293)$ [1 mark] $\Delta H^0_{sol} = +14\ kJmol^{-1}$ [1 mark]	2
	c	Ionic radius. Ionic charge.	1 1
	d	$LiI > NaI > KI$	1
22	a.i	 methylbenzene	1
	a.ii	Friedel-Crafts Alkylation	1
	a.iii	Substitution reaction	1

		The alkyl group is introduced into the benzene ring by replacing one of the hydrogen atoms. This reaction involves the use of an alkyl halide and a Lewis acid catalyst, $AlCl_3$, to generate the electrophile that reacts with the benzene ring.	1
	b.i	 benzoic acid	1
	b.ii	Hot alkaline potassium manganate(VII) **Or** $KMnO_4$	1
23	**a**	sodium phenoxide 2,4,6-Tribromophenol	1 1
	b,i	compound 1 **Or** Sodium phenoxide	1
	b.ii	compound 3 **Or** Diazonium salt	1
	c		2
	d	Chloroethane is highly reactive in nucleophilic substitution due to a weaker, polar carbon-chlorine bond. **Or** Chlorobenzene is less reactive due to resonance stabilization and a stronger, less polar C-Cl bond.	1

This is the end of the Marking Guide