Kennedy College
CHEMISTRY
Trial written examination
Units 3 and 4

QUESTION AND ANSWER BOOK

Structure of book

<table>
<thead>
<tr>
<th>Section</th>
<th>Number of questions</th>
<th>Number of questions to be answered</th>
<th>Number of marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>10</td>
<td>90</td>
</tr>
</tbody>
</table>

Total 120

• Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
• Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied
• Question and answer book of 23 pages
• Data book
• Answer sheet for multiple-choice questions

Instructions
• Write your name in the space provided at the top of this page.
• Unless indicated, the diagrams in this book are not drawn to scale.
• All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

KENNEDY COLLEGE 2022
SECTION A – Multiple-choice questions

Instructions for Section A
Answer all questions in pencil on the answer sheet provided for multiple-choice questions. Choose the response that is correct or that best answers the question. A correct answer scores 1; an incorrect answer scores 0. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question. Unless otherwise indicated, the diagrams in this book are not drawn to scale.

Question 1
A particular secondary cell has the following chemical reaction when recharging

\[
\text{Cd(OH)}_2(\text{s}) + \text{Ni(OH)}_2(\text{s}) \rightarrow \text{Cd(s)} + 2\text{H}_2\text{O(l)} + \text{NiO}_2(\text{s})
\]

What is the half equation occurring at the cathode during discharge?
A. \(\text{NiO}_2(\text{s}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{Ni(OH)}_2(\text{s})\)
B. \(\text{NiO}_2(\text{s}) + 2\text{H}_2\text{O(l)} + 2\text{e}^- \rightarrow \text{Ni(OH)}_2(\text{s}) + 2\text{OH}^-(\text{aq})\)
C. \(\text{Cd(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Cd(OH)}_2(\text{s}) + 2\text{H}^+(\text{aq}) + 2\text{e}^-\)
D. \(\text{Cd(s)} + 2\text{OH}^-(\text{aq}) \rightarrow \text{Cd(OH)}_2(\text{s}) + 2\text{e}^-\)

Question 2
What is the correct IUPAC name for lysine?
A. 1,5-diaminohexanoic acid
B. 2-aminohexanoic acid
C. 2,6-diaminohexanoic acid
D. aminohexanoic acid

Question 3
What is the main reason why chemical reactions proceed at a faster rate at higher temperatures?
A. reactant molecules spread further apart, reducing the density of the reactants
B. intermolecular forces between the reactant molecules are broken
C. reactant molecules vibrate faster and therefore collide more frequently
D. a greater proportion of the reactant molecules collide with sufficient kinetic energy

Question 4
Which statement regarding fuel sources is incorrect?
A. hydrogen fuel cells release no greenhouse gases
B. methanol fuel cells release one mole of carbon dioxide for each mole of methanol oxidised
C. nuclear fission uses a non-renewable energy source
D. some buildings in Australia use solar panels to generate electricity
Question 5
Two spontaneous redox reactions are shown below.

\[ \text{2MnO}_4^{-}(aq) + 11\text{H}^{+}(aq) + 5\text{Cl}^{-}(aq) \rightarrow 2\text{Mn}^{2+}(aq) + 3\text{H}_2\text{O}(l) + 5\text{HClO}(aq) \]

\[ \text{5BrO}_3^{-}(aq) + 4\text{Mn}^{2+}(aq) + 6\text{H}_2\text{O}(l) \rightarrow 5\text{HBrO}(aq) + 4\text{MnO}_4^{-}(aq) + 7\text{H}^{+}(aq) \]

The strongest reductant in the above pair of reactions is
A. \text{MnO}_4^{-}(aq)
B. \text{Cl}^{-}(aq)
C. \text{HBrO}(aq)
D. \text{Mn}^{2+}(aq)

Use the following information to answer Questions 6 and 7.

<table>
<thead>
<tr>
<th>fuel</th>
<th>Energy content (kJ g(^{-1}))</th>
<th>Energy density (kJ L(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>methane</td>
<td>55.6</td>
<td>23 500 (liquefied)</td>
</tr>
<tr>
<td>butane</td>
<td>49.6</td>
<td>29 800 (liquefied)</td>
</tr>
<tr>
<td>octane</td>
<td>47.8</td>
<td>33 400</td>
</tr>
<tr>
<td>ethanol</td>
<td>29.7</td>
<td>23 400</td>
</tr>
</tbody>
</table>

Question 6
Which of the following fuels has the highest density?
A. methane
B. butane
C. octane
D. ethanol

Question 7
Which of the following fuels releases the fewest moles carbon dioxide per gram of fuel that undergoes complete combustion?
A. methane
B. butane
C. octane
D. ethanol

Question 8
The energy released from the combustion of propane at SLC, in MJ/tonne, is
A. 28.8
B. 50.5
C. 2880
D. 50 500
Question 9
A pH graph for a particular titration is shown below.

The solution in the burette is most likely to be
A. 0.10 M KOH(aq)
B. 0.010 M NaOH (aq)
C. 0.10 M HNO₃(aq)
D. 0.010 M HCl(aq)

Question 10
A researcher conducted a redox titration to find the concentration of sodium oxalate solution. A 25.00 mL aliquot of sodium oxalate was titrated with 0.108 M potassium permanganate solution. The two unbalanced half-equations for this redox titration are

\[
\begin{align*}
C_2O_4^{2-}(aq) & \rightarrow CO_2(g) \\
MnO_4^{-}(aq) & \rightarrow Mn^{2+}(aq)
\end{align*}
\]

The mean titre volume of three concordant titres was 12.20 mL.

The concentration of the sodium oxalate solution is closest to
A. 0.106 M
B. 0.132 M
C. 0.0530 M
D. 0.553 M

Question 11
The most appropriate technique to find the concentration of trace amounts of mercury ions in seafood is
A. ¹H NMR spectroscopy
B. UV-visible spectroscopy
C. atomic absorption spectroscopy
D. high performance liquid chromatography (HPLC)
**Question 12**
Oleocanthal is a naturally occurring phenolic compound in olive oil. Oleocanthal is the main component responsible for the pungent flavour of fresh olive oil.

A 3.50 mL sample of olive oil is estimated to have an oleocanthal concentration of 10 mg/mL. The high-performance liquid chromatography (HPLC) calibration curve for oleocanthal is shown below.

The minimum factor by which the sample of olive oil must be diluted before analysis in the HPLC instrument is closest to
A. 10
B. 12
C. 35
D. 84

**Question 13**
Which statement regarding biodiesel and petrodiesel is correct?
A. biodiesel has a higher viscosity than petrodiesel
B. biodiesel has a lower melting point than petrodiesel
C. biodiesel releases no carbon dioxide when combusted
D. biodiesel molecules have the same functional groups as petrodiesel molecules
**Question 14**
The equilibrium equation for carbon monoxide gas and chlorine gas is as follows:

\[ \text{CO(g)} + \text{Cl}_2(\text{g}) \rightleftharpoons \text{COCl}_2(\text{g}) \quad \Delta H = -108 \text{ kJ mol}^{-1} \]

A rate-concentration graph for the equilibrium reaction is shown below.

What change occurred at 60 seconds?
A. the reaction was heated at constant pressure  
B. the reaction volume was decreased at constant temperature  
C. a mixture of CO(g) and Cl_2(g) was added  
D. a catalyst was added, which increased the rate of both the forward and reverse reactions

**Question 15**
Which of the following 2-amino acids have basic side chains?
A. neither histidine nor asparagine  
B. histidine but not asparagine  
C. asparagine but not histidine  
D. histidine and asparagine

**Question 16**
Which of the following molecular formulae represents a molecule likely to be found in petrodiesel?
A. C_3H_8O  
B. C_{12}H_{30}O_2  
C. C_8H_18  
D. C_6H_{12}O_6
Nitrosyl chloride (NOCl) is a highly toxic gas that decomposes according to the equation

$$2\text{NOCl(g)} \rightleftharpoons 2\text{NO(g)} + \text{Cl}_2(g)$$

In an experiment, 3.0 mol of NOCl(g) is placed in an empty 4.0 L flask and allowed to reach equilibrium. The flask and its contents are kept at a constant temperature. When equilibrium is reached, the concentration of NOCl(g) was found to be 0.670 M.

**Question 17**
The correct expression for the equilibrium constant is

A. $$\frac{[\text{NO(g)}] \times [\text{Cl}_2(g)]}{[\text{NOCl(g)}]}$$

B. $$\frac{[\text{NO(g)}]^2 \times [\text{Cl}_2(g)]}{[\text{NOCl(g)}]^2}$$

C. $$\frac{\sqrt{[\text{NO(g)}] \times [\text{Cl}_2(g)]}}{\sqrt{[\text{NOCl(g)}]}}$$

D. $$\frac{\frac{1}{2} \times [\text{NO(g)}] \times \frac{1}{2} \times [\text{Cl}_2(g)]}{2 \times [\text{NOCl(g)}]}$$

**Question 18**
The correct value of the equilibrium constant at this temperature is closest to

A. $$1.41 \times 10^1$$

B. $$2.82 \times 10^1$$

C. $$1.14 \times 10^{-3}$$

D. $$5.70 \times 10^{-4}$$

**Question 19**
An experimental methanol fuel cell consumes 1.00 gram of methanol every 14 minutes. The current produced by the methanol fuel cell is closest to

A. 11.5 A

B. 14.5 A

C. 17.5 A

D. 21.5 A
**Question 20**
The heat and pressure of a vehicle engine can cause nitrogen gas and oxygen gas to react together to form nitric oxide gas according to the following equation

\[ \text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g}) \]

The equilibrium constant for this reaction is 0.40 at a particular temperature. The enthalpy change for the reverse reaction is \(-180.1 \text{ kJ mol}^{-1}\). If two moles of nitrogen gas and two moles of oxygen gas are placed into an empty reactor vessel, which statement is most correct?

A. the rate of the forward reaction will never be greater than the rate of the reverse reaction
B. the frequency of collisions between \text{N}_2(\text{g}) + \text{O}_2(\text{g}) will increase as the reaction proceeds
C. \text{N} is oxidised in the forward reaction from an oxidation number of \(-3\) in \text{N}_2(\text{g}) to +2 in \text{NO}(\text{g})
D. decreasing the temperature of the equilibrium system will decrease the rate of the reverse reaction

**Question 21**
A camping stove is attached to a gas canister that contains 230.0 grams of butane gas. A saucepan with 1.00 litre of cold water at 7 °C is placed on top of the camping stove. If the camping stove and saucepan have an average efficiency of 41% (due to heat energy escaping to the surroundings), the number of times a saucepan of cold water could be boiled this way using the butane gas canister is approximately

A. there is not enough butane in the canister to boil the water even once
B. 12 times
C. 29 times
D. 72 times

**Question 22**
A 12.4 kg gold ingot (specific heat capacity = 0.13 J g\(^{-1}\) K\(^{-1}\)) is heated to 80.0 °C and placed into a bucket containing 3.00 L of water at 10.0 °C. Theoretically, when the gold ingot and the water in the bucket reach thermal equilibrium, their final temperature should be closest to

A. 14.0 °C
B. 18.0 °C
C. 24.5 °C
D. 25.6 °C

**Question 23**
Valine has

A. 4 \(^1\)H environments and 4 \(^13\)C environments
B. 4 \(^1\)H environments and 5 \(^13\)C environments
C. 5 \(^1\)H environments and 4 \(^13\)C environments
D. 5 \(^1\)H environments and 5 \(^13\)C environments
**Question 24**
The 2-amino acid with the lowest melting point is
A. alanine
B. cysteine
C. glutamic acid
D. glycine

**Question 25**
The conversion of vitamin D$_2$ to vitamin D$_3$ is
A. oxidation
B. reduction
C. neither oxidation nor reduction
D. both oxidation and reduction on different parts of the molecule

**Question 26**
When propene gas and chlorine gas are placed into a dark, sealed container
A. the reactants polymerise to form polyvinylchloride (PVC)
B. 1,2-dichloropropane will form
C. a mixture of 1-chloropropane and 2-chloropropane will form
D. no reaction occurs

**Question 27**
A chromatogram was set up with a non-polar mobile phase. Which statement is most correct?
A. if the polarity of the mobile phase and stationary phase were reversed, Spot K would have a greater $R_f$
B. Spot K adsorbs the strongest to the stationary phase
C. Spot K is the least polar component in all the samples tested
D. the $R_f$ value of Spot K is 0.30
A 5.0 V battery is connected to two beakers as shown below.

**Question 28**
The strongest reductant at the anode is
A. Na⁺(aq)  
B. H₂O(l)  
C. Cu²⁺(aq)  
D. Cu(s)

**Question 29**
The electrons in this circuit flow from
A. reductant to anode to cathode to oxidant  
B. oxidant to cathode to anode to reductant  
C. reductant to cathode to anode to oxidant  
D. oxidant to anode to cathode to reductant

**Question 30**
The product at the cathode is
A. H₂(g) + 2OH⁻(aq)  
B. O₂(g) + 4H⁺(aq)  
C. Cl₂(g)  
D. Cu²⁺(aq)
Instructions for Section B
Give simplified answers to all numerical questions, with an appropriate number of significant figures; unsimplified answers will not be given full marks.
Show all working in your answers to numerical questions; no marks will be given for an incorrect answer unless it is accompanied by details of the working.
Ensure chemical equations are balanced and that the formulas for individual substances include an indication of state, for example, H₂(g), NaCl(s).
Unless otherwise indicated, the diagrams in this book are not drawn to scale.

Question 1 (8 marks)
Pale yellow-coloured Fe³⁺(aq) reacts with colourless SCN⁻(aq) in aqueous solution to produce red-coloured FeSCN²⁺(aq) according to the following equilibrium reaction

\[ \text{Fe}^{3+}(aq) + \text{SCN}^-(aq) \rightleftharpoons \text{FeSCN}^{2+}(aq) \ \Delta H \leq 0 \]

a. Explain whether the reactants or the products have greater enthalpy. 2 marks

b. After 10.0 mL of 0.10 M Fe³⁺(aq) solution and 12.0 mL 0.10 M SCN⁻(aq) solution were mixed, the final concentration of FeSCN²⁺(aq) was found to be \( 1.15 \times 10^{-5} \) M after equilibrium has been reached. Use this information to calculate the value of the equilibrium constant for this reaction. 3 marks

c. Explain, using a calculation of equilibrium quotient (Q), the effect of adding 50.0 mL of distilled water on the position of equilibrium for the above reaction. 2 marks

d. Suggest an instrumental technique that could be used to measure change in [FeSCN²⁺(aq)] over time quantitively. 1 mark

SECTION B – continued
TURN OVER
Question 2  (8 marks)
a. Draw the structural formula of but-1-ene in the Compound A box 1 mark

b. Write the semi-structural formulae of Compounds B–E in the boxes below 4 marks

c. Write an oxidation half equation to represent the reaction of Compound E with acidified potassium permanganate solution. 2 marks

d. Identify how infra-red spectroscopy could be used to differentiate between Compound B and Compound C. 1 mark
Question 3  (8 marks)
A student wants to plate their metal tongs with chromium to make them shinier. The student’s plating cell is shown below.

![Plating Cell Diagram]

**a.** State the polarity of the chromium electrode  

**b.** Write the half-equation for the reaction occurring at the cathode  

**c.** The student turns on the cell with a current of 4.5 A and a voltage of 8.10 V for exactly 10 minutes. Calculate the mass of chromium deposited onto the metal tongs.  

**d.** Suppose that the chromium electrode was impure, and instead consisted of 99% chromium and 1% gold. Explain what effect, if any, this would have on the mass of chromium metal deposited onto the metal tongs in part (c) above.
Question 4  (11 marks)
The molten carbonate fuel cell (MCFC) is a special type of high-efficiency fuel cell. MCFCs are very large and operate at high temperatures of around 650 °C. A diagram of an MCFC is shown below.

a. State the role of the molten carbonate in the MCFC  

b. Label the anode, cathode, positive electrode, and negative electrode on the diagram above  

c. Write the balanced redox half-equation for the reaction occurring at the anode  

d. Write the balanced redox half-equation for the reaction occurring at the cathode  

e. Write the overall equation for the MCFC  

f. Calculate the mass of hydrogen required to produce a current of 1.0 A for 60 minutes  

g. State one advantage of using the MCFC above over burning coal to generate electricity  

\[ H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(g) \]

\[ CO_2(g) \rightarrow CO_2^2- \]

\[ CO_2^2- \rightarrow CO_2(g) \]

\[ CO_3^2- \rightarrow CO_2(g) \]

\[ CO_2(g) \rightarrow CO_3^2- \]

\[ H_2O(g) \rightarrow CO_2(g) \]

\[ O_2(g) \rightarrow O_2(g) \]

SECTION B – continued

TURN OVER
**Question 5**  (9 marks)
Avocados contain proteins, carbohydrates, fats as well as many vitamins and minerals. The table below shows the amount of each nutrient in each 100 g of raw avocado.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Per 100 g raw avocado</th>
</tr>
</thead>
<tbody>
<tr>
<td>protein</td>
<td>1.6 g</td>
</tr>
<tr>
<td>carbohydrates</td>
<td>8.2 g</td>
</tr>
<tr>
<td>fat</td>
<td>13.2 g</td>
</tr>
</tbody>
</table>

**a.** An athlete cuts an avocado of mass 160 g into eight equal slices. Calculate how many slices of avocado would need to be consumed to provide the athlete with 427 kJ of energy.  

**b.** Use your knowledge of chemistry to describe the process of digesting fat in humans. In your answer, include

- the organ in which the fat is digested
- the enzyme that breaks down the fat
- the pH required
- the type of chemical reaction involved
- the functional groups broken and formed
- the products produced immediately upon initial digestion of the fat
Question 6  (10 marks)
One commercially available vehicle fuel is liquefied petroleum gas (LPG). The skeletal formula of the main component of LPG is shown below.

\[ \text{C}_3\text{H}_8 \]

a. Write the IUPAC name of this molecule 1 mark

b. Write a balanced thermochemical equation to show complete combustion of the molecule named in part (a) at SLC 2 marks

c. How much energy, in GJ, would be released from the complete combustion of 98.1 kg of the molecule named in part (a) at SLC? 3 marks

d. A customer at a car dealership is interested in purchasing either a car that runs on LPG, a car that runs on petrodiesel or a car that runs on biodiesel. Explain which fuel (LPG, petrodiesel or biodiesel) will have the lowest boiling point. 3 marks

e. State one disadvantage of using biodiesel over petrodiesel as a vehicle fuel 1 mark

SECTION B – continued
TURN OVER
Question 7  (9 marks)
Tryptophan is an essential amino acid that cannot be produced by the human body and must be obtained through your diet. Tryptophan was discovered in the early 1900s after it was isolated from casein, a protein found in milk.
In the body, tryptophan can be converted into the neurotransmitter serotonin, which improves our mood. Consuming tryptophan, which is found in large amounts in turkey meat and tuna fish, has been associated with lowering cortisol levels, reducing stress, and suppressing aggressive behaviour.

a. Draw the zwitterion of tryptophan  1 mark

b. What is meant by the term “chiral carbon”?  1 mark

__________________________________________________________
__________________________________________________________

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

c. Identify the chiral carbon atom in tryptophan by adding an asterisk (*) to the diagram in part (a)  1 mark

d. Explain whether valine or tryptophan would have a higher retention time in a column chromatograph with a non-polar stationary phase  3 marks

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________________________________________________________________
________________________________________________________________
________________________________________________________________

__________________________________________________________
__________________________________________________________

e. List three changes to the column chromatograph that would increase the retention time for all substances  3 marks

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

SECTION B – continued
Question 8  (4 marks)
A student is conducting a calorimetry experiment to find the $\Delta H$ for the combustion of octane. The student first calibrated the calorimeter using 12.0 V and a current of 8.0 A. The temperature change over time is shown below.

**a.** Use the information provided to calculate the calibration factor for the calorimeter  
2 marks

---

**b.** Use the theoretical heat of combustion for octane to estimate the mass of octane that would need to combust in order to raise the temperature of the calorimeter by 35.0 °C.  
2 marks

---
**Question 9** (10 marks)
A molecule has been identified as a contaminant in a piece of clothing. To investigate the identity of the contaminant molecule, it was extracted, purified and put through several different spectroscopic tests. The infra-red (IR) spectrum of the chemical is shown below.

![Infra-red (IR) spectrum](image)

a. Use the infra-red (IR) spectrum to identify the functional groups present in the compound 2 marks

__________________________________________

__________________________________________

__________________________________________

b. Combusting 5.56 g of the molecule produced 10.05 g of carbon dioxide and 3.43 g water vapour. Use this data to identify the empirical formula of the compound. 3 marks

__________________________________________

__________________________________________

__________________________________________

__________________________________________

__________________________________________

SECTION B – continued
c. Mass spectroscopy indicated that the parent molecular ion had a m/z value of 146. Write the formula for the parent molecular ion

__________________________
__________________________
__________________________

2 marks

d. A low-resolution $^1$H NMR spectrum for the compound is shown below.

![Low-resolution $^1$H NMR spectrum](image)

Explain the splitting patterns in a high-resolution $^1$H NMR spectrum you would expect to find at

- 1.5 ppm

- 12.0 ppm

1 mark

1 mark

e. Draw the structural formula for the compound

1 mark
Question 10  (13 marks)
A student is investigating the efficiency of different types of vehicle fuels. The student rented three different cars, each using a different fuel, and drove them successively on the same 100.0 km round trip to compare their energy usage. Part of the student’s experimental report is provided below.

Effect of different fuel types on carbon dioxide emissions per kilometre driven

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>fuel source</td>
<td>diesel</td>
<td>rechargeable battery</td>
<td>hydrogen fuel cell</td>
</tr>
<tr>
<td>details of amount of fuel used</td>
<td>used 11.1 litres of diesel to drive 100 km</td>
<td>when fully charged, the battery stores a maximum of 360 000 kJ energy</td>
<td>the hydrogen gas we used would have had a volume of 13 460 L at SLC</td>
</tr>
<tr>
<td>density of diesel is 0.850 g mL⁻¹</td>
<td>during our journey, the battery charge depleted by 30.0%</td>
<td></td>
<td>fortunately, it was compressed!</td>
</tr>
<tr>
<td>distance driven</td>
<td>100.0 km</td>
<td>100.0 km</td>
<td>100.0 km</td>
</tr>
<tr>
<td>weather</td>
<td>sunny, 16 °C</td>
<td>sunny, 0 °C</td>
<td>sunny, 20 °C</td>
</tr>
<tr>
<td>energy used in MJ</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. State one controlled variable the student’s investigation  
   ___________________________________________________________  1 mark

b. Calculate the energy used by each of the vehicles and write your answers in the table above  
   ___________________________________________________________  6 marks
c. Calculate the mass of carbon dioxide emitted from vehicle A per kilometre driven. You may make the following two assumptions in your answer
   - the diesel fuel is decane
   - the fuel combusted completely in oxygen

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   d. The weather was particularly cold during the road trip with vehicle B. State one problem with using battery electric vehicles at low temperatures

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   e. Suggest how the student could increase the validity of the results she obtained

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   f. Suggest one non-renewable source of hydrogen gas

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

END OF TEST