Penrith High School

Year 11

Preliminary HSC
Yearly Examination

2010

Chemistry

General Instructions

- Reading time – 5 minutes
- Exam time – 2 hrs
- Board-approved calculators may be used
- Write using blue or black pen
- Answers written in pencil may be disqualified from review
- A Data Sheet, Formulae Sheets and Vocabulary List are provided at the back of this paper.

Total marks (70)

There are Two Parts

Part A – Twenty 1- Mark Multiple Choice Questions

Total marks (20)

- Attempt Questions 1 – 20
- Allow about 30 minutes for this part

Part B - Free Response Questions

Total marks (50)

- Attempt Questions 21 – 28
- Allow about 1 hour and 30 minutes for this part

The Multiple Choice Answer Sheet must be placed inside this exam upon collection at the end of the examination.

STUDENT'S NAME: _____

Part A – Instructions for Multiple Choice Questions

Select the alternative A, B, C or D that best answers the question.
Fill in the response oval completely.

Example   2 + 4 = ?

    (A) 2   (B) 6   (C) 8   (D) 9

    (A) ⬭   (B) ⬬   (C) ⬭   (D) ⬭

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

    (A) ⬬   (B) ⊗   (C) ⬭   (D) ⬭

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word 'correct' and drawing an arrow as follows:

correct

    (A) ⊗   (B) ⊗   (C) ⬭   (D) ⬭

Student Name: _____

<u>**Preliminary HSC Chemistry**</u>

Part A Multiple Choice Answer Sheet

1.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

2.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

3.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

4.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

5.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

6.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

7.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

8.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

9.   (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

10. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

11. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

12. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

13. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

14. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

15. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

16. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

17. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

18. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

19. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

20. (A) ⬭   (B) ⬭   (C) ⬭   (D) ⬭

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Place answers on the separate Multiple Choice Answer Sheet

1. The following diagram shows the structure of diamond, fullerenes and graphite which are all composed of carbon atoms.
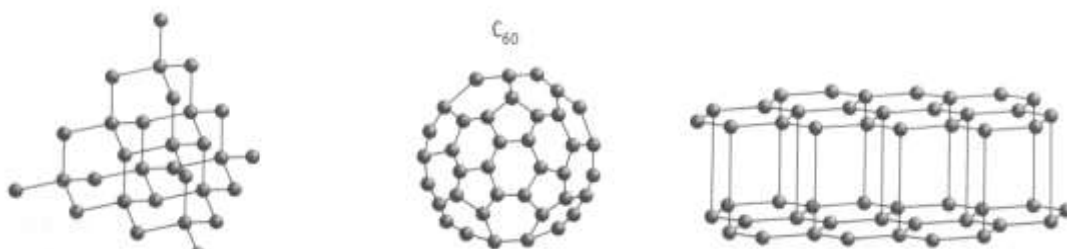

These can be classified as

(A) Allotropes

(B) Isomers

(C) Isotopes

(D) Compounds

2. Which alternative identifies a correct trend across a period from left to right?

(A) ionisation energy decreases

(B) atomic radii increases

(C) reactivity increases

(D) electro negativity increases

3. Uranium oxide is reacted with hydrogen fluoride gas for isotopic enrichment of uranium for use in nuclear reactors. Uranium tetrafluoride gas (UF_4) produced is then reacted with fluorine to form uranium hexafluoride gas (UF_6) as shown by the equations below.

$$UO_{2\,(s)} + 4HF_{(g)} \rightarrow 2H_2O_{(g)} + UF_{4\,(g)}$$

$$UF_{4\,(g)} + F_{2\,(g)} \rightarrow UF_{6\,(g)}$$
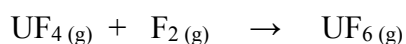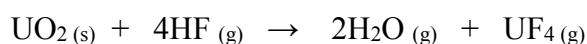
If 25 litres of hydrogen fluoride gas reacts with excess uranium oxide, how many litres of uranium hexafluoride gas could be formed?

(A) 4.0 litres

(B) 6.25 litres

(C) 0.16 litres

(D) 25.0 litres

4. Thermal pollution is the discharge into rivers or lakes of large quantities of hot water that significantly changes the temperature of the river or lake. This is undesirable as

(A) increased temperature increases solubility of oxygen gas

(B) increased temperature decreases solubility of oxygen gas

(C) increased temperature increases solubility of carbon dioxide gas

(D) increased temperature decreases solubility of salts

5. Combustion is an example of

(A) an endothermic reaction

(B) an exothermic reaction

(C) an electrochemical reaction

(D) a condensation reaction

6. The raw materials needed as reactants for photosynthesis in plants are

(A) water and oxygen

(B) glucose and water

(C) glucose and oxygen

(D) water and carbon dioxide

7. Name the compound shown below
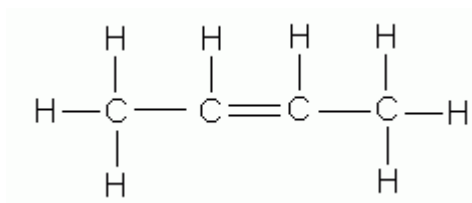
(A)   2 butene

(B)   3 butene

(C)   2 butyne

(D)   3 butyne

8. Carbon compounds can be classified into groups based on their functional groups. These groups of compounds form a

(A) heterozygous series

(B) homologous series

(C) hierological series

(D) haemologous series

9. Alkanes and alkenes have strict guidelines in regard to their storage. These rules are most likely due to

(A) the low volatility of hydrocarbons

(B) the ignition temperature of hydrocarbons

(C) the polar nature of hydrocarbons

(D) the weak dispersion forces of hydrocarbons

10. The diagrams below show the crystalline forms of fluorite (calcium fluoride) and carbon dioxide.

fluorite (CaF_2)

($\bullet$ Ca, $\circ$ F)

carbon dioxide (CO_2)

($\bullet$ C, $\circ$ O)
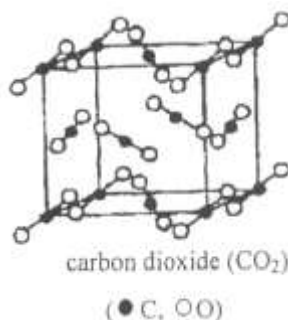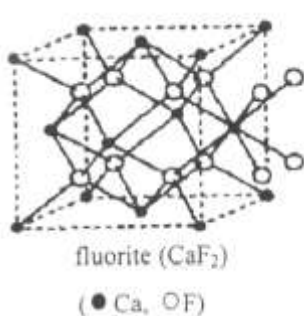
Which statement is correct?

(A) Flourite is an ionic compound with low melting point

(B) Carbon Dioxide is a covalent compound with a low melting point

(C) Flourite is a covalent compound with a high melting point

(D) Carbon Dioxide is an ionic compound with a high melting point

11. Silver nitrate solution reacts with sodium chloride solution to produce a white precipitate. The correct net ionic equation for this reaction would be

(A) $AgNO_3$ (aq) + $NaCl$ (aq) → $AgCl$ (aq) + $NaNO_3$ (aq)

(B) NO_3^- (aq) + Na^+ (aq) → $NaNO_3$ (aq)

(C) $AgNO_3$ (aq) + $NaCl$ (aq) → $AgCl$ (s) + $NaNO_3$ (aq)

(D) Ag^+ (aq) + Cl^- (aq) → $AgCl$ (s)
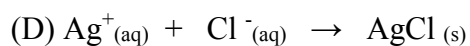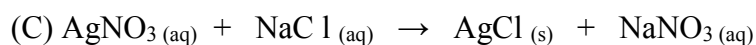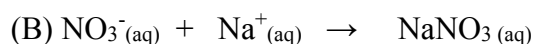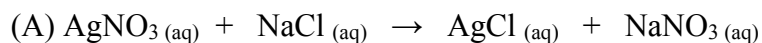
12. Which of the following statements is incorrect?

(A) Enthalpy is defined as the heat absorbed per mole of a substance.

(B) Breaking bonds in chemical reactions absorbs energy

(C) Forming bonds in chemical reactions releases energy

(D) Change in enthalpy is positive for exothermic reactions

13. The molarity of a solution is described as

(A) the moles of solute per litre of solution

(B) the mass of solute per litre of solution

(C) the moles of water per litre of solution

(D) the mass of water per litre of solution

14. Polar molecules are generally soluble in water. This is mainly due to the fact that

(A) water is a non polar molecule

(B) water has dipole-dipole interactions

(C) water has a lower density than ice

(D) water is a linear molecule

15. The diagram below shows two methanol molecules.
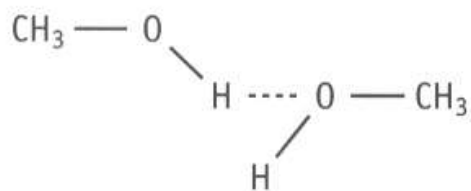
The dashed line (....) in this diagram represents

(A) a non polar covalent bond

(B) a polar covalent bond

(C) dispersion forces

(D) hydrogen bonding

16. A solution was formed by dissolving 0.15 moles of barium hydroxide in 500 mL of water. The molarity of the solution would be

(A)   0.30 moles/litre

(B)   3.33 moles/litre

(C)   0.08 moles/litre

(D)   0.03 moles/litre

17. The diagram below shows the reaction pathway for a chemical reaction.
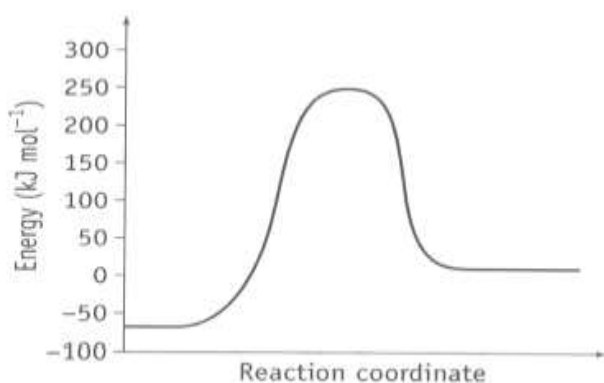
Which statement is correct?

(A) The reaction is exothermic

(B) The energy of the products is lower than the reactants

(C) Activation energy is greater than enthalpy change

(D) The reaction occurs spontaneously.

18. Combustion reactions can proceed at different rates. In the cylinders of petrol engines, fuel and air are combusted to produce rapidly expanding gases that drive the pistons. This is an example of

(A) slow combustion

(B) fast combustion

(C) explosive combustion

(D) spontaneous combustion

19. Reaction rate of chemical reactions is increased by temperature because it

(A) releases more energy in chemical reactions

(B) lowers activation energy in chemical reactions

(C) increases change in enthalpy of chemical reactions

(D) increases kinetic energy of reactants.

20. Which of the following equations shows the complete combustion of propane gas?

(A) $CH_3CH_2CH_3 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

(B) $CH_3CH_2CH_3 + 4O_2 \rightarrow 3CO_2 + 2H_2O$

(C) $CH_3CH_2CH_3 + 6O_2 \rightarrow 3CO_2 + 6H_2O$

(D) $CH_3CH_2CH_3 + 7O_2 \rightarrow 3CO_2 + 8H_2O$

Part B – Free Response Questions

Question 21. (4 marks)

Using Lewis electron dot formula, explain the differences between the polarity of ammonia (NH_3) and methane (CH_4). P13.1e   **(4 marks)**

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Question 22 (5 marks)

The graph shows the boiling points of the molecular hydrides (compounds formed between an element and hydrogen) of Group 6 and Group 7 verses the period of the periodic table.
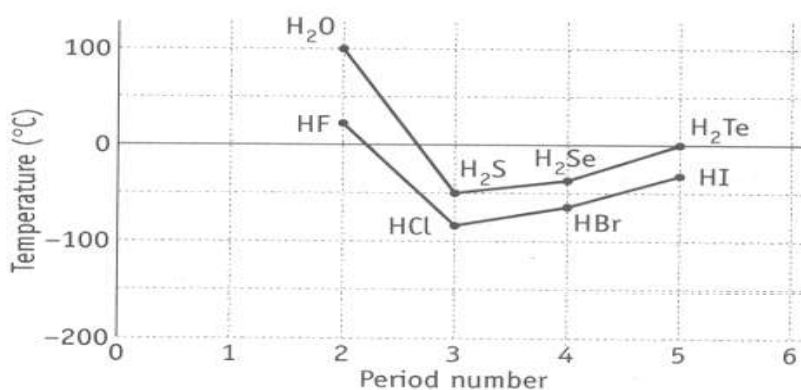
(a) Describe the trend shown in boiling points for Group 6. P14.1a   **(2 marks)**

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(b) Account for this trend shown in Group 6 in terms of intermolecular forces. P14.1g

(3 marks)

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Question 23. (7 marks)

During your course you completed a first hand investigation to measure the change in temperature when substances dissolve in water and calculated and compared the molar heat of solution.

(a) Explain why a repetition of procedures would be appropriate for this investigation. P11.2d   **(2 marks)**

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(b) Data collected from one student team showed an average temperature change of 3.2°C when 5.3 grams of calcium chloride was dissolved in 250mL of water. Calculate the molar heat of solution for calcium chloride. P10   **(3 marks)**

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(c) The value obtained for the molar heat of solution was lower than the accepted value for calcium chloride. Suggest ways of modifying the experiments to minimise errors. P11.2b   **(2 marks)**

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Question 24 (7 marks)

The following diagram shows some of the different arrangement of bonds for hydrocarbon compounds and their structures.

Bonding

Chains

Figure 4.11 A straight-chain compound, for example, nonane of an alkane C_nH_{2n+2}. Single C–C bonds

Figure 4.13 A branched-chain compound, for example, 2,6-dimethyl octane

Rings

or

Figure 4.12 A cyclic ring, for example, cyclohexane (for 6C atoms)

Figure 4.14 An aromatic ring, for example, benzene ring

Straight Chain and Cyclic Carbon Compounds

(a) Construct a balanced equation to show the complete combustion of cyclohexane. P13.1 d   **(2 mark)**

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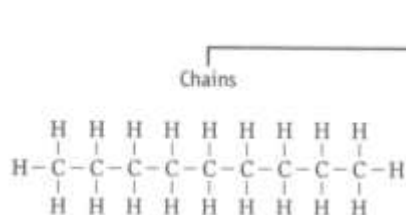
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(b) In an investigation, 0.58 grams of cyclohexane was reacted with excess oxygen in a combustion reaction. Calculate the predicted number of moles of carbon dioxide gas and water formed during the complete combustion of the cyclohexane. P10 **(3 marks)**

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(c) During the investigation, the combusted cyclohexane caused the formation of soot on the bottom of a container of water. Explain this observation. P14.1d   **(2 marks)**

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Question 25 (8 marks)

(a) Describe the separation of fractions in the process of fractional distillation of petroleum. P3 **(3 marks)**

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(b) Assess the impact of technological advances such as fractional distillation of petroleum on the understanding of the chemistry of carbon compounds. P3 **(5 marks)**

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Question 26 (4 marks)

Justify the increased recycling of metals in our society. P4 **(4 marks)**

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Question 27 (7 marks)

A chemical reaction follows the pathway indicated by the figures in the table.

Energy of Reaction Component	Energy kJ/mole
Energy of Products	40
Energy of Reactants	110
Activation Energy	50

(a) Construct a graph of Energy v Extent of Reaction to represent the chemical reaction pathway and label the reaction components identified in the table. P13.1f

(3 marks)

Extent of Reaction
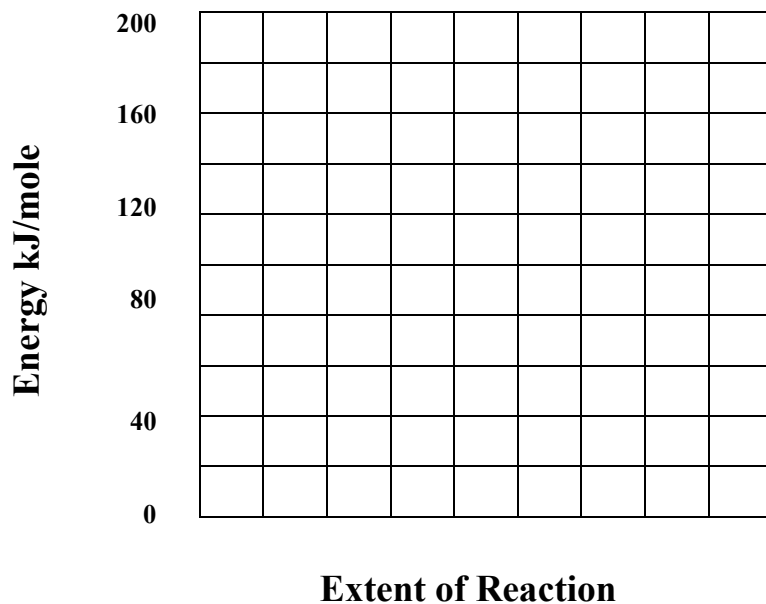
(b) Demonstrate, using the graph, the enthalpy change (ΔH) for this reaction and calculate the value of the enthalpy change. 13.1e   **(2 marks)**

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(c) Describe how the shape of the graph would change to show the effect of a catalyst on this reaction. P13.1f   **(2 marks)**

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Question 28 (8 marks)

During 2010 a large oil spill occurred in the Gulf of Mexico due to an explosion on an oil drilling platform. Extensive media coverage of the attempted cleanup operation and responses to the accident occurred.

Stimulus A: Oil Spill Processes

The following diagram shows some of the responses, processes that follow and approaches to cleaning up an oil spill. These responses included
- Natural dispersion of oil by wind, sun and currents
- Capping the oil leak to prevent oil spillage
- Cleanup of shoreline/animals contaminated with oil
- Contain spill with booms and skim water to collect oil
- Use dispersants to break up oil and speed its biodegradation
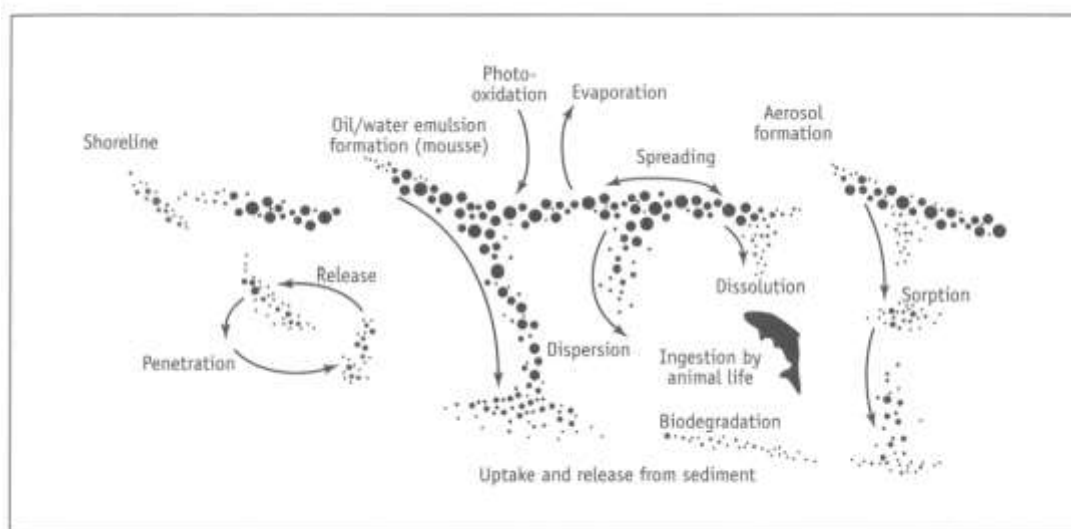- Biodegradation by micro-organisms into harmless substances

Figure 4.42 Processes following an oil spill

Stimulus B: Article from Australian Newspaper

Hope for Gulf as BP plugs well, most of the oil gone

Sydney Morning Herald, August 5, 2010

An end to the Gulf of Mexico oil disaster was in sight as BP plugged its runaway well and US officials said most of the toxic crude has been cleaned up or dispersed. At 4.9 million barrels - or enough oil to fill 311 Olympic-sized swimming pools - the disaster is the biggest maritime spill on record. It threatened the fish and wildlife-rich US Gulf coast with environmental ruin and plunged residents of coastal communities into months of anguish over their livelihoods and the region's future.

A government report released Wednesday found that a third of the oil was captured or mitigated through burning, skimming, chemical dispersion and direct recovery from the wellhead. Heat from the sun helped some of the chemicals in the crude evaporate. Waves and currents broke the slick up into smaller patches. Then the microbes which feed on natural oil seeps in the Gulf got to work, it said.

"At least 50 per cent of the oil that was released is now completely gone from the system," said Jane Lubchenco, head of the National Oceanic and Atmospheric Administration. "And most of the remainder is degrading rapidly, or is being removed from the beaches." But Lubchenco was quick to stress that scientists will not be able to determine for a long time the full extent of the damage.

(a) Identify a hypothesis or prediction in the proposed responses to the problem of the oil spill. P14.1c **(2 marks)**

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(b) Use the stimulus material to develop the logical consequence of your hypothesis or prediction. P14.3b **(3 marks)**

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(c) Assess the accuracy of scientific information presented in the stimulus material in regard to the oil spill. P12.4f **(3 marks)**

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