1.1 Matter, Chemical Change & the Mole Concept

Question Paper

Course	DP IB Chemistry
Section	1. Stoichiometric Relationships
Topic	1.1 Matter, Chemical Change & the Mole Concept
Difficulty	Easy

Time allowed: 40

Score: /27

Percentage: /100

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Question 1a

a)
Urea, $CO(NH_2)_2$, is an animal waste product that can be used as a fertiliser. It can also be made artificially by reacting ammonia, NH_3, with carbon dioxide, CO_2, forming water as a co-product.

Formulate a balanced equation for the reaction.

[1 mark]

Question 1b

b)
Calculate the molar mass of urea, $CO(NH_2)_2$.

[1 mark]

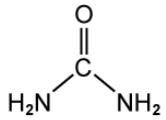
Question 1c

c)
Calculate the percentage of nitrogen in urea. Give your answer to two decimal places.

[1 mark]

Question 1d

d)
The chemical structure of urea is shown below:



Deduce the total number of electron pairs in the molecule.

[1 mark]

Question 2a

a)
Name the six changes of state, and state which changes are accompanied by a decrease in particle separation distances.

[2 marks]

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Question 2b

b)
State the difference between a *homogeneous* and a *heterogeneous* mixture.

[1 mark]

Question 2c

c)
Classify the following mixtures as *homogeneous* or *heterogeneous*: crude oil, concrete and brass.

[3 marks]

Question 2d

d)
Which technique would be the most suitable for the separation of crude oil?

[1 mark]

Question 3a

a)
A compound with M_r=104.07 contains 34.62 % carbon, 3.88 % hydrogen and 61.50 % oxygen by mass.

Calculate its empirical formula.

[4 marks]

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Question 3b

b)
Calculate the molecular formula of the compound in part a).

[1 mark]

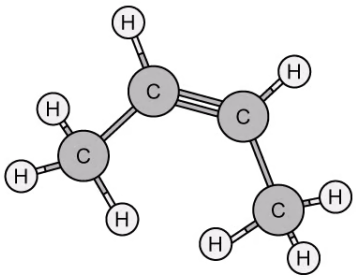
Question 3c

c)
Draw a possible structure for the compound in part b).

[1 mark]

Question 3d

d)
Deduce the empirical formula of the following molecule:



[1 mark]

Question 4a

c)
Determine the molecular formula of the compound in part b), given the $M_r = 90.09$.

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[1 mark]

Question 4b

a)
State the meaning of the term empirical formula.

[1 mark]

Question 4c

An unknown compound contains carbon, hydrogen and oxygen only. It was shown to contain 3.20 g carbon, 0.54 g hydrogen and 4.26 g oxygen.

b)
Calculate the empirical formula of the unknown compound.

[3 marks]

Question 5a

a)
Define the term *one mole* in chemistry.

[1 mark]

Question 5b

b)
How many atoms are present in 0.200 mol of P_2O_5?

[1 mark]

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Question 5c

c)
How many moles are in 2.35×10^{24} molecules of oxygen gas?

[1 mark]

Question 5d

d)
How many atoms are in 4.00 g of hydrogen gas?

[1 mark]

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