

# 1.1 Matter, Chemical Change & the Mole Concept

## Question Paper

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

**Time allowed:** 40  
**Score:** /27  
**Percentage:** /100

### Question 1a

a)

Urea,  $\text{CO}(\text{NH}_2)_2$ , is an animal waste product that can be used as a fertiliser. It can also be made artificially by reacting ammonia,  $\text{NH}_3$ , with carbon dioxide,  $\text{CO}_2$ , forming water as a co-product.

Formulate a balanced equation for the reaction.

[1 mark]

### Question 1b

b)

Calculate the molar mass of urea,  $\text{CO}(\text{NH}_2)_2$ .

[1 mark]

### Question 1c

c)

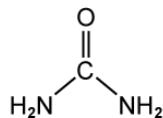
Calculate the percentage of nitrogen in urea. Give your answer to two decimal places.

[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]

**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]**

### Question 3b

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

[1 mark]

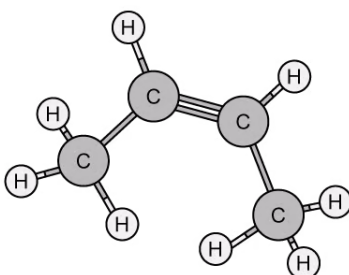
### Question 3c

- 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  $M_r = 90.09$ .

[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  $\text{P}_2\text{O}_5$ ?

[1 mark]

**Question 5c**

c)

How many moles are in  $2.35 \times 10^{24}$  molecules of oxygen gas?

[1 mark]

**Question 5d**

d)

How many atoms are in 4.00 g of hydrogen gas?

[1 mark]