

AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ARTS AND SCIENCE DEPARTMENT OF EDUCATION
EDUC 273 (Science for Elementary Teachers 1)

EXAMINATION FOR Semester 1, 2005-6

28 January 2006, 3:00 p.m.

Time Permitted: 2 hours

Mark Total: 175

WEIGHTING: 50%

Answer all Questions in the spaces provided.

YOUR NAME: _____

(1) Consider these two chemical elements:

${}^7\text{N}$

${}^{19}\text{K}$

a) What is the number called and what does it represent?

_____ (2 marks)

b) Draw diagrams showing the electron configurations of each of these atoms. (Show the

${}^7\text{N}$

_____ (2 marks)

${}^{19}\text{K}$

_____ (3 marks)

c) In which part of the Periodic Table do we find each of these two elements? Choose between the following: top left side, bottom left side, middle, top right side, bottom right side.

N: _____

(1 mark)

K: _____

(1 mark)

(2)

and can be safely stored and handled. Both are made up only of P atoms. What word describes two or more different forms of a chemical element?

_____ (1 mark)

b) Write down the chemical symbols and names of three chemical elements the symbols of which begin with th
mark only if both the symbol and spelling are correct.)

<u>Symbol</u>	<u>Name</u>
_____	_____
_____	_____
_____	_____

(3 marks)

c) Complete this table comparing metals with non-

	<u>Metals</u>	<u>Non-metals</u>
malleability	_____	_____
lustre	_____	_____
electrical conductivity	_____	_____

(3 marks)

d) Describe two ways in which graphite behaves as a semi-metal.

_____ (2 marks)

e) Name two non-ferrous metals.

_____ (2 marks)

f) Explain what an alloy is and name one alloy.

(2 marks)

g) Answer this question for EITHER iron OR aluminium.

(i) Name an ore from which the metal is extracted and give its chemical formula.

(2 marks)

(ii) Briefly outline the steps by which the metal is extracted from the concentrated ore.

(3 marks)

(3)a) Use electron dot diagrams to represent

a hydrogen molecule

(1 mark)

a hydrogen fluoride molecule

(2 marks)

b) Present a diagram of a hydrocyanic acid (HCN) molecule using strokes for bonds (do not show electrons).

(2 marks)

 (2 marks)

d) Complete the following table (the first one has been done for you):

<u>Compound</u>	<u>Formula</u>	<u>Ions Present</u>
sodium chloride	NaCl	Na^+ and Cl^-

potassium sulphate

calcium nitrate

 (2 marks)

e) Fill in the gaps:

Hard water is water that does not readily form a _____ with soap. It is responsible for leaving deposits of _____ in hot water systems.

Hard water forms when _____ dissolves in water and forms a weak acid that reacts with _____. The product of this reaction is calcium bicarbonate.

Temporary hard water can be made soft by _____. Hard water that can not be made soft this way is called _____ hard water and requires chemical softening.

(3 marks)

(4)

Explain the terms

enthalpy: _____
 _____ (2 marks)

exothermic: _____
 _____ (2 marks)

Name the type of exothermic reaction in which a substance reacts with a gas, producing much light and heat as the reaction proceeds: _____ (1 mark)

b)

coin be made, and why?

(3 marks)

(5)a) Write an ionisation equation for hydrochloric acid showing what happens when HCl gas dissolves in water, and circle the ion which is responsible for the acidic properties of the solution.

(2 marks)

b) Complete these word equations:

ACID + ALKALI (1 mark)

ACID + CARBONATE (2 marks)

c) Fill in the gaps:

Acidic solutions taste _____ while alkaline solutions taste _____. (2 marks)

(2 marks)

(6)a) Complete this series:

no. C atoms	1	2	3	4	5	6	7	8	
prefix	meth	_____	_____	_____	_____	_____	hept	_____	(3 marks)

b) What is the general formula for the alkanes? _____ (2 marks)

b) Which physical property of alkanes does fractional distillation make use of to separate them? _____ (1 mark)

c) Complete these word equations for the burning of alkane fuels:

Complete combustion:

ALKANE + OXYGEN _____ + _____ (1 mark)

Combustion in limited air supply:

ALKANE + OXYGEN _____ (2 marks)

Combustion in very limited air supply:

ALKANE + OXYGEN _____ + _____ + _____ (3 marks)

d) Draw the functional groups for

(i) alcohols: (1 mark)

(ii) carboxylic acids: (2 marks)

_____ (3 marks)

f) In the first step in the production of teflon, one hydrogen atom on an ethene molecule is replaced with a fluorine atom. Draw the molecule arising from this substitution.

(2 marks)

of compound in which small molecules are joined up to form large ones.

(1 mark)

(7)a) A 20 cm³ piece of aluminium weighs 54 g. Calculate the density of aluminium, beginning with the formula.

(Formula 1 mark)

(Working 1 mark)

(Units 1 mark)

b) The Moon has a gravitational field 1/6th that of the Earth. A 12 kg steel object is taken to the Moon.

What is its mass on the Moon? _____ kg (1 mark)

What is its weight on the Moon? _____ kg-equivalent (1 mark)

c) Does a pan balance measure mass or weight? Justify your answer.

(2 marks)

(8)a) What did Aristotle regard as the natural motion condition of any object?
_____ (1 mark)

To what force did mediaeval scientists attribute movement? Why did they think moving objects slow down and eventually stop?

(2 mark)

b) Using a simple diagram, describe an example of the relativity of motion. Your example should compare the movement of the same object as perceived differently by two observers.

(3 marks)

c) C

(3 marks)

d) A car travelling on an unsealed, rough surface goes onto a smooth road surface. If the driver does not change the amount of fuel being burned by the engine by altering pressure on the gas pedal, what will happen and why?

(2 marks)

e) Use the example in (d) to draw a diagram showing how forces acting on a moving object (in this case, the car) have become unbalanced. Indicate the net force that has arisen.

(3 marks)

f) A car travelling at 90 kph on the open road enters a town and slows down to 40 kph over a period of 10 seconds. Calculate the acceleration of the vehicle over this time period.

(Formula 1 mark)

(Working 1 mark)

(Units 2 marks)

g) Name the mass-related resistance of all objects to changes in their movement.

(1 mark)

h) List two factors which determine how quickly an object falls in a fluid.

(1 mark)

(1 mark)

(9)a) NAME (do not just give the symbol) the unit used for heat energy.

(1 mark)

(Formula 1 mark)

(Working 1 mark)

(Units 1 mark)

c)

_____ (2 marks)

d) Arrange these substances from the highest to the lowest heat capacity: aluminium, water, copper.

(2 marks)

you warm your hands by putting them on a radiator? _____ (1 mark)

you warm yourself up by sitting in front of a glowing electric heater?

_____ (1 mark)

f) Draw a diagram to show convection currents in a large pan of water heated by a small gas ring.

(2 marks)

(10)a) Draw a diagram showing a single wave. Indicate on your diagram its wavelength and amplitude.

(3 marks)

b) A radio station transmits at 1600 kHz.

s, and in what

units?

(3 marks)

c) Draw a diagram showing how sound waves propagate in air.

(3 marks)

d) At approximately what speed do electromagnetic waves travel?

(2 marks)

e) What kind of image is formed by a convex mirror?

(2 marks)

Draw a diagram showing what a convex mirror does to parallel incident light rays.

(2 marks)

f) Draw a diagram showing what a convex lens does to parallel incident light rays striking it at right angles to its centreline.

(3 marks)

g) Distinguish between reflection and refraction (of light).

(2 marks)

h) What colour do we get when we mix red, blue and yellow light?

(1 mark)

Briefly explain why we get a different effect when mixing red, blue and yellow paints.

(2 marks)

i) Briefly explain the role of each of these structures in hearing:

ear drum: _____ (1 mark)

ossicles: _____ (1 mark)

cochlea: _____

(2 marks)

j) Briefly explain the role of each of these structures in vision:

iris: _____

(2 marks)

retina: _____

(2 marks)

k) What is myopia and what causes it in many teenagers?

(3 marks)

(11)a) A girl notices that little sparks appear when she is combing her hair. Explain to her why this is happening.

(2 marks)

The girl has also noticed that these sparks tend to occur when she is combing her hair on the balcony on a hot, dry day rather than in the moisture-laden air of a warm bathroom. Why is this?

(1 mark)

(2 marks)

c) Name the units (do not just give symbols) we use to express

the amount of electric current flowing in a circuit _____ (1 mark)

the potential difference across a power source or a resistor _____ (1 mark)

the resistance to the passage of electricity of a resistor _____ (1 mark)

the amount of electrical energy converted into other forms of energy by
a resistor _____ (1 mark)

d) Using the correct symbols, draw a circuit made up of a battery, a lightbulb, and a switch.

(3 marks)

e)

called.

(4 marks)

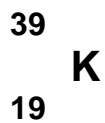
Compare the ways in which DC and AC are generated.

(2 marks)

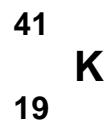
f) Note two distinguishing features of electronic circuits.

(2 marks)

(12)a) Consider the atoms



and



_____ and _____ (1 mark)

(1 mark)

(2 marks)

d) Distinguish between nuclear fission and nuclear fusion.

(2 marks)

e) Complete this sentence: A 100 kiloton nuclear bomb gives off the same amount of energy as exploding _____ tons of _____ (2 marks)