UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

0620 CHEMISTRY

0620/22 Paper 22 (Core Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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1 **(a)** **(i)** titanium / vanadium / zirconium / niobium **max [2]**
(1 mark each)
allow: symbols

(ii) Na / Mg [1]

(iii) sodium / Na [1]

(iv) potassiu / K [1]

(v) vanadium / V [1]

(b) O_2 [1]
correct balance [1]

2 **(a)** **(i)** A: giant ionic [1]
B: simple atomic [1]
C: simple molecular [1]
D: metallic [1]

(ii) B and C (both needed for mark) [1]

(b) solid; molten; [2]

3 **(a)** coolant / making ethanol / any other names large scale relevant reaction
e.g. making sulfuric acid [1]

(b) blue / anhydrous cobalt chloride (paper); turns pink; [2]
OR white / anhydrous copper sulfate; turns blue;

(c) **(i)** lighted splint;
pops / explodes; [2]

(ii) pH 12 [1]

(d) **(i)** 3 (CO_2); 4(H_2O); [2]

(ii) combustion [1]

(iii) 36 (mg) [1]

4 **(a)** Any 2 of:
diffusion /
ink particles move /
water particles or molecules move /
movement of particles is random / [2]

(b) two or more substances (together) that can be separated by physical means [1]

(c) **(i)** ethanol [1]
allow: carboxylic acids

(ii) oxidation state / third box down ticked [1]

(iii) idea of small molecules / monomers joining / repeating units;
long chains / large molecules formed; [2]

(d) **(i)** ring around COOH group [1]

(ii) removal of oxygen / decrease in oxidation number / addition of electrons [1]

5 **(a)** filtration / centrifugation [1]
allow: decanting

(b) C [1]

(c) **(i)** solvent shown in bottom of beaker; [1]
spot on the base line <u>vertically below</u> the spots shown; [1]
chromatography paper labelled anywhere; [1]

(ii) 4 [1]

(d) **(i)** A [1]

(ii) bromine water;
decolourises / goes colourless; [2]
allow: potassium manganate (VII); decolourises;

(iii) substance containing carbon and hydrogen <u>only</u> [1]

(iv) ethanoic acid [1]

(v) alcohols / alkanols [1]

6 **(a)** conduct heat / conduct electricity / shiny / malleable / ductile **max [2]**

(b) 4 [

(c) 82 electrons [1]
82 protons [1]
126 neutrons [1]

(d) lead + oxygen → lead(II) oxide [1]

(e) **(i)** carbon [1]

(ii) gas at room temperature / third box down ticked [1]

7 **(a)** **(i)** one of:
BMF molecule and diamond a giant covalent structure / [1]
BMF has pentagonal (and hexagonal) structure diamond has bent hexagonal or tetrahedral structure /
BMF each carbon joined to 3 others, diamond each carbon joined to four others /

(ii) two of:
graphite has (flat) hexagonal rings, diamond has bent hexagonal rings or tetrahedral /
graphite has 3 bonds to each carbon, diamond has 4 /
graphite is layered diamond is not /
graphite has two types of bonding / forces or weak and strong bonds whereas diamond has only one type of bond / covalent bonds only [2]

(b) covalent [1]

(c) layers can slide over each other / forces weak between layers [1]

(d) cutting / drilling **allow:** jewellery [1]

(e) any 2 of:
carbon dioxide is a greenhouse gas /
absorbs infrared radiation /
increases global warming /
lead to climate change / [2]

(f) any two of:
sulfur reacts with oxygen (when coal burnt) /
forms sulfur dioxide /
sulfur dioxide reacts with oxygen (to form sulfur trioxide) /
sulfur dioxide or trioxide dissolve in rain (to form acid) / [2]

(g) **(i)** waste gases from digestion in animals / second box down ticked

(ii) correct dot and cross diagram for methane

(iii) ethane / propane / butane etc [1]

8 **(a)** calcium oxide [1]

(b) thermal decomposition [1]

(c) carbon dioxide has been removed from the limestone / it comes from the limestone [1]

(d) neutralising acid soils / treating acidic lakes / flue gas desulfurisation etc [1]

(e) temperature of Bunsen / distance of Bunsen from the tube / amount or mass of carbonate used [1]

(f) **(i)** calcium [1]

(ii) 25 cm^3 [1]

(iii) calcium faster than strontium which is faster than barium / idea of trend down the group;
correct trend i.e. less rapid reaction the further down the group; ORA [2]

(g) add acid to carbonate;
bubble gas or carbon dioxide (evolved) through limewater / test gas or carbon dioxide with limewater;
limewater goes milky or cloudy; [3]