BELMONT HIGH SCHOOL

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MID- COURSE EXAM 2004

2 UNIT CHEMISTRY HSC

Section 1.01 TIME ALLOWED **(a) 2 HOURS + 5 minutes reading time**

INSTRUCTIONS

Answer all questions

All answers must be written in the separate answer booklet

A periodic table, table of reduction potentials and constants been included.

A list of common verbs and their meanings have been included. Use them as a reference

At the end of the exam both question and answer booklets must be handed in.

IMPORTANT

When an answer requires a calculation you must show all working

Remember that your responses will be compared to what is considered to be an ideal answer. Ensure that your answers are accurate and of a suitable standard.

A guide as to the depth of the required answer is the number of marks allocated and the complexity of the verbs used in the question.

PART A

Choose the best alternative and circle its letter in the space provided in the answer booklet. (1 mark each)

1) The radio-isotope Pu-242 decays into the isotope U-238. The emission accompanying this change is

A) alpha emission
B) beta emission
C) gamma emission
D) positron emission

2) An example of a condensation polymer is

A) polyethene
B) PVC
C) polypropene
D) nylon

3) The type of galvanic cell which utilises a mixture of manganese dioxide paste and solid carbon as the anode is the

A) lithium cell
B) dry cell
C) Gratzel cell
D button cell

4) A compound which would decolourise an aqueous solution of bromine in the absence of ultraviolet light is

A) hexene
B) heptane
C) ethanol
D) glucose

5) A product common to the dehydration of ethanol, the formation of nylon, the combustion of ethene and the esterification of alcohols is

A) hydrogen gas
B) sulfuric acid
C) carbon dioxide
D) water

6) The oxidation state of Manganese in the permanganate ion (MnO_4^-) is

A) +7
B) 0
C) –2
D) +8

7) When copper metal is placed in a solution of silver nitrate the chemical reaction which takes place is

A) $2Ag^+ + Cu \rightarrow Cu^{2+} + 2Ag$
B) $Cu^{2+} + 2e^- \rightarrow Cu$
C) $2Ag + Cu^{2+} \rightarrow 2Ag^+ + Cu$
D) $Ag \rightarrow Ag^+ + e^-$

8) A non metal oxide when reacted with water produces an acidic solution. Identify the chemical below that would produce a BASIC solution when mixed with water.

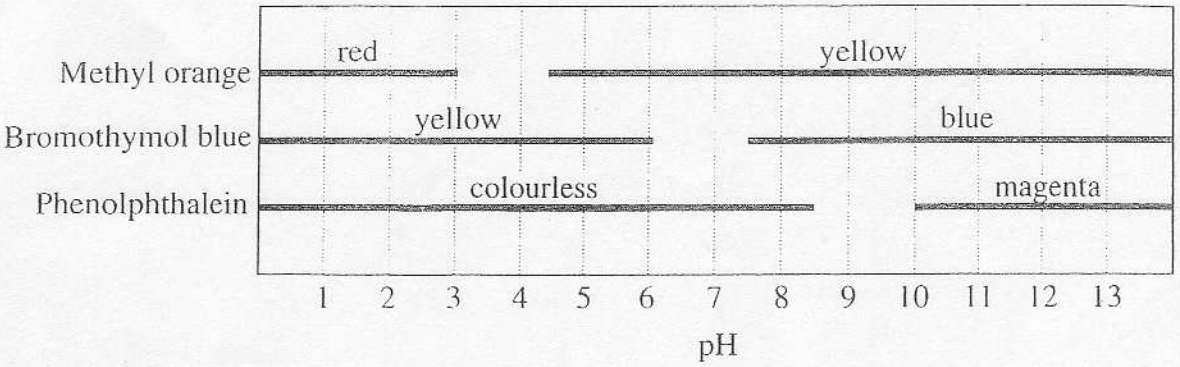
A) Sulfur Dioxide
B) Sodium Chloride
C) Nitrogen Dioxide
D) Magnesium Oxide

9) When a sample of Zn is added to silver nitrate solution a
A) Redox reaction occurs
B) Polymer is produced
C) Transuranic element decomposes
D) Acid base reaction occurs

10) A common radio-isotope used in nuclear medicine is

A) Carbon-14
B) Plutonium-242
C) Technetium-99
D) Helium-3

11) The graph shows the colour ranges of the acid–base indicators methyl orange, bromothymol blue and phenolphthalein.



A solution is yellow in methyl orange, blue in bromothymol blue and colourless in phenolphthalein.

What is the pH range of the solution?

(A) 4.5 to 6.0

(B) 6.0 to 7.5

(C) 7.5 to 8.5

(D) 8.5 to 10.0

12) A group of students produced a red solution by boiling red cabbage leaves in water. When dilute sodium hydroxide was added to the solution, it turned purple. When dilute hydrochloric acid was added to the red solution, no colour change occurred.

Which of these substances, when added, is most likely to cause the red solution to change colour?

(A) Cleaning solution containing ammonia

(B) Concentrated hydrochloric acid

(C) Orange juice

(D) Vinegar

13) The pH of unpolluted rainwater is about 6.0. Which substance contributes most to this?

(A) CO_2

(B) N_2

(C) NO_2

(D) O_3

14) Emission from radioisotopes can be detected by a

A. pH meter
B. thermometer
C. smoke detector
D. photographic film

15) The table shows the pH of some naturally occurring substances:

substance	approximate pH	substance	approximate pH
stomach acid	2	tomato juice	4
lemon juice	3	sea water	8

The next table shows the properties of four acid-base indicators:

Name	Colour in		pH range in which colour changes
	low pH	high pH	
phenolphthalein	colourless	pink	8.3 – 10.0
phenol red	yellow	red	6.8 – 8.4
methyl red	pink	yellow	4.4 – 6.2
methyl yellow	red	yellow	2.4 – 4.0

Which mixture has the correct colour next to it?

A. lemon juice + phenolphthalein → pink
B. tomato juice + phenol red → red
C. sea water + methyl red → pink
D. stomach acid + methyl yellow → red

PART B (26 marks)

Complete the table in your answer booklet by using one word or short answers.

PART C

Short answer questions. Show all working

16) Put the appropriate chemical symbol, mass number or atomic number into the boxes to represent a balanced nuclear reaction producing a transuranic element (5 marks)

$$^{238}_{92}\square + {}^{12}_{\square}C \rightarrow \square\square + 4\,{}^{1}_{0}n$$

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17) Name a radioisotope used in ***industry***, and describe what it is used for (3 marks)

18) Sulfur burns with oxygen to produce sulfur dioxide:
   a) Write a balanced symbol equation for the reaction (2 marks)
   b) What volume of Sulfur dioxide gas would be released at 25°C and 100KPa when 8.00g of Sulfur is burnt? (2 marks)

19) a) Describe how you would ***use*** and ***set up*** a datalogger to measure the pH of some household substances (3 marks)
b) Name 2 acidic and 2 alkaline substances you could test (2 marks)

20) Nitric oxide (NO) reacts with oxygen gas to produce nitrogen dioxide. The reaction reaches equilibrium and is exothermic.

a Define Le Chatelier's principle. (1 mark)
b Write an equation to represent the above equilibrium (2 marks)
c Include in your equation the term HEAT (1 mark)
d In terms of Le Chatelier what would be the effect of warming this reaction (1mark)

21) When an iron nail is placed into a solution of copper sulfate the following redox reaction takes place

$Fe + Cu^{2+} \longrightarrow Fe^{2+} + Cu$

a) Define the term oxidising agent (1mark)
b) Identify the oxidising agent in the above reaction (1mark)
c) Write an equation for the oxidation half reaction (1mark)

22) In your course you have been asked to carry out a many second hand investigations.
a) ***Name*** 1 such investigation (1 mark)
b) ***Name*** and ***describe*** how you would use 3 possible sources for your information. (3 marks)
c) How could you ensure that the sources of information that you used were accurate (2 marks)

23) Describe in ***words*** the major sources of Sulfur dioxide in the atmosphere under the headings "Natural sources" and "Sources due to human activities" Use a table for your results (4marks)

24) Changing one element into another is called transmutation

a) Define the term **transuranic atom** and give an example. (2marks)

b) In simple terms describe how a transuranic element could be formed. (1mark)

c) Radioisotopes are useful in medicine and in industry and are often produced in Cyclotrons or linear accelerators. **Define the term radioisotope** and **describe the functioning of a cyclotron or linear accelerator** (2marks)

d) Technetium –99 is a widely used radioisotope and is produced in a nuclear reactor according to the following reactions. Describe in words what is happening in the following reactions when Technetium –99 is produced (2marks)

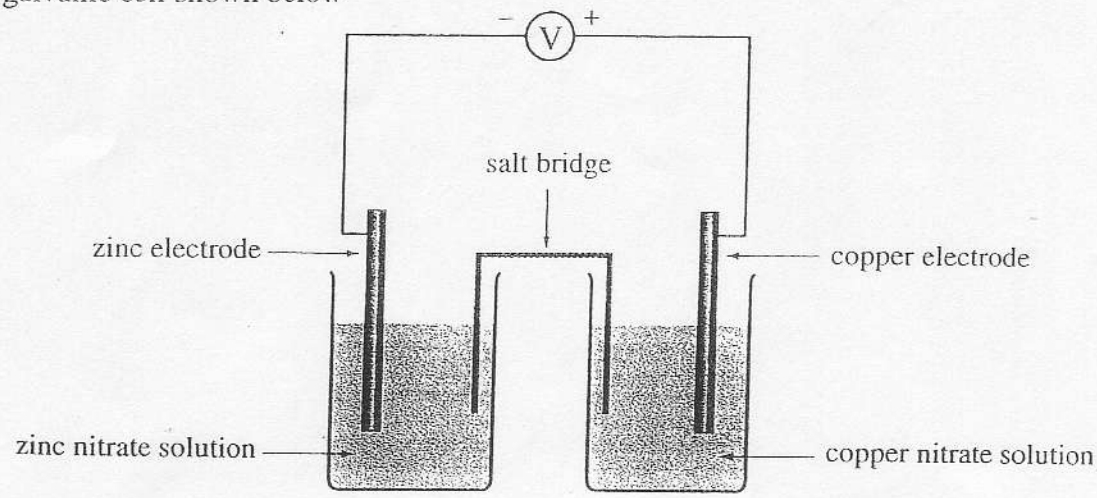
$$^{98}_{42}Mo + {}^{1}_{0}n \longrightarrow {}^{99}_{42}Mo$$

$$^{99}_{42}Mo \longrightarrow {}^{99}_{43}Tc + {}^{0}_{-1}e$$

PART C

Extended answer questions

25) Study the galvanic cell shown below



a) Name the anode. (1 mark)

b) Give the general name of the process which occurs at the anode. (1 mark)

c) Identify the direction of electron flow. (1 mark)

d) Compare the ease of reduction of the two metal ions present in the cell. (2 marks)

e) Write the two half equations taking place in the cell. Indicate at which electrode each reaction is taking place. (2 marks)

f) Write the cell reaction. (1 mark)

g) Assuming that the cell is operating under standard conditions determine the cell voltage. (2 marks)

h) Show a symbolic representation of this cell (1mark)

i) Identify the positive and negative terminals(1mark)

26) Explain the ***formation*** and ***effects*** of acid rain. Use equations where appropriate.(5 marks)

27) During your course you performed a first hand investigation to study the mass changes involved and volumes of gases released at 25°C and 100 kPa when a soft drink is decarbonated.

a) Write an aim for your experiment (1mark)

b) Outline your procedure (3marks)

c) Make a list of equipment needed (2marks)

d) Include a possible set of results (2marks)

e) From your results calculate the volume of gas evolved at 25°C and 100 KPa (2 marks)

f) Write a conclusion for your experiment (1mark)

g) Would you prefer to work as a team or as an individual? ***Justify*** your answer (1mark)

28) In water there is an equilibrium between gaseous and dissolved carbon dioxide, according to the equation

$$CO_{2(g)} \rightleftharpoons CO_{2(aq)}$$

The dissolving process is exothermic.

A further series of equilibrium reactions occurs as the dissolved carbon dioxide reacts with water.

$$CO_{2(aq)} + H_2O_{(l)} \rightleftharpoons H_2CO_{3(aq)}$$
$$H_2CO_{3(aq)} \rightleftharpoons H^+_{(aq)} + HCO_3^-{}_{(aq)}$$

Explain in terms of Le Chatelier's Principle why

a. fizzing occurs when a bottle of soft drink is opened? (2marks)

b. the fizzing is less if the bottle of soft drink was kept in the refrigerator than if it was kept at room temperature.(2mark)

c. Adding orange juice causes the drink to go flat (2marks)