2018 PRELIMINARY EXAMINATION
International Baccalaureate 2

Chemistry
Higher level
Paper 3

1. (a) (i) Relative uncertainty from measuring cylinder = $\frac{0.5}{10}$

Relative uncertainty from gas syringe = $\frac{0.5}{13.7}$

Total percentage uncertainty = $(\frac{0.5}{10} + \frac{0.5}{13.7})(100) = 8.6\%$ [1]

(ii) **Use a larger volume of hydrogen peroxide** to produce a larger volume of gas [1]

(b) (i) % error = $\frac{0.130-0.114}{0.130}(100) = 12.3\%$ [1]

(ii) Not all oxygen is collected / Oxygen is lost during the replacement of bung / (OWTTE) [1]

Adapt the equipment so that the MnO_2 catalyst can be mixed with H_2O_2 in a sealed system to prevent loss/escape of gas. [1]

2. (a) $0 = (-0.5897 \times 10^{-14})x + 19.022$

$x = 3.226 \times 10^{15}$ [1]

(b) $\Delta E = (6.63 \times 10^{-34})(3.226 \times 10^{15}) = 2.139 \times 10^{-18}$ J [1]

$E = (2.139 \times 10^{-18})(6.02 \times 10^{23}) = 1.287 \times 10^{6}$ J or 1287 kJ [1]

[Answer can be in J or kJ.]

3. (a) The mass remains relatively constant after the second and third heating. / There is no further decrease in mass. [1]

(b) $mH_2O = 25.825 - 23.977 = 1.848$ g $m_2 - m_3$

$nH_2O = \frac{1.848}{18.02} = 0.1026$ mol [1]

$mMgCl_2 = 23.977 - 22.347 = 1.63$ g $m_3 - m_1$

$nMgCl_2 = \frac{1.63}{24.31+2(35.45)} = 0.0171$ mol [1]

$nMgCl_2 : nH_2O = 0.0171 : 0.1026 = 1 : 6$ [1]

$n = 6$

(c) Value of n increases. [1]

The mass of sample and container after heating will be smaller than expected, resulting in a greater mass of H_2O / OWTTE [1]

4. (a) caboxamide / Hydroxyl / Ether / Alkenyl / Amine [2]
[Award 1 mark for 2 correct answer. Award 2 marks for 4 correct answers.]

(b) Parenteral; Topical / Rectal / Pulmonary [1]
More rapid effect : Parenteral [1]

(c) When two or more drugs given at the same time have an effect on the body that is greater than the sum of their individual effects. [1]

(d)
- A virus can **multiply very quickly** once inside a host cell [1]
- Viruses can **mutate** their DNA and RNA rapidly,
- It is difficult to design drugs that target only the virus and do not affect the host cell

Make reference to any point.

5. (a)
- Overcome the resistance that bacteria has develop to existing antibiotics / prevent methicillin from being destroyed by penicillinase. [1]
- Develop resistance to breakdown of methicillin by stomach so it can be administered orally. [1]
- To minimize the adverse side effects

(b) β-lactam ring of the drugs interfere with the **transpeptidase** enzymes that bacteria need to make cell walls / interfere with formation of bacterial cell wall / *OWTTE*; [1] [1]

the increased osmotic pressure causes the bacterium to die / the bacterial cells absorb too much water and burst / *OWTTE*; [1]

(c) Makes methicillin less effective / Destroyed bacteria may be replaced by more harmful bacteria / Allows resistant bacteria population to build up [1]

6. (a) Mild analgesics prevent stimulation of nerve endings at the site of pain by preventing production of prostaglandins. [1]
Strong analgesics (temporary) bind to opioid receptors in the brain, preventing transmission of pain impulses in the brain. [1]

(b) (i) Phenol and Alcohol [1]

(ii) Condensation / Addition−elimination [1]

(c) (i) The dose that is lethal to 50% of the population [1]
Used in animal trials [1]

(ii) Heroin [1]

7. (a) Rantidine : compete with histamine for binding at H_2 receptors, prevents chain events for production of acid. [1]

Omeprazole : proton pump inhibitors, prevent release of acid from parietal cells into stomach. [1]

(b) $n CH_3COONa = \frac{4.28}{2(12.01)+3(1.01)+2(16.00)+22.99} = 0.05217$ mol

$[CH_3COONa] = \frac{0.05217}{0.250} = 0.2087$ mol dm^{-3} [1]

$pH = 4.76 + \log \frac{0.2087}{0.50} = 4.38$ [1]

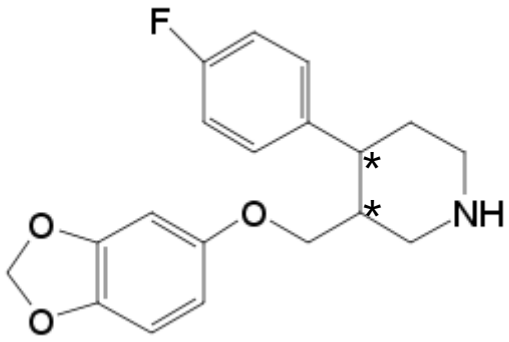
8. (a) $^{225}_{89}Ac \rightarrow 3\,^{4}_{2}\alpha + {}^{213}_{83}Bi$ [1]

(b) Monoclonal antibodies can be labelled with an α−emitting radioisotope. [1]

The antibodies travel through the body and attach to the cancer cells.

Decay of the radioisotope produces α−particles which destroys cancerous cell. [1]

9. (a) [1]



(b) Chiral auxillary is one enantiomer of an optically active substance that is temporarily incorporated into a non−chiral molecule to synthesise the desired enantiomer. [1]

The auxillary can be removed and recycled after the new product is formed. [1]

10. Anabolic steroids and their metabolites can be extracted and concentrated for detection in low concentrations. [1]

Anabolic steroids produces a characteristic mass spectrum which can be compared with a library of known compounds. [1]