

PART A

1 A sample of alcohol has the following four properties:

- 1) It has a volume of 100 mL.
- 2) It does not conduct electricity.
- 3) Its temperature is 22°C.
- 4) It is flammable.

Which of these are characteristic properties of alcohol?

- | | |
|------------|------------|
| A) 1 and 2 | C) 2 and 4 |
| B) 1 and 3 | D) 3 and 4 |

2 Which one of the following statements about compounds is true?

- A) They are pure substances that form when two or more different atoms are combined.
- B) They are mixtures that can be separated only by physical means.
- C) They always consist of identical atoms.
- D) They always have the characteristics properties of the elements from which they were formed.

3 The following four statements refer to Democritus' discontinuous model and Aristotle's continuous model.

- 1) Matter consists of tiny particles that cannot be divided.
- 2) Matter is made up of four elements (earth, water, fire and air).
- 3) Matter consists of separate particles.
- 4) Matter fills the entire space it occupies.

Which of the above statements were made by Democritus?

- | | |
|------------|------------|
| A) 1 and 2 | C) 2 and 4 |
| B) 1 and 3 | D) 3 and 4 |

4 The atomic mass of the first 18 elements of the periodic table increases as their atomic number increases.

Which one of the following statements best explains this increase in mass?

- A) Atomic mass depends most of all on the number of electrons and protons in each element.
- B) Atomic mass depends most of all on the number of electrons and neutrons in each element.
- C) Atomic mass depends most of all on the number of neutrons in each element.
- D) Atomic mass depends most of all on the number of neutrons and protons in each element.

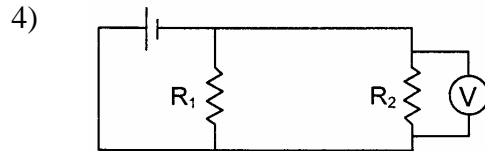
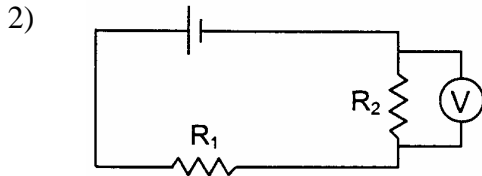
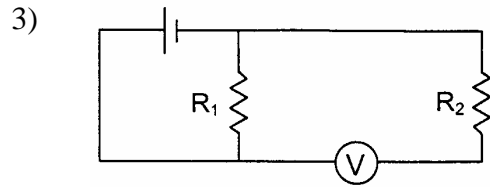
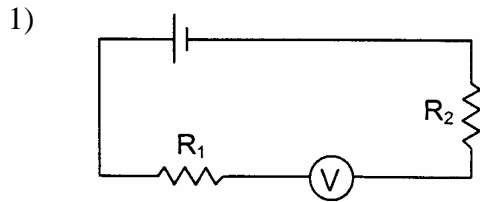
5 The following are changes undergone by different substances:

- 1) Salt dissolving in water
- 2) Sublimation of iodine
- 3) Oxidation of copper
- 4) Neutralization of an acid by a base

Which of the above are physical changes?

- | | |
|------------|------------|
| A) 1 and 2 | C) 2 and 3 |
| B) 1 and 4 | D) 3 and 4 |

8 Four electric circuit diagrams are given below.



You wish to measure the potential difference across the terminals of resistor R_2 .

Which diagrams show a correctly connected voltmeter?

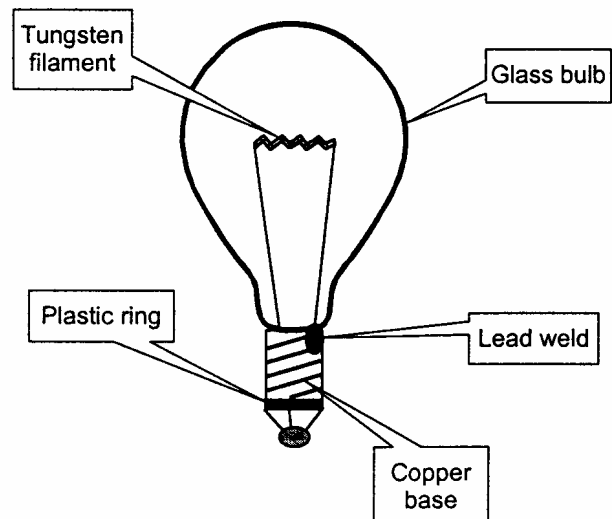
A) 1 and 3

C) 2 and 3

B) 1 and 4

D) 2 and 4

9 The diagram on the right shows the main parts of an incandescent light bulb.



Which of the substances used to make this light bulb are insulators?

A) Copper and lead

C) Plastic and glass

B) Plastic and lead

D) Glass and tungsten

19 Which one of the following equations is NOT balanced correctly?

- A) $\text{P}_4\text{O}_{10} + 6 \text{H}_2\text{O} \rightarrow 4 \text{H}_3\text{PO}_4$
- B) $2 \text{F}_2 + 2 \text{H}_2\text{O} \rightarrow 4 \text{HF} + \text{O}_2$
- C) $2 \text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O}$
- D) $\text{HCl} + 2 \text{NaHCO}_3 \rightarrow 2 \text{NaCl} + 2 \text{H}_2\text{O} + 2 \text{CO}_2$

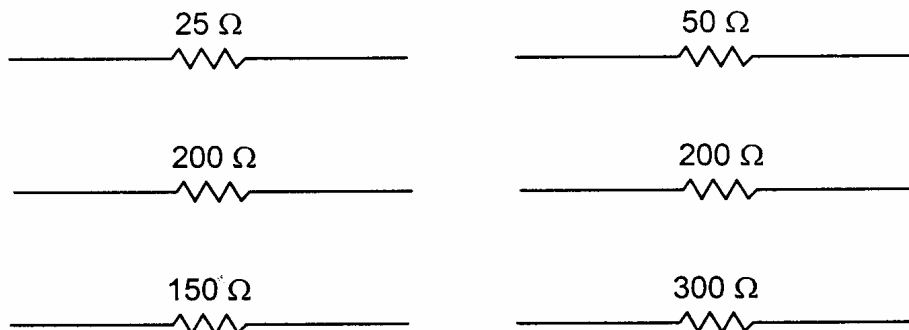
PART B

20 In your answer booklet, draw a simplified atomic model (Bohr-Rutherford) for the potassium atom ${}_{19}^{39}\text{K}$.

21 In a laboratory, you are given a liquid and asked to determine its density.

1. List the materials you would need.
2. List the steps in the experiment you would perform in this case (procedure).
3. Give an example of how you would calculate the density, using made-up data.

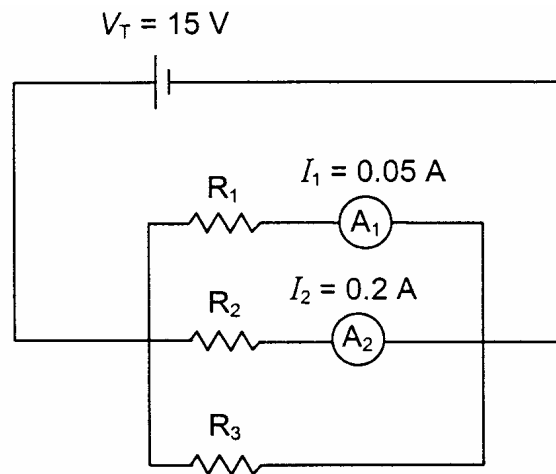
22 In the laboratory, you are given a power supply ($\text{---}\text{+}\text{---}$), conducting wires and the six resistors shown below.



Using the power supply and two of these resistors, you must build a parallel circuit that has an equivalent resistance of 100Ω .

Draw this parallel circuit in your answer booklet.

- 23 The following electric circuit consists of a power supply, three resistors (R_1 , R_2 and R_3) and two ammeters A_1 and A_2 .



The potential difference (V_T) across the power supply is 15 V, ammeter A_1 reads 0.05 A and ammeter A_2 reads 0.2 A.

The equivalent resistance (R_{eq}) of the circuit is $30\ \Omega$.

What is the value of resistor R_3 ?

Show all your work.

24 In the laboratory, you are given two acidic solutions. One has a pH value of 5, and the other has a pH value of 6.8. You are also given the following four indicators.

1) Methyl orange

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Red		Orange		Yellow									

2) Bromothymol blue

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Yellow					Green		Blue						

3) Phenolphthalein

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Colourless								Pink		Dark pink			

4) m-Cresol purple

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Yellow							Brown		Violet				

Name the only indicator that would allow you to distinguish between the two solutions.

State the colour of that indicator after it is added to each solution.

25 In the laboratory, a student was given a container with 150 mL of a solution of sodium hydroxide (NaOH) that had a concentration of 20 g/L.

She added three 150-mL beakers of water to this solution.

What was the concentration of the diluted solution?

Show all your work.

4. CORRECTION KEY

PART A

Questions 1 to 19, 4 marks or 0 marks.

1 C

2 A

3 B

4 D

5 A

6 C

7 B

8 D

9 C

10 C

11 B

12 D

13 C

14 C

15 D

16 A

17 A

18 B

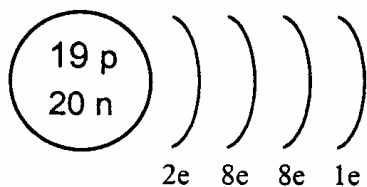
19 D

PART B

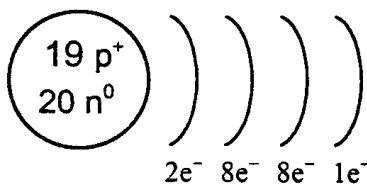
Questions 20 to 25

20 Example of an appropriate diagram

/4



or

**21** Example of an appropriate procedure

/4

1. Materials you would need:
 - Balance
 - Graduated cylinder

2. Steps in the experiment you would perform (procedure):
 - Weigh the empty graduated cylinder and record its mass.
 - Pour a certain amount of liquid into the graduated cylinder and record the volume of liquid.
 - Weigh the graduated cylinder when it contains the liquid and record its mass.

3. Example of how you would calculate the density, using made-up data:

Mass of the cylinder: X

Volume of the liquid: Y

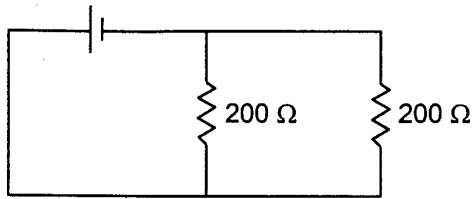
Mass of the cylinder when it contains the liquid: Z

 $Z - X = \text{mass of the liquid}$

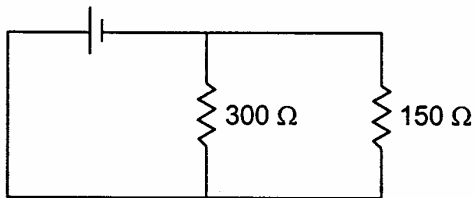
$$\frac{\text{mass of the liquid}}{Y} = \text{density}$$

22 Example of a parallel circuit

/4



or

**23 Example of an appropriate procedure**

/4

Calculation of the total current

$$I_t = \frac{V_T}{R_{eq}} = \frac{15 \text{ V}}{30 \Omega} = 0.5 \text{ A}$$

Calculation of the current in R_3

$$I_3 = I_t - I_1 - I_2$$

$$I_3 = 0.5 \text{ A} - 0.05 \text{ A} - 0.2 \text{ A}$$

$$I_3 = 0.25 \text{ A}$$

Calculation of the voltage in V_3

$$V_T = V_1 = V_2 = V_3 = 15 \text{ V}$$

Calculation of the resistance of R_3

$$R_3 = \frac{V_3}{I_3} = \frac{15 \text{ V}}{0.25 \text{ A}} = 60 \Omega$$

Answer

The value of resistor R_3 is 60Ω .

24 Example of an appropriate procedure

/4

Indicator: 2) Bromothymol blue

Colour of that indicator after it is added to each solution:

The indicator will turn yellow when added to the acid with a pH of 5.

The indicator will turn green when added to the acid with a pH of 6.8.

4 marks	Right indicator and correct colours
3 marks	Does not apply
2 marks	Does not apply
1 mark	Right indicator but the colours are incorrect or missing
0 marks	Wrong indicator regardless of the colours

25 Example of an appropriate procedure

/4

Since the volume increases from 150 mL to 600 mL (i.e. it is 4 times greater), the initial concentration will be divided by 4.

$$20 \text{ g/L} \div 4 = 5 \text{ g/L}$$

A procedure involving the formula $C_1V_1 = C_2V_2$ is also acceptable.

Answer

The concentration of the diluted solution was 5 g/L.

