



EXAMINATION NO.: \_\_\_\_\_

# THE MALAWI NATIONAL EXAMINATIONS BOARD

2004 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

## PHYSICAL SCIENCE

Subject Number: M162/I

Thursday, 21 October

Time Allowed:  $2\frac{1}{2}$  hours  
8:30 – 11:00 am

### PAPER I

(150 marks)

#### Instructions

1. This paper contains 12 pages. Please check.
2. Fill in your **Examination Number** at the top of each page.
3. Answer **all** the **eight** questions in the spaces provided.
4. The maximum number of marks for each answer is indicated against each question.



1. a. Table 1 shows particles found in the atoms of four elements.

Table 1

| ELEMENT      | PROTONS | NEUTRONS | ELECTRONS | MASS NUMBER |
|--------------|---------|----------|-----------|-------------|
| Hydrogen (H) | 1       |          |           | 1           |
| Carbon (C)   |         |          | 6         | 12          |
| Nitrogen (N) | 7       | 7        |           |             |
| Sodium (Na)  |         | 12       | 11        |             |

(4 marks)

- (i) Complete the table by filling in the missing numbers.
- (ii) Which element in the table will easily form an ionic compound?

(1 mark)

- (iii) Give a reason for the answer to 1a(ii).

(2 marks)

- (iv) Work out the molecular mass of methane ( $\text{CH}_4$ ).

(3 marks)

- (v) What kind of chemical bonds are involved in methane?

(1 mark)

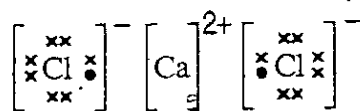
- (vi) Explain the answer to 1a(v).

(3 mark)



(Continued)

- b. The dot and cross diagram of calcium chloride is shown below.



- (i) Write the chemical formula of calcium chloride.

\_\_\_\_\_ (1 mark)

- (ii) Explain the meaning of the sign 2+ on the Ca atom.

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

- c. Table 2 shows elements represented by letters Q, R, L, M, X, W, Y and Z in the same period of the periodic table.

Table 2

| GROUP    | I | II | III | IV | V | VI | VII | VIII |
|----------|---|----|-----|----|---|----|-----|------|
| Elements | Q | R  | L   | M  | X | W  | Y   | Z    |

- (i) Write the formula of a charged atom of R.

\_\_\_\_\_ (1 mark)

- (ii) Give the letter of the element in the table which belongs to the halogen family.

\_\_\_\_\_ (1 mark)

- (iii) Give the letter of an element in the table that would not react with another element.

\_\_\_\_\_ (1 mark)

- (iv) Give a reason for the answer to 1c(iii).

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

Continued/...



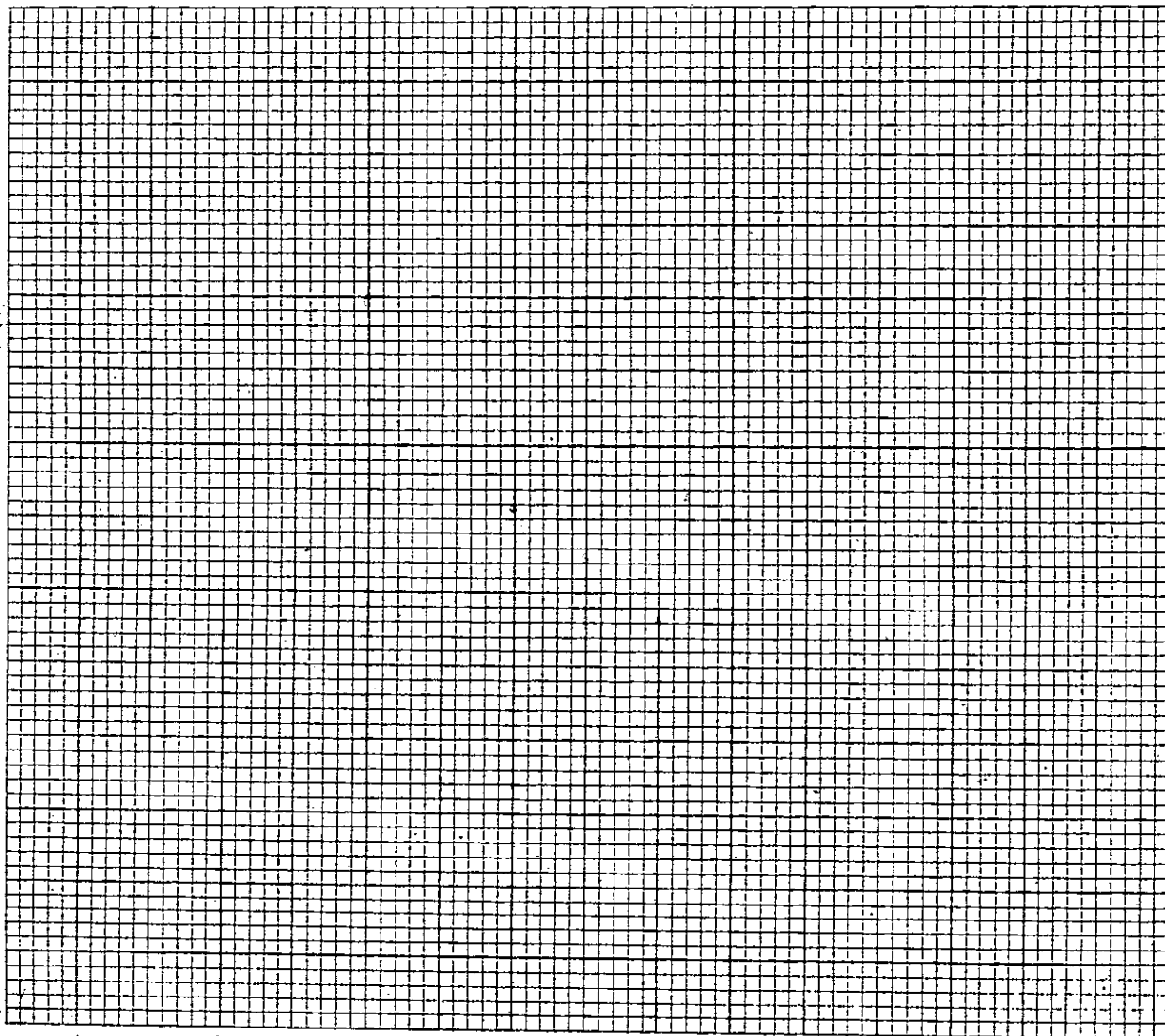
104

2. a. Table 3 shows results in an experiment to verify a gas law.

Table 3

|                           |     |     |     |     |     |
|---------------------------|-----|-----|-----|-----|-----|
| VOLUME (cm <sup>3</sup> ) | 10  | 12  | 14  | 16  | 18  |
| PRESSURE (kpa)            | 200 | 169 | 144 | 127 | 114 |

- (i) Plot a suitable graph to show the relationship between **pressure** and **volume**.



(6 marks)

- (ii) What relationship is being demonstrated by this graph?

(1 mark)

- (iii) Which variables would be kept constant in this investigation?

(2 marks)

Continued/



2. (Continued)

- b. (i) A pressure of 50 000 Pa is exerted by a column of water at the base of a container. Calculate the height of the water column. (Density of water = 1 000 kg/m<sup>3</sup>; g = 10 ms<sup>-2</sup>)

(3 marks)

- (ii) Explain why the base of a dam is thicker at the bottom than the top.

(2 marks)

- (iii) Two identical gas jars were filled with liquid mercury (density 13.6 g/cm<sup>3</sup>) and water respectively. Explain the difference in pressure exerted at the base of the jars by the two substances.

(2 marks)

- c. Figure 1 is a diagram of an instrument used to measure gas pressure.

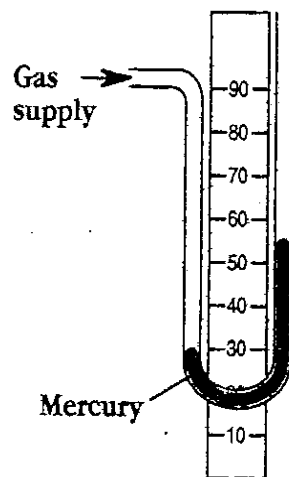


Figure 1

- (i) Name the instrument.

(1 mark)

- (ii) Read the pressure difference in mm Hg.

(1 mark)

Continued/...

2. c. (Continued)

- (iii) What is the pressure of the gas supply if the atmospheric pressure is 755 mm Hg and the pressure difference is 30 mm Hg?

(2 marks)

3. a. State one use of each of the following polymers.

- (i) plastic \_\_\_\_\_  
 \_\_\_\_\_
- (ii) carbohydrate \_\_\_\_\_  
 \_\_\_\_\_

(2 marks)

b. State any two ways of disposing of plastics to avoid polluting the environment.

(2 marks)

c. The following are structural formulae of four molecules with the molecular formula  $C_4H_8$ .

(i) Name the molecules 1 and 2.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

(1 mark)

(1 mark)

(ii) Which two structures are conformations of each other?

(1 mark)

Continued/...



(Continued)

d. Table 4 shows molecular formulae and boiling points of some compounds.

Table 4

| COMPOUND | MOLECULAR FORMULA | BOILING POINT (°C) |
|----------|-------------------|--------------------|
| A        | $C_2H_4$          | -104               |
| B        | $C_2H_5OH$        | 79                 |
| C        | $CH_3COOH$        | 118                |
| D        | $H_2O$            | 100                |
| E        | $C_2H_6$          | -89                |

(i) Which compounds in the table are hydrocarbons?

(2 marks)

(ii) Which compounds in the table are soluble in water?

(2 marks)

(iii) Which compounds in the table are gases at room temperature?

(2 marks)

(iv) Explain why the boiling point of compound D is higher than the boiling point of compound E.

(4 marks)

(v) Describe a test which can be done to distinguish the compounds C and D.

(3 marks)

a. Explain why a voltmeter is connected in parallel while an ammeter is connected in series.

(4 marks)

Continued/...

4. (Continued)

b. Figure 2 is a diagram of a resistor.

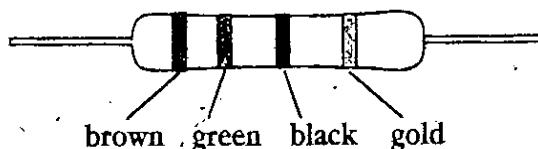


Figure 2

What is the resistance of the resistor?

---



---

(3 marks)

c. (i) Explain the difference between an electric motor and an electric generator.

---



---



---

(2 marks)

(ii) State any two factors which affect the amount of voltage produced by a generator.

---



---



---

(2 marks)

d. (i) What is a "semiconductor"?

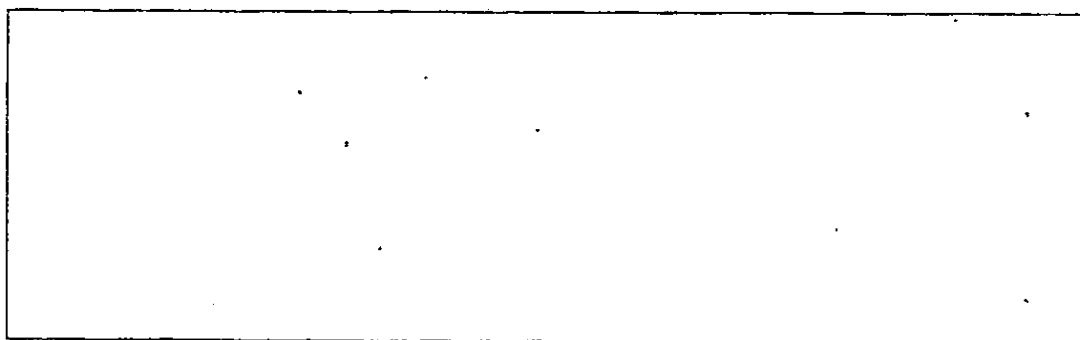
---



---

(1 mark)

(ii) Draw a circuit diagram in which a bulb, a cell and a diode are connected in series such that the diode is forward biased.



(2 marks)

(iii) What is meant by the term "doping" in relation to a semi-conductor?

---



---



---

(2 marks)



d. (Continued)

(iv) State two functions of transistors.

\_\_\_\_\_  
 \_\_\_\_\_

(2 marks)

e. (i) Are the headlamps of a motor car connected in series or in parallel?

\_\_\_\_\_ (1 mark)

(ii) Give a reason for the answer to 4e(i).

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

a. Define the term "oscillation" in relation to a swinging pendulum.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(2 marks)

b. Figure 3 is a diagram of a simple pendulum. The mass vibrates between points A and C through B.

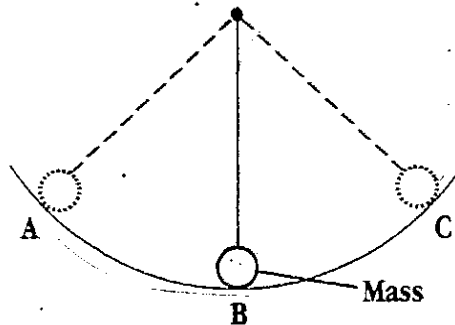


Figure 3

(i) What happens to the speed of the mass as it moves from positions:

(1) A to B? \_\_\_\_\_

\_\_\_\_\_ (1 mark)

(2) B to C? \_\_\_\_\_

\_\_\_\_\_ (1 mark)

(ii) What is the speed of the mass at C?

\_\_\_\_\_ (1 mark)

(iii) What happens to the frequency and amplitude of oscillation of a pendulum as time increases?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(2 marks)

Continued/....

2004

5. b. (Continued)

(iv) State the energy changes of the mass as it changes from A to C.

\_\_\_\_\_  
\_\_\_\_\_

(2 marks)

(v) What happens to the frequency of vibration of a pendulum when the length of the string is changed?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2 marks)

c. An object 2 cm high is placed 7.5 cm in front of a converging lens of focal length 5 cm.

(i) Calculate the image distance.

\_\_\_\_\_

(4 marks)

(ii) Describe the nature of the image formed.

\_\_\_\_\_  
\_\_\_\_\_

(3 marks)

(iii) Calculate the magnification of the image.

\_\_\_\_\_

(2 marks)

6. a. State any **two** safety precautions to be taken when handling radioactive substances.

\_\_\_\_\_  
\_\_\_\_\_

(2 marks)

b. (i) Describe the "alpha particles" and "beta particles".

alpha particles \_\_\_\_\_

\_\_\_\_\_

beta particles \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(6 marks)

Continued/...

14

(ii) Explain why gamma radiation is used in sterilization of medical equipment.

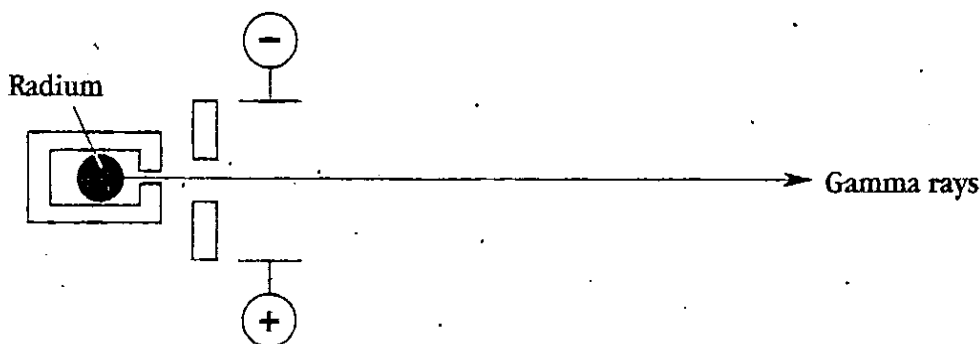
**(3 marks)**

c. (i) The Radon-222 (Rn) isotope is formed from the alpha decay of radium-226 (Ra). Write a nuclear equation to show this change. (Atomic number of Ra is 88).

(3 marks)

(ii) **Figure 4** is a diagram showing radiation passing through an electric field. Draw and label **in the diagram** the paths taken by the alpha-particles and the beta-particles.

(2 marks)



### Figure 4

(iii) Explain why the behaviour of particles is as shown in **6c(ii)**.

(4 marks)

7. a. Describe how the concentration of  $20 \text{ cm}^3$  of sodium chloride solution can be determined by evaporation method.

**(10 marks)**

Continued/...

7. (Continued)

- 

- (2 marks)

---

---

---

---

---

- (3 marks)**

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100

- (13 marks)**

\_\_\_\_\_

(2 marks)

