

2528/102
2922/102
ENVIRONMENTAL CHEMISTRY
AND APPLIED SCIENCE
Oct./Nov. 2019
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY
MODULE I

ENVIRONMENTAL CHEMISTRY AND APPLIED SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

An answer booklet;

Non-programmable scientific calculator.

This paper consists of TWO sections; A and B.

Answer ALL the questions in section A and any THREE questions from section B in the answer booklet provided.

Each question in section A carries 4 marks while each question in section B carries 20 marks.

Maximum marks for each part of a question are as indicated.

Candidates should answer the questions in English.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A (40 marks)

Answer ALL the questions in this section.

1. Define each the following terms:
 - (a) environmental chemistry; (2 marks)
 - (b) atmospheric chemistry. (2 marks)
2. (a) Draw the chemical structure of 2, 2, 3-trimethyl pentane. (2 marks)
(b) Write a balanced chemical equation for the reaction between ethene and hydrogen chloride gas. (2 marks)
3. Name any four plant micronutrients present in the soil. (4 marks)
4. Three gases A, B and C in a vessel exert a total pressure of 101.3 kN/m^2 . The partial pressure of A and B are 42.5 kN/m^2 and 30.5 kN/m^2 respectively. Calculate the:
 - (a) partial pressure of gas C; (2 marks)
 - (b) mole fraction of gas B. (2 marks)
5. Solve the equations: $\frac{3}{x} + \frac{2}{y} = 14$ (4 marks)
 $\frac{5}{x} - \frac{3}{y} = -2$
6. The total surface area of a closed cylindrical container is 20.0 m^2 . Calculate the radius of the cylinder given that its height is 2.80 m . (4 marks)
7. Write the expression $\text{Log } 8 - \text{Log } 4 + \text{Log } 32$ in terms of $\text{Log } 2$. (4 marks)
8. A model car moves round a circular track of radius 0.5 m at 3 revolutions per second. Determine its:
 - (a) angular velocity; (2 marks)
 - (b) linear speed. (2 marks)
9. Define each of the following terms as used in fluid mechanics:
 - (a) turbulent flow; (2 marks)
 - (b) newtonian fluid. (2 marks)

12. (a) State each of the following laws:
- (i) Newton's first law of motion; (2 marks)
 - (ii) Newton's second law of motion; (2 marks)
 - (iii) Law of conservation of momentum. (2 marks)
- (b) A resultant force of 25 N acts on a mass of 0.5 kg initially at rest. Calculate the:
- (i) acceleration; (2 marks)
 - (ii) final velocity after 20 s; (3 marks)
 - (iii) distance moved. (3 marks)
- (c) (i) An arrow of mass 100 g is shot at 15 m/s into a block of wood of mass 400 g lying at rest on a smooth surface. Calculate the common velocity after impact. (3 marks)
- (ii) The block in (c) (i) is struck by a second arrow of mass 100 g travelling at 12 m/s. Calculate the common velocity after impact. (3 marks)
13. (a) State five properties of cathode rays. (5 marks)
- (b) Draw a labelled diagram showing the main parts of a cathode ray oscilloscope. (6 marks)
- (c) Describe the working of an electron gun in the cathode ray oscilloscope. (4 marks)
- (d) The Y-plates of a cathode ray oscilloscope (CRO) is connected to an alternating current (a.c) with the time base set at 6 ms/div and the Y-gain at 120v/div. The trace on the CRO screen showed the number of division covered as 8 and the number of cycles as 2. Determine the frequency of the a.c signal. (5 marks)
14. (a) A surveyor measures the angle of elevation at the top of a perpendicular building as 20° . He moves 100 m nearer to the building and finds that the angle of elevation is 50° . Determine the height of the building. (6 marks)
- (b) A triangle ABC has sides $a = 7.5$ cm, $b = 6$ cm and $c = 7$ cm. Determine:
- (i) the three angles; (6 marks)
 - (ii) area of the triangle. (4 marks)

- (c) Prove the following trigonometric identity. (4 marks)

$$\frac{\cos x - \cos^3 x}{\sin x} = \sin x \cos x$$

15. (a) Differentiate the equation $y = \frac{(x+2)^2}{x}$. (4 marks)

- (b) Determine the coordinates of the point where the gradient is -1 on the curve,

$$y = 3x^2 - 7x + 2 \quad (4 \text{ marks})$$

- (c) A missile fired from ground level rising x metres vertically upwards in t seconds is given by $x = 100t - \frac{25t^2}{2}$. Determine the:

- (i) initial velocity of the missile; (3 marks)
- (ii) time taken when the height of the missile is a maximum; (2 marks)
- (iii) maximum height reached; (2 marks)
- (iv) velocity with which the missile strikes the ground; (3 marks)
- (v) acceleration after 2 s. (2 marks)

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