SMARTWIZ

GRADE12 PHYSICAL SCIENCE EXAM

MARKS: 150

MARKS	

TIME: 2. 5 HOURS

SCHOOL _____

CLASS (eg. 4A) _____

SURNAME _____

NAME _____

Instructions for Learners:

• Read all instructions carefully before you begin the exam.

• Write your full name and student number clearly on the answer sheet/book.

• Answer all questions unless otherwise instructed.

• Show all your work/calculations where necessary.

• Write neatly and clearly.

• Use only a blue or black pen. Do not use correction fluid or tape.

• Electronic devices (calculators, cell phones, etc.) are not allowed unless explicitly permitted.

• Raise your hand if you have any questions.

• Do not talk to other learners during the exam.

• Any form of dishonesty will result in immediate disqualification from the exam.

This exam consists of Eight pages, including the cover page.

SECTION A: PHYSICS (75 MARKS)

Question 1: Multiple Choice Questions (10 Marks)

Choose the correct answer and write only the letter (A–D) next to the question number.

1.1 Which of the following is a vector quantity?
    A. Distance   B. Speed   C. Velocity   D. Power
    Answer: _____

1.2 A car accelerates uniformly from rest to 20 m/s in 10 s. The distance covered is:
    A. 100 m   B. 200 m   C. 20 m   D. 10 m
    Answer: _____

1.3 According to Ohm's Law, current is:
    A. Directly proportional to voltage
    B. Inversely proportional to resistance
    C. Inversely proportional to voltage
    D. A and B
    Answer: _____

1.4 A projectile reaches its maximum height when:
    A. Acceleration is 0   B. Vertical velocity is 0
    C. Horizontal velocity is 0   D. Total energy is 0
    Answer: _____

1.5 Which EM wave has the highest frequency?
    A. Microwaves   B. Infrared   C. Ultraviolet   D. Gamma rays
    Answer: _____

Question 2: Newton's Laws and Motion (15 Marks)

2.1 Draw a free-body diagram of the box. (3)

2.2 Calculate the horizontal component of the force. (2)

_____

_____

2.3 Determine the acceleration of the box. (3)

_____

_____

_____

2.4 How long does it take for the box to travel 5 m from rest? (3)

_____

_____

_____

2.5 If friction is 1.5 N, calculate the new net force. (4)

_____

_____

_____

_____

Question 3: Electric Circuits (15 Marks)

3.1 Calculate total resistance. (2)

_____

_____

3.2 Determine total current. (3)

_____

_____

_____

3.3 Voltage across 6 Ω resistor. (3)

_____

_____

_____

3.4 Resistors in parallel: calculate total resistance. (4)

_____

_____

_____
_____

3.5 Why are bulbs in parallel brighter than in series? (3)

_____
_____
_____
_____

Question 4: Waves, Sound and Light (10 Marks)

4.1 Define diffraction. (2)

_____
_____

4.2 Two properties of sound waves. (2)

_____
_____

4.3 Light from air to water: describe speed, frequency, wavelength changes. (3)

_____
_____
_____

4.4 Calculate the frequency of a wave ($\lambda = 0.5$ m, v = 340 m/s). (3)

_____
_____
_____
_____

SECTION B: CHEMISTRY (75 MARKS)

Question 5: Stoichiometry (15 Marks)

5.1 Balance: __ H_2 + __ $O_2 \rightarrow$ __ H_2O (1)
   Answer: _____

5.2 Moles in 10 g H_2. (3)

_____
_____
_____

5.3 Moles of O_2 needed. (3)

5.4 Mass of water produced. (4)

5.5 Volume of O_2 gas at STP. (4)

Question 6: Acids and Bases (10 Marks)

6.1 Define Brønsted–Lowry acid and base. (2)

6.2 pH of solution with $[H+]=1\times10^{-4}$[H^+] = 1 \times 10^{-4}$[H+]=1×10−4. (2)

6.3 Strong vs. weak acid with examples. (3)

6.4 Base with pH = 12: strong or weak? Explain. (3)

Question 7: Chemical Bonding (10 Marks)

7.1   Define ionic and covalent bonding. (2)

_____

_____

7.2   Draw Lewis structure for H_2O. (2)

(Draw below)

7.3   Why does NaCl conduct in solution but not solid? (3)

_____

_____

_____

7.4   Which has higher boiling point: H_2O or CH_4? Why? (3)

_____

_____

_____

_____

Question 8: Organic Chemistry (15 Marks)

8.1   Name CH_3CH_2COOH. (2)
Answer: _____

8.2   Structural formula for butane. (2)
(Draw below)

_____

_____

8.3 C_2H_4 is an: alkane / alkene / alkyne? (1)
Answer: _____

8.4   General formula for alkanes. (1)
Answer: _____

8.5   Functional group of alcohols? (1)
Answer: _____

8.6   Test to distinguish alkane from alkene. (2)

_____

_____

8.7   Combustion of propane: balanced equation. (3)

_____

_____

_____

8.8   What is isomerism? Give example. (3)

_____

_____

_____

_____

Question 9: Chemical Equilibrium (10 Marks)

9.1   Define dynamic equilibrium. (2)

_____

_____

9.2   Effect of increased temperature on exothermic reaction. (2)

_____

_____

9.3   State Le Chatelier's Principle. (2)

_____

_____

9.4   What happens to equilibrium if pressure increases in:
$N_2 + 3H_2 \rightleftharpoons 2NH_3$ (2)

_____

9.5   One industrial application of Le Chatelier's principle. (2)

TOTAL : 150

MEMO

SECTION A: PHYSICS (75 MARKS)

Question 1: Multiple Choice (5 × 2 = 10)

1.1 C
1.2 A
1.3 D
1.4 B
1.5 D

Question 2: Newton's Laws and Motion (15)

2.1 Free-body diagram (3)

- Force at angle (F) ✓
- Weight down (W = mg) ✓
- Normal force up (N) ✓

2.2 Horizontal component of force:
$$F_x = F \cos \theta = 10 \cos 30° = 8.66\, \text{N}$$ ✓✓

2.3 Acceleration:
$$a = \frac{F_{\text{net}}}{m} = \frac{8.66}{2} = 4.33\, \text{m·s}^{-2}$$ ✓✓✓

2.4 Use $s = \frac{1}{2}at^2$
$$5 = \frac{1}{2}(4.33)t^2 \Rightarrow t = 1.52\, \text{s}$$ ✓✓✓

2.5 Frictional force = 1.5 N
New net force: $F_{\text{net}} = 8.66 - 1.5 = 7.16\, \text{N}$ ✓
New acceleration: $a = \frac{7.16}{2} = 3.58\, \text{m·s}^{-2}$ ✓✓✓

Question 3: Electric Circuits (15)

3.1 Total resistance (series):
$$R = 4 + 6 = 10\, \Omega$$ ✓✓

3.2 Current:
$$I = \frac{V}{R} = \frac{12}{10} = 1.2\, \text{A}$$ ✓✓✓

3.3 Voltage across 6 Ω:
$$V = IR = 1.2 \times 6 = 7.2\, \text{V}$$ ✓✓✓

3.4 Parallel:
$$\frac{1}{R} = \frac{1}{4} + \frac{1}{6} = \frac{5}{12} \Rightarrow R = 2.4\, \Omega$$ ✓✓✓✓

3.5 Bulbs in parallel get full voltage; in series, voltage is divided ✓
Parallel bulbs operate at higher current ✓
Therefore, they shine brighter ✓

Question 4: Waves, Sound and Light (10)

4.1 Diffraction: bending of waves around obstacles or through gaps ✓✓

4.2 Properties: longitudinal ✓, require a medium ✓

4.3 Light into water: speed ↓, frequency stays same ✓, wavelength ↓ ✓✓

4.4 Frequency:
$$f = \frac{v}{\lambda} = \frac{340}{0.5} = 680\, \text{Hz}$$ ✓✓✓

SECTION B: CHEMISTRY (75 MARKS)

Question 5: Stoichiometry (15)

5.1 Balanced: $2H_2 + O_2 \rightarrow 2H_2O$ ✓
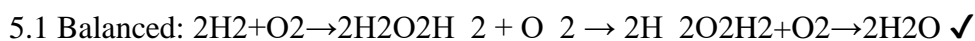
5.2 Moles of H_2:
$$n = \frac{m}{M} = \frac{10}{2} = 5\, \text{mol}$$ ✓✓✓

5.3 Mole ratio $H_2:O_2 = 2:1 \rightarrow$
$$n(O_2) = \frac{5}{2} = 2.5\, \text{mol}$$ ✓✓✓
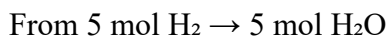
5.4 Water:
From 5 mol $H_2 \rightarrow$ 5 mol H_2O
Mass $= n \cdot M = 5 \cdot 18 = 90\, \text{g}$ ✓✓✓

5.5 Volume of O_2:
$$V = n \cdot 22.4 = 2.5 \cdot 22.4 = 56.0\, \text{dm}^3$$ ✔✔✔✔

Question 6: Acids and Bases (10)

6.1 Acid = proton donor ✔
Base = proton acceptor ✔

6.2 $\text{pH} = -\log[H^+] = -\log(1 \times 10^{-4}) = 4$ ✔✔

6.3 Strong acid: completely ionizes (e.g. HCl) ✔
Weak acid: partially ionizes (e.g. CH_3COOH) ✔✔

6.4 Base with pH 12 = weak to moderate strength base ✔
Still basic but not at strongest (14) ✔✔

Question 7: Chemical Bonding (10)

7.1 Ionic = transfer of electrons ✔
Covalent = sharing of electrons ✔

7.2 Lewis structure (2):

- Two H atoms single bonded to O ✔
- Two lone pairs on O ✔

7.3 In solution: ions are mobile ✔
In solid: ions locked in lattice, cannot move ✔✔

7.4 H_2O > CH_4 due to hydrogen bonding ✔✔✔

Question 8: Organic Chemistry (15)

8.1 CH_3CH_2COOH = Propanoic acid ✔✔

8.2 Butane structure:
CH_3–CH_2–CH_2–CH_3 ✔✔

8.3 C_2H_4 = Alkene ✔

8.4 Alkane formula: C_nH_{2n+2} ✔

8.5 Alcohol group = –OH ✔

8.6 Test: Add bromine water ✔
Alkene decolorizes it ✔✔

8.7 Combustion of propane:
$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ ✔✔✔

8.8 Isomerism = same molecular formula, different structures ✔
Example: Butane and isobutane ✔✔

Question 9: Chemical Equilibrium (10)

9.1 Dynamic equilibrium = forward & reverse reactions occur at same rate ✔✔

9.2 Exothermic + temp ↑ → equilibrium shifts left ✔✔

9.3 Le Chatelier's Principle: system shifts to oppose change ✔✔

9.4 Pressure ↑ → equilibrium shifts to side with fewer moles → right (toward NH_3) ✔✔

9.5 Application: Haber Process for ammonia production ✔✔

✅ **TOTAL: 150 MARKS**