

GRADE 11 | 2024 | PRACTICE EXAM

Physical Sciences
PAPER 1: PHYSICS

Time: 3 hours

Total: 150 marks

Paper 1 - Physics Practice Exam

INSTRUCTIONS

- Answer ALL questions.
- Approved scientific calculator may be used.
- Formulae and data on the back cover (you may write them in where indicated).
- Show ALL substitutions and units.
- Round answers to two decimal places unless otherwise instructed.

QUESTION 1 [20 marks]

MULTIPLE CHOICE -- Choose ONE answer for each question and circle the letter. (1 mark each)

1.1 A 5 kg block accelerates at 3 m/s^2 across a frictionless surface. The net force is:
A) 0.6 N B) 15 N C) 1.67 N D) 8 N

1.2 A box
A) 65 N

1.3 The unit of momentum is:
A) kg.m/s^2 B) N C) kg.m/s D) J

1.4 For ev
A) 1st

1.5 A spring with $k = 200\text{ N/m}$ is compressed by 0.05 m. Elastic PE stored:
A) 0.25 J B) 10 J C) 4000 J D) 0.5 J

1.6 Sound
A) Tra

1.7 Ohm's Law states that (at constant temperature):
A) V is proportional to R B) I is proportional to V C) R increases with V D) V decreases with I

1.8 Two re
A) 9 O

1.9 When a wave source moves toward a stationary observer, the observer hears:
A) Lower frequency B) Higher frequency C) Same frequency D) No sound

1.10 The pe
A) 50 s

QUESTION 2 [30 marks]**VECTORS IN 2D****2.1 (4)**

Define a VECTOR quantity and give two examples.

2.2 (8)

A hiker walks 40 m East, then 30 m North.

- (a) Calculate the magnitude of the resultant displacement using the Theorem of Pythagoras.
(b) Determine the direction of the resultant displacement (angle with East).

2.3 (10)

Two forces act on an object: $F_1 = 60\text{ N}$ at 0° (East) and $F_2 = 80\text{ N}$ at 90° (North).

- (a) Determine the x- and y-components of each force.
(b) Calculate the magnitude of the resultant.
(c) Calculate the direction (angle above East).

2.4 (8)

A force of 200 N acts at 35° above the horizontal on a box.

Calculate:

- (a) The horizontal component.
(b) The vertical component.

QUESTION 3 [40 marks]**NEWTON'S LAWS****3.1 (3)**

State Newton's Second Law of Motion in words.

3.2 (12)

A 10 kg block is pulled along a rough horizontal surface by a 60 N force.

The coefficient of kinetic friction is 0.25 ($g = 9.8 \text{ m/s}^2$).

- (a) Draw a labelled free body diagram of all forces on the block.
- (b) Calculate the frictional force.
- (c) Calculate the acceleration of the block.

3.3 (12)

Two masses are connected by a string over a frictionless pulley:

Mass A = 8 kg hangs vertically; Mass B = 12 kg lies on a frictionless horizontal surface.

- (a) Draw the system free body diagram.
- (b) Calculate the acceleration of the system.
- (c) Calculate the tension in the string.

3.4 (8)

A 60 kg person stands on a scale in a lift. The scale reads 540 N.

- (a) Is the lift accelerating upward or downward? Explain.
- (b) Calculate the magnitude of acceleration ($g = 10 \text{ m/s}^2$).

3.5 (5)

Explain why a rocket accelerates upward using Newton's Third Law.

QUESTION 4 [30 marks]**MOMENTUM AND IMPULSE**

4.1 (3)

Define MOMENTUM and write the formula including units.

4.2 (8)

A 0.5 kg ball moving at 8 m/s East collides with a wall and bounces back at 6 m/s West.

(a) Calculate the change in momentum (Δp).

(b) If the collision lasts 0.04 s, calculate the average force exerted by the wall on the ball.

4.3 (3)

State the LAW OF CONSERVATION OF MOMENTUM.

4.4 (10)

Trolley A (3 kg) moves East at 4 m/s and collides with stationary Trolley B (2 kg).

After collision Trolley A moves East at 1 m/s.

(a) Calculate the velocity of Trolley B after the collision.

(b) Is this an elastic or inelastic collision? Justify your answer by calculating kinetic energies.

4.5 (6)

How does an airbag in a car reduce the risk of injury? Refer to impulse in your answer.

QUESTION 5 [30 marks]**ELECTRICITY -- CIRCUITS****5.1 (9)**

A circuit has a 12 V battery. Two resistors $R_1 = 4 \text{ Ohm}$ and $R_2 = 8 \text{ Ohm}$ are connected in SERIES.

(a) Calculate the total resistance.

- (b) Calculate the current.
- (c) Calculate the voltage across R2.

5.2 (10)

R3 = 6 Ohm and R4 = 12 Ohm are connected in PARALLEL across a 24 V supply.

- (a) Calculate the total resistance of the parallel combination.
- (b) Calculate the total current drawn from the supply.
- (c) Calculate the current through each resistor.

5.3 (8)

Explain the difference between a series and parallel circuit in terms of:

- (a) Current
- (b) Voltage
- (c) Advantage in household wiring (which is used and why?)

5.4 (8)

A 60 W light bulb operates at 220 V for 8 hours.

- (a) Calculate the resistance of the bulb.
- (b) Calculate the energy used in kWh.
- (c) If electricity costs R2.50 per kWh, calculate the cost.

FORMULA SHEET -- Physical Sciences Grade 11

- Newton's 2nd Law: $F_{\text{net}} = m \times a$
- Weight: $F_g = m \times g$ ($g = 9.8 \text{ m/s}^2$ on Earth)
- Friction: $f = \mu \times N$
- Momentum: $p = m \times v$
- Impulse: $F \times \Delta t = \Delta p = m \times \Delta v$
- Kinetic energy: $KE = (1/2) m v^2$
- Work: $W = F \times d \times \cos(\theta)$
- Power: $P = W / t = F \times v$
- Ohm's Law: $V = I \times R$
- Series: $R_T = R_1 + R_2 + \dots$
- $1/R_T = 1/R_1 + 1/R_2$ (parallel)
- Wave speed: $v = f \times \lambda$
- Period: $T = 1 / f$
- Coulomb's Law: $F = k \times Q_1 \times Q_2 / r^2$ ($k = 9 \times 10^9$)