SMARTWIZ

GRADE 10 Physical Science EXAM

MARKS: 150

MARKS	

TIME: 2 **hour**

SCHOOL_____

CLASS (e.g. 10A) _____

SURNAME_____

NAME_____

Instructions for Students:

> Read all instructions carefully before beginning the exam.

> Write your name and student ID clearly on the answer sheet/booklet.

> Answer all questions unless otherwise stated.

> Show all your work/calculations where applicable.

> Write clearly and legibly.

> Use blue or black ink only. * Do not use correction fluid/tape.

> No electronic devices (calculators, phones, etc.) are allowed unless explicitly permitted.

> Raise your hand if you have any questions.

> Do not talk to other students during the exam.

> Any form of cheating will result in disqualification.

SECTION A: Multiple Choice (20 marks)

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

1. Which of the following quantities is a vector?
   A. Distance
   B. Speed
   C. Mass
   D. Velocity

   _____

2. The SI unit of force is:
   A. Newton
   B. Joule
   C. Watt
   D. Pascal

   _____

3. Which type of wave requires a medium to travel?
   A. Light
   B. Radio
   C. Sound
   D. X-rays

   _____

4. A car accelerates from rest to 20 $m \cdot s^{-1}$ in 4 seconds. The acceleration is:
   A. 2 $m \cdot s^{-2}$
   B. 4 $m \cdot s^{-2}$
   C. 5 $m \cdot s^{-2}$
   D. 10 $m \cdot s^{-2}$

   _____

5. Ohm's Law states that:
   A. V = I / R
   B. V = IR
   C. P = VI
   D. R = I/V

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SECTION B: Short Questions (50 marks)

6. Define the following terms:
a) Displacement (2)

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b) Acceleration (2)

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7. A car travels a distance of 60 km in 2 hours.
a) Calculate the average speed of the car in $m \cdot s^{-1}$. (4)

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8. State Newton's three laws of motion. (6)

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9. Draw a free body diagram of a box resting on a table. (3)
(Indicate all forces acting on the box)

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10. A 2 kg object is accelerated at 3 $m \cdot s^{-2}$. Calculate the net force. (3)

11. A spring is stretched by 5 cm under a force of 10 N. Calculate the spring constant. (3)

12. Describe two differences between transverse and longitudinal waves. (4)

13. A wave travels at 300 $m \cdot s^{-1}$ and has a frequency of 15 Hz. Calculate the wavelength. (3)

14. Define the term “electrical resistance.” (2)

15. List three safety features in a home electrical system. (3)

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SECTION C: Long Questions (80 marks)

16. A trolley moves down a frictionless ramp. It starts from rest and after 5 seconds its speed is 10 $m \cdot s^{-1}$.

a) Calculate the acceleration of the trolley. (3)

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b) Calculate the distance it travelled in the 5 seconds. (4)

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c) Draw a velocity-time graph for the motion. (5)

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17. An object of mass 5 kg is dropped from a height of 20 m. Ignore air resistance.

a) Calculate the potential energy before falling. (3)

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b) What is its speed just before hitting the ground? (use energy conservation) (4)

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c) What is the kinetic energy before impact? (2)

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18. A 60 W light bulb is left on for 2 hours.

a) How much energy does the bulb use in kilowatt-hours (kWh)? (3)

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b) If electricity costs R1.50 per kWh, calculate the cost. (2)

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19. A circuit consists of a 12 V battery and two resistors of 3 Ω and 6 Ω in series.

a) Calculate the total resistance. (2)

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b) Calculate the current in the circuit. (3)

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c) Calculate the voltage across the 6 Ω resistor. (3)

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20. Draw and label a simple circuit diagram with: a battery, a switch, a light bulb, and a resistor in series. (5)

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21. Describe how energy is transferred in a coal power station, from the coal to your home. (6)

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TOTAL: 150 MARKS

MEMORANDUM – GRADE 10 PHYSICAL SCIENCES: PHYSICS PAPER

SECTION A: Multiple Choice (5 x 2 = 10 marks)

1. D
2. A
3. C
4. C
5. B

SECTION B: Short Questions (50 marks)

6. Definitions (4 marks)
a) Displacement: The change in position of an object in a specific direction. (2)
b) Acceleration: The rate of change of velocity over time. (2)

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7. Average Speed (4 marks)
Distance = 60 km = 60 000 m
Time = 2 hours = 7200 s
Speed = Distance / Time = 60000 / 7200 = **8.33 m·s^{-1}** (4)

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8. Newton's Laws (6 marks)
1st Law: An object stays at rest or in uniform motion unless acted upon by a net force. (2)
2nd Law: F = ma – the acceleration of an object is proportional to the net force acting on it. (2)
3rd Law: For every action, there is an equal and opposite reaction. (2)

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9. Free Body Diagram (3 marks)
Box:

- Downward arrow: Weight / Gravitational force (labelled "Fg" or "W")
- Upward arrow: Normal force (labelled "Fn" or "N")
  Mark for each correctly labelled force.

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10. Net Force (3 marks)
F = ma = 2 × 3 = **6 N** (3)

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11. Spring Constant (3 marks)
$F = kx \rightarrow k = F / x$
$x = 5\ cm = 0.05\ m$
$k = 10 / 0.05 =$ **$200\ N \cdot m^{-1}$** (3)

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12. Differences between wave types (4 marks)
Transverse:

- Particles move perpendicular to direction of wave
- Example: Light waves

Longitudinal:

- Particles move parallel to direction of wave
- Example: Sound waves
  (2 marks for each)

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13. Wavelength (3 marks)
$v = f\lambda \rightarrow \lambda = v / f = 300 / 15 =$ **20 m** (3)

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14. Resistance (2 marks)
The opposition to the flow of electric current in a circuit. (2)

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15. Safety Features (3 marks)
Any 3:

- Fuses
- Circuit breakers
- Earth wires
- Insulation
  (1 mark each)

SECTION C: Long Questions (80 marks)

16. Trolley down ramp (12 marks)
a) $a = \Delta v / t = 10 / 5 =$ **$2\ m \cdot s^{-2}$** (3)
b) $\Delta x = \frac{1}{2} at^2 = 0.5 \times 2 \times 25 =$ **25 m** (4)
c) Velocity-time graph:

- Straight line from (0,0) to (5,10)
- Label axes correctly
  (2 for correct shape, 1 for axes labels, 2 for points plotted)

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17. Falling object (9 marks)
a) PE = mgh = 5 × 9.8 × 20 = **980 J** (3)
b) KE = PE → ½ mv² = 980
v² = (2 × 980)/5 = 392 → v = √392 ≈ **19.8 m·s⁻¹** (4)
c) KE = ½ mv² = ½ × 5 × (19.8)² = **980 J** (2)

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18. Electrical energy and cost (5 marks)
a) Energy = P × t = 0.06 kW × 2 h = **0.12 kWh** (3)
b) Cost = 0.12 × R1.50 = **R0.18** (2)

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19. Series Circuit (8 marks)
a) R_total = 3 + 6 = **9 Ω** (2)
b) I = V / R = 12 / 9 = **1.33 A** (3)
c) V = IR = 1.33 × 6 = **8 V** (3)

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20. Circuit Diagram (5 marks)
Correct diagram with:

- Battery
- Switch
- Bulb
- Resistor
  All in series and properly labelled (1 mark each)

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21. Energy Transfer in Power Station (6 marks)

- Chemical energy in coal is burned
- Produces thermal energy (steam)
- Steam spins turbines (mechanical energy)
- Turbines drive generators (electrical energy)
- Electricity is transmitted through power lines to homes
  (6 valid points = 6 marks)

TOTAL: 150 MARKS