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Physical Science

Controlled Test (Term 1) - 2024



**Gauteng Department of Education  
Johannesburg North District (D10)**

**GRADE 12**

**PHYSICAL SCIENCES  
CONTROLLED TEST 1  
15 MARCH 2024**

**MARKING GUIDELINES**

**MARKS: 100**

**TIME: 2 Hours**



**SECTION A: PHYSICS****QUESTION 1**

- 1.1 C ✓✓ (2)
- 1.2 B ✓✓ (2)
- 1.3 D ✓✓ (2)
- [6]**

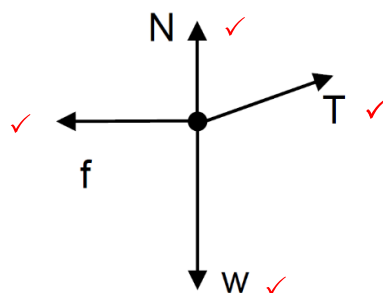
**QUESTION 2**

- 2.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force ✓ and inversely proportional to the mass ✓ of the object.

OR

The resultant/net force acting on an object is equal to the rate of change of momentum of the object (in the direction of the resultant/net force.) ✓✓ (2)

2.2



(4)

Accepted Labels	
w	$F_g/F_w$ /force of Earth on block/weight/gravitational force
T	$F_T$ /Tension/ $F/F_A$
f	$F_f / f_k$ / friction / kinetic friction
N	Normal force / $F_N$ / Force of surface on block

**Notes**

- Mark is awarded for label and arrow.
- Do not penalise for length of arrows.
- Deduct 1 mark for any additional force.
- If all forces are correctly drawn and labelled, but no arrows, deduct 1 mark.
- If force(s) do not make contact with body max  $\frac{3}{4}$
- ACCEPT: If T is not shown but  $T_{||}$  and  $T_{\perp}$  are shown, give 1 mark for both (However explain to learners that components will NO LONGER be accepted on free-body diagrams)

2.3.1 ANY OF: ✓

The blocks/system are accelerating.

OR

The acceleration is changing / not zero /  $a \neq 0$  ( $\text{m}\cdot\text{s}^{-2}$ ) /  $a = 1,32 \text{ m}\cdot\text{s}^{-2}$ 

OR

Velocity is /increasing/changing/not constant

OR

 $F_{\text{net}}$  is not equal to zero (1)2.3.2  $F_{\text{net}} = ma$  } ✓  
 $mg - T = ma$  }

$$(2)(9,8) - T = 2(1,32) \quad \checkmark$$

$$\underline{T = 16,96 \text{ N}} \quad \checkmark \quad (3)$$

2.3.3 POSITIVE MARKING FROM 2.3.2

$$F_{\text{net}} = ma \quad \checkmark$$
$$T_x - f_k = ma \quad \checkmark$$

$$T \cos 15^\circ - f_k = ma$$

$$(16,96) \cos 15^\circ - f_k = (8)(1,32) \quad \checkmark$$

$$f_k = 5,82 \text{ N to the left} \quad \checkmark \quad (4)$$

2.4 Any ONE ✓

- Normal force changes/decreases
  - The angle (between string and horizontal) changes/increases.
  - The vertical component of the tension changes/increases
- (1)

2.5 Yes ✓

The frictional force (coefficient of friction) /  $\mu_k$  depends on the nature of the surfaces in contact. ✓

OR

The  $\mu_k$  changes ✓ (2)**[17]**

**QUESTION 3**

- 3.1 The total linear momentum of an isolated system remains constant ✓✓ (is conserved) in both magnitude and direction. (2 or zero) (2)  
*Accept closed system however explain to learners a closed system will no longer be accepted*

3.2 **OPTION 1**  
**SOUTH AS POSITIVE**

$$\Sigma p_i = \Sigma p_f$$

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$m_1(+20) + (1\,248)(-15) \checkmark = (m_1 + 1\,248)(10) \checkmark$$

$$20m_1 - 18\,720 = 10m_1 + 12\,480$$

$$10m_1 = 31\,200$$

$$m_1 = 3\,120 \text{ kg} \checkmark$$

1 mark for any

Accept solution with North as Positive

No. of passengers =  $3\,120 - 2000 = 1\,120 \div 70 = 16$  passengers

Therefore  $16 - 12 = 4$  passengers in excess ✓

OR

$$3\,120 - 2000 - 12(70) = 280 \div 70 = 4 \text{ passengers in excess} \quad (5)$$

**OPTION 2**  
**SOUTH AS POSITIVE**

Let number of passengers = x

$$\Sigma p_i = \Sigma p_f$$

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$(2000 + 70x)(+20) + (1\,248)(-15) \checkmark = [(2000 + 70x) + 1\,248](10) \checkmark$$

$$40\,000 + 1400x - 18\,720 = 32\,480 + 700x$$

$$700x = 11\,200$$

$$x = 16 \checkmark$$

1 mark for any

Accept solution with North as Positive

Therefore  $16 - 12 = 4$  passengers in excess ✓

3.3 **POSITIVE MARKING FROM 3.2**

Mass of taxi = 3 120 kg

$$E_k = \frac{1}{2}mv^2$$

$$E_{ki} = \frac{1}{2}m_1 v_{1i}^2 + \frac{1}{2}m_2 v_{2i}^2$$

$$= \frac{1}{2}(3\,120)(20)^2 + \frac{1}{2}(1\,248)(-15)^2 \checkmark$$

$$= 624\,000 + 140\,400$$

$$= 764\,400 \text{ J}$$

1 mark for any



$$\begin{aligned}
 E_{kf} &= \frac{1}{2}(m_1 + m_2)v_f^2 \\
 &= \frac{1}{2}(3\,120 + 1\,248)(10)^2 \quad \checkmark \\
 &= \frac{1}{2}(4\,368)(10)^2 \\
 &= 218\,400 \text{ J}
 \end{aligned}$$

$E_{ki} \neq E_{kf} \quad \checkmark$  Therefore the collision is inelastic (4)

3.4 During a collision, the crumple zone/ airbag:

- The impulse/change in momentum/ $\Delta p$  remains constant
- The contact time/ $\Delta t$  increases
- The net force/force/ $F_{\text{net}}$  decreases

(3)  
[14]

**QUESTION 4**

4.1 9,8 m.s<sup>-2</sup> downwards ✓ (No marks if -9,8 or no direction included) (1)

4.2.1

**OPTION 1**

$$v_f^2 = v_i^2 + 2a\Delta y \quad \checkmark$$

$$v_f^2 = (0)^2 + 2(-9,8)(-19,6) \quad \checkmark$$

$$v_f = -19,6 \text{ m}\cdot\text{s}^{-1}$$

$$\underline{v_f = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ downwards}} \quad \checkmark$$

Accept if downwards taken as positive

**OPTION 2**

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$$

$$-19,6 = (0)^2 + \frac{1}{2}(-9,8)\Delta t^2$$

$$\Delta t = 2$$

$$v_f = v_i + a\Delta t \quad \checkmark$$

$$= 0 + (-9,8)(2) \quad \checkmark$$

$$v_f = -19,6 \text{ m}\cdot\text{s}^{-1}$$

$$\underline{v_f = 19,6 \text{ m}\cdot\text{s}^{-1} \text{ downwards}} \quad \checkmark$$

(3)

4.2.2

**OPTION 1**

**For A:**

$$\Delta x_A = v_i\Delta t + \frac{1}{2}a\Delta t^2$$

$$-19,6 = 0 + \frac{1}{2}(-9,8)\Delta t^2 \quad \checkmark$$

$$\Delta t = 2\text{s}$$

$$\Delta t_A = \Delta t_B$$

$$\Delta x_B = v_i\Delta t + \frac{1}{2}a\Delta t^2 \quad \checkmark$$

$$-29,6 \quad \checkmark = v_i(2) + \frac{1}{2}(-9,8)(2)^2 \quad \checkmark$$

$$v_i = -5 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = \underline{5 \text{ m}\cdot\text{s}^{-1} \text{ downwards}} \quad \checkmark$$

**OPTION 2**

**For A:**

$$v_{fA} = v_i + a\Delta t$$

$$-19,6 = 0 + (-9,8)\Delta t \quad \checkmark$$

$$\Delta t = 2\text{s}$$

$$\Delta t_A = \Delta t_B$$

$$\Delta x_B = v_i\Delta t + \frac{1}{2}a\Delta t^2 \quad \checkmark$$

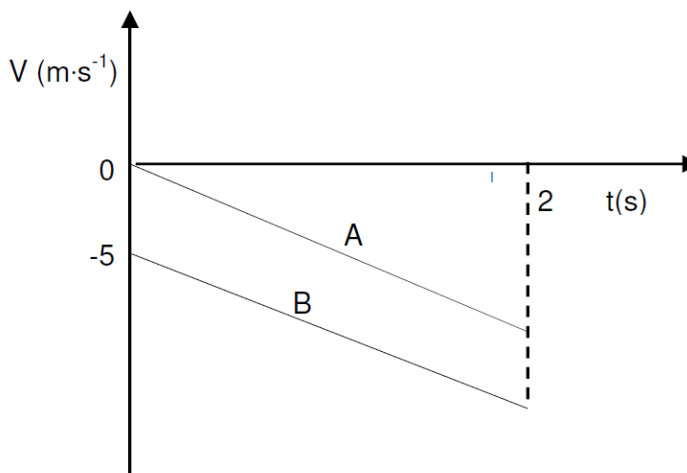
$$-29,6 \quad \checkmark = v_i(2) + \frac{1}{2}(-9,8)(2)^2 \quad \checkmark$$

$$v_i = -5 \text{ m}\cdot\text{s}^{-1}$$

$$v_i = \underline{5 \text{ m}\cdot\text{s}^{-1} \text{ downwards}} \quad \checkmark$$

(5)

4.3 **POSITIVE MARKING FROM 4.2.2**



Marking criteria	Marks
<b>A</b> starts at 0 m·s <sup>-1</sup> with negative gradient	✓
Graphs for <b>A</b> and <b>B</b> stop at 2s	✓
<b>B</b> starts at -5 m·s <sup>-1</sup> with negative gradient	✓
Lines parallel to each other	✓

(4)  
[13]

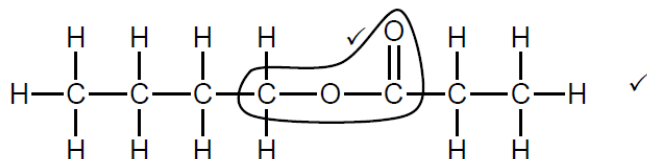
**SECTION B: CHEMISTRY****QUESTION 1**

- 1.1 D ✓✓ (2)
- 1.2 C ✓✓ (2)
- 1.3 C ✓✓ (2)
- [6]**

**QUESTION 2**

- 2.1 Unsaturated ✓
- Any ONE: ✓
- Compound C has a triple/multiple bond between C atoms
  - Compound C does NOT contain the maximum number of H atoms bonded to C atoms.
  - Compound C is an alkyne (2)
- 2.2.1 D ✓ (1)
- 2.2.2 B ✓ (1)
- 2.2.3 A ✓ (1)
- 2.2.4 E ✓ (1)

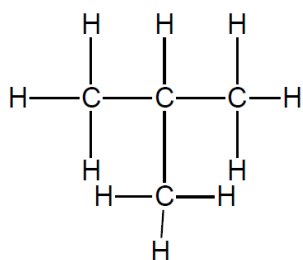
2.3.1



Marking criteria:

- Whole structure correct 2/2
  - Only functional group correct Max: 1/2
  - If condensed or semi-structural formula used Max: 1/2 (2)
- 2.3.2 Hydroxyl (group) ✓ (Do NOT accept Alcohol) (1)
- 2.3.3 Butan-2-ol ✓ (Do NOT accept Butanol / Butan-1-ol) (1)

2.3.4



Propane (3C) parent chain ✓  
Methyl (1C) branch on carbon 2 ✓

- 2.4.1 Haloalkane / Alkyl halide ✓ (1)



2.4.2 3,5-✓ dibromo✓ octane ✓

Marking criteria:

- Octane (1 mark)
  - Dibromo (1 mark)
  - Substituents (dibromo) correctly numbered, hyphens, commas correctly used. (1 mark)
- (3)

2.5  $2\text{C}_4\text{H}_{10}$ ✓ +  $13\text{O}_2 \rightarrow 8\text{CO}_2$  +  $10\text{H}_2\text{O}$  *both products*✓ *correct balancing*✓ (3)  
**[19]**

**QUESTION 3**3.1 150 kPa✓ (1)3.2.1 The temperature ✓ at which the vapour pressure of a liquid is equal to the atmospheric (external) pressure✓ (2)3.2.2 55°C ✓ (1)3.3.1 Z ✓ (1)3.3.2 Carboxylic acids have, in addition to London forces and dipole-dipole forces, two sites for hydrogen bonding between molecules. ✓Alcohols have, in addition to London forces and dipole-dipole forces, one site for hydrogen bonding between molecules. ✓Ketones have, in addition to London forces, dipole-dipole forces between molecules. ✓Intermolecular forces in carboxylic acids is the strongest. ✓Most energy needed to overcome intermolecular forces in carboxylic acid hence the lowest vapour pressure. (4)3.3.4 Propanone✓ (Accept: propan-2-one) (1)  
**[10]**

**QUESTION 4**

4.1 Secondary ✓  
The C atom bonded to the -OH group is bonded to TWO other C atoms ✓ (2)

4.2.1 Elimination of water /H<sub>2</sub>O ✓ (1)

4.2.2 Sulphuric acid or Phosphoric acid ✓

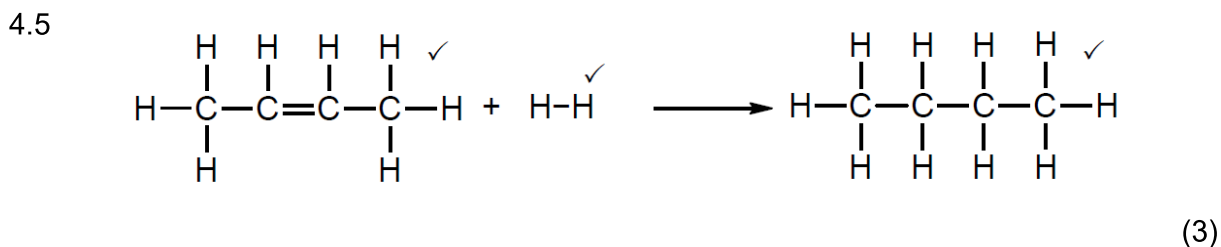
4.3.1 Hydrogenation ✓ (1)

4.3.2 Dehydrohalogenation / dehydrobromination ✓ (1)

4.4.1 Substitution (hydrolysis) ✓ (1)

4.4.2 Dilute base / Dilute sodium hydroxide (NaOH) ✓  
Moderate temperature/(mild) heat ✓ (2)

4.4.3 2-bromobutane ✓ (2)



Accept H<sub>2</sub> (instead of H-H)

4.6 butane ✓ (1)  
[15]

**TOTAL SECTION B: [50 MARKS]**  
**[TOTAL = 100 MARKS]**

Physical Sciences

Controlled Test (Term 1) - 2024

# COGNITIVE LEVELS FOR PHYSICAL SCIENCE GRADE 12 – CONTROLLED TEST 2024

QUESTION	MARKS	COGNITIVE LEVELS			
		1	2	3	4
		Recall (15 %)	Comprehension (40 %)	Analysis Application (35 %)	Evaluation Synthesis (10 %)
SECTION A: PHYSICS					
1.1	2		2		
1.2	2			2	
1.3	2			2	
2.1	2	2			
2.2	4		4		
2.3.1	1	1			
2.3.2	3			3	
2.3.3	4			4	
2.4	1			1	
2.5	2		2		
3.1	2	2			
3.2	5			5	
3.3	4		4		
3.4	3			3	
4.1	1	1			
4.2.1	3		3		
4.2.2	5				5
4.3	4			4	
SECTION B: CHEMISTRY					
1.1	2			2	
1.2	2		2		
1.3	2				2
2.1	2			2	
2.2.1	1		1		
2.2.2	1			1	
2.2.3	1		1		
2.2.4	1		1		
2.3.1	2		2		
2.3.2	1		1		
2.3.3	1		1		
2.3.4	2		2		
2.4.1	1		1		
2.4.2	3				3
2.5	3		3		
3.1	1		1		
3.2.1	2	2			
3.2.2	1		1		
3.3.1	1			1	
3.3.2	4			4	
3.3.3	1				1
4.1	2	2			
4.2.1	1	1			
4.2.2	1	1			
4.3.1	1	1			
4.3.2	1			1	
4.4.1	1		1		
4.4.2	2		2		
4.4.3	2		2		
4.5	3		3		
4.6	1		1		
TOTAL	100	13	41	35	11
%	100%	13%	41%	35%	11%



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