



# education

DEPARTMENT: EDUCATION  
MPUMALANGA PROVINCE

**GRADE 12**

**PHYSICAL SCIENCES MONTHLY TEST  
APRIL 2020  
TOPIC: NEWTON'S LAWS**

**MEMORANDUM**

**MARKS: 55**

**This Memorandum consists of 4 pages**

## QUESTION 1

1.1 B ✓✓

1.2 A ✓✓

1.3 C ✓✓

1.4 C ✓✓

1.5 C ✓✓

[10]

## QUESTION 2

2.1 The force that opposes the motion✓ of an object and which act parallel to the surface✓

(2)

2.2



$F_g/w/weight/force\ of\ gravity$ ✓  
(accept the components of Weight)

(3)

$$\begin{aligned} 2.3.1 \quad f_{k(max)} &= \mu_k F_N \checkmark \\ &= \underline{0,15(3)(9,8)(\cos 30^\circ)} \checkmark \\ &= 3,82\ N \checkmark \end{aligned}$$

(3)

2.3.2 **Positive marking from 2.3.1**  
Right/downwards as positive:

$$\begin{aligned} 5\ kg\ block: \quad F_{net} &= ma \quad \checkmark \\ T + f &= ma \\ \underline{T - (8)} &= 5a \checkmark \end{aligned}$$

1

$$\begin{aligned} 3\ kg\ block: \quad T + f + F_{g//} &= ma \\ -T - 3,82 + (3)(9,8)\sin 30^\circ &= 3a \checkmark \\ \underline{-T + 10,88} &= 3a \end{aligned}$$

2

Substitute 2 into 1:

$$a = 0,36\ m \cdot s^{-2}$$

Substitute a into 1:

$$\begin{aligned} T - 8 &= (5)(0,36) \checkmark \\ T &= 9,8\ N \checkmark \end{aligned}$$

(6)

[14]

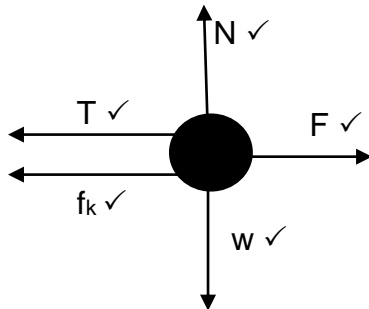
## QUESTION 3

3.1 The force that opposes the motion of a moving object ✓✓ relative to a surface

(2)

### 3.2 Accepted labels

w	F <sub>g</sub> / F <sub>w</sub> /force of earth on block/weight / 19,6 N / mg / gravitational force
f <sub>k</sub>	f/friction/
T	Tension /
F	F <sub>app</sub> / F <sub>T</sub>
N	Normal force / F <sub>N</sub> / Force of surface on block



(5)

#### Notes

- Any additional forces: max  $\frac{4}{5}$
- No arrows:  $\frac{0}{5}$

Force(s) not touching object: max  $\frac{4}{5}$

### 3.3

For 2 kg block:

$$\begin{aligned}
 F_{\text{net}} &= ma \quad \checkmark \\
 F - T - f &= 2a \\
 20 - T - 3,1 &= 2a \quad \checkmark \\
 \underline{16,9 - T} &= 2a \quad \checkmark \\
 T &= 16,9 - 2a
 \end{aligned}$$

✓ For either  
2a or 1,5a

For 1,5 kg block:

$$\begin{aligned}
 F_{\text{net}} &= ma \\
 T - 1,5(9,8) &= 1,5a \\
 \underline{T - 14,7} &= 1,5a \quad \checkmark \\
 T &= 1,5a + 14,7
 \end{aligned}$$

$$\begin{aligned}
 \therefore \underline{16,9 - 2a} &= 1,5a + 14,7 \quad \checkmark \\
 2,2 &= 3,5a \\
 a &= 0,63 \text{ m} \cdot \text{s}^{-2} \quad \checkmark
 \end{aligned}$$

OR

$$\begin{aligned}
 T &= 16,9 - 2a \\
 \underline{T} &= \underline{1,5a + 14,7} \\
 0 &= 2,2 - 3,5a \\
 a &= 0,63 \text{ m} \cdot \text{s}^{-2} \quad \checkmark
 \end{aligned}$$

(subtract)

(6)  
[13]

## QUESTION 4

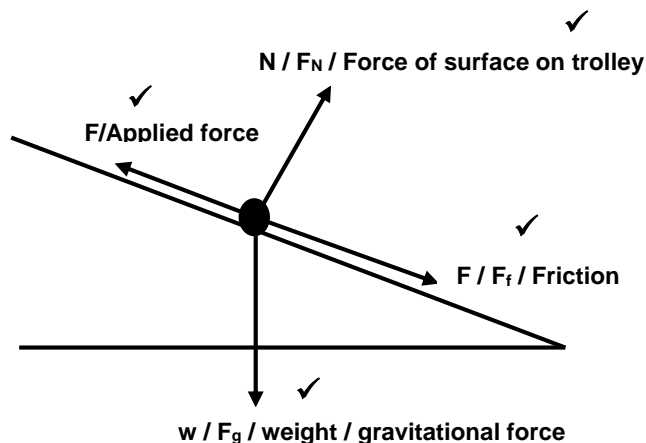
### 4.1

4.1.1 When a net force ( $F_{\text{net}}$ ) is applied to an object (of mass,  $m$ ) it accelerates in the direction of the (net) force. The acceleration is directly proportional to the (net) force and inversely proportional to the mass of the object. ✓✓(2 or 0)

OR

The net force acting on an object is equal to the rate of change of momentum of the object (in the direction of the force). ✓✓(2 or 0) (2)

4.1.2



(4)

(Accept the components of  $F_g$  INSTEAD of  $F_g$  but not both  $F_g$  and the components. No arrows =  $\frac{3}{4}$ ; forces not touching dots =  $\frac{3}{4}$ )

4.1.3 (a)

$$F_f = \mu_k F_N = \mu_k (mg \cos 30^\circ) = 0,2 (33,95) = 6,79 \text{ N}$$

(3)

(b) **Positive marking from 2.1.3 a**

$$F_{g//} = mg \sin 30^\circ = (4)(9,8) \sin 30 = 19,6 \text{ N}$$

$$F_{\text{net}} = ma_R = F + F_f + F_{g//}$$

$$(4) (0,43) = F + (-6,79) + (-19,6)$$

$$F = 28,11 \text{ N}$$

(5)

4.2

$$F = \frac{G m_1 m_2}{r^2} = \frac{6,67 \times 10^{-11} \times 2000 \times 6 \times 10^{24}}{(6,5 \times 10^6)^2} = 18944,34 \text{ N}$$

(4)

[18]

**TOTAL: 55**