education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

# PROVINCIAL ASSESSMENT

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## GRADE 11

## PHYSICAL SCIENCES: PAPER 1

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## 19 MARCH 2025

**Marks: 100**

**Time: 2 hours**

**This question paper consists of 9 pages and 2 data sheets.**

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**INSTRUCTIONS AND INFORMATION**

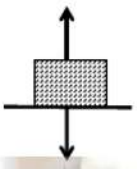
1. Write your name on the answer sheet provided.
2. This question paper consists of SIX questions. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. Number the answers correctly according to the numbering system used in this question paper.
6. You are advised to use the attached DATA SHEETS.
7. The formulae and substitutions must be shown in ALL calculations.
8. Give brief motivations, discussions, et cetera where required.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Start EACH question on a NEW page.
11. All diagrams are not necessarily drawn according to scale.
12. Write neatly and legibly.

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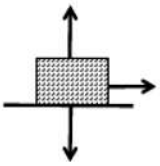
**QUESTION 1**

1.1 A block is moving with constant velocity to the right on a frictionless surface. Which sketch below correctly illustrates all the forces acting on the block?

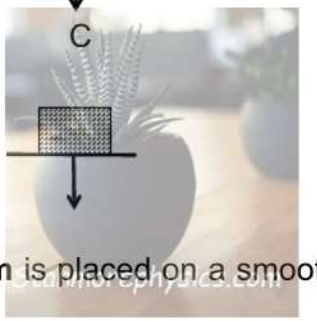
A



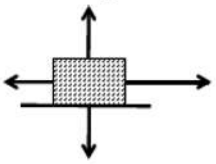
B



C

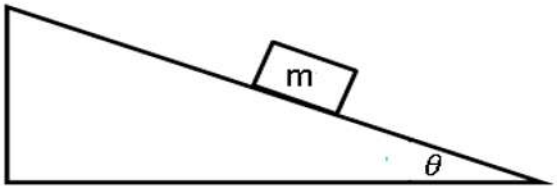


D



(2)

1.2 A block of mass **m** is placed on a smooth inclined plane of inclination **θ** with the horizontal.
What is the magnitude of the normal force exerted by the surface on the block?



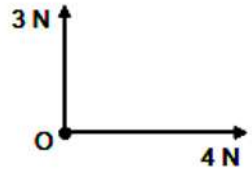

A mg

B mg cos θ

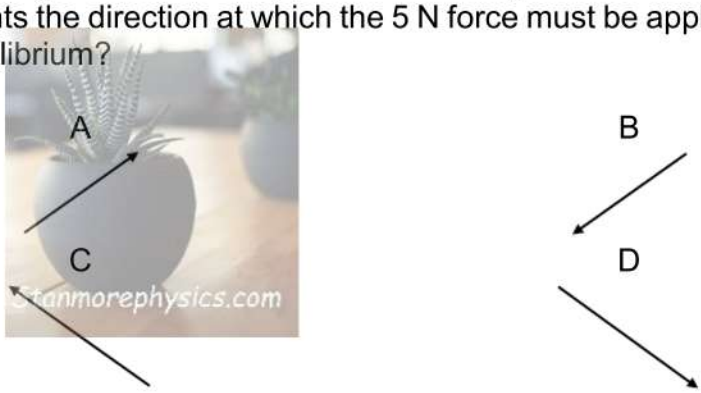
C mg sin θ

D mg tan θ (2)

1.3 The vector diagram shows two forces in the same plane acting on an object **O**.




Another force of magnitude 5 N is applied on the object **O**. Which ONE of the following represents the direction at which the 5 N force must be applied to ensure object **O** is in equilibrium?




(2)

1.4 Two hypothetical planets, **X** and **Y**, have the same mass. The diameter of planet **Y** is twice that of planet **X**.
If the acceleration due to gravity on the surface of planet **X** is **g**, then the acceleration due to gravity on the surface of planet **Y** will be …

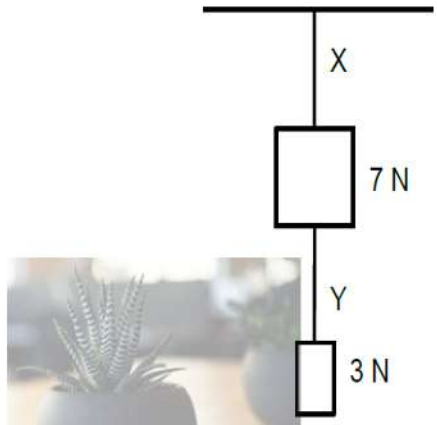
A $\frac{g}{16}$

B $\frac{g}{4}$

C $\frac{g}{2}$

D 2g (2)

1.5 Two blocks of weight 7 N and 3 N are attached to two ropes, **X** and **Y** as shown in the diagram below.




The blocks hang vertically at rest. The masses of the ropes are negligible. What is the tension in rope X and in rope Y?

| | TENSION IN **X** | TENSION IN **Y** |
|---|---|---|
| A | 10 N | 10 N |
| B | 10 N | 3 N |
| C | 7 N | 4 N |
| D | 7 N | 7 N |

(2)

1.6 Two charges point charges of +2 nC and +2 nC are located on a straight line. S and T are two points that lie on the same straight line as shown in the diagram below.




Which ONE of the following are the correct directions of the resultant electric field at point S and point T due to point charges +2 nC and +2 nC

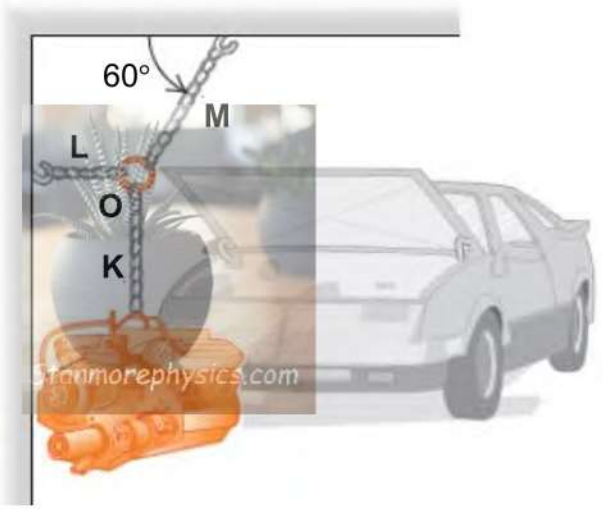
| | DIRECTION OF THE RESULTANT ELECTRIC FIELD AT POINT **S** | DIRECTION OF THE RESULTANT ELECTRIC FIELD AT POINT **T** |
|---|---|---|
| A | Right | Left |
| B | Left | Left |
| C | Right | Right |
| D | Left | Right |

(2)

**[12]**

## QUESTION 2

A car engine with weight **w** hangs from a chain(**K**) that is linked at point **O** to two other chains, one chain(**M**) that is fastened at angle of 60° to the ceiling and the other chain(**L**) to the wall as shown in the diagram below. Tension in **M** is 2540 N when point **O** is at equilibrium.




2.1 Define the term *resultant*. (2)

2.2 What is the magnitude of the resultant force on point **O**. (1)

2.3 Draw a labelled free-body diagram showing ALL the forces acting on point **O**. (3)

2.4 Calculate:

2.4.1 The magnitude of the vertical component of **M**. (2)

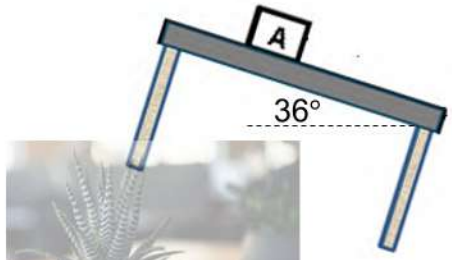
2.4.2 Mass of the engine. (3)

2.4.3 Tension in L. (2)

**[13]**

## QUESTION 3

Block **A,** of mass 6 kg is placed on a table. The angle between the surface of the table and the horizontal is 36° as shown in the diagram below. The block is just about to slide and the maximum static frictional force acting on the block is 28,22 N.

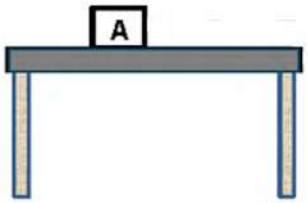



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3.1 Define *frictional force*. (2)

3.2 Calculate the co-efficient of static friction between the block and the surface of the table. (4)

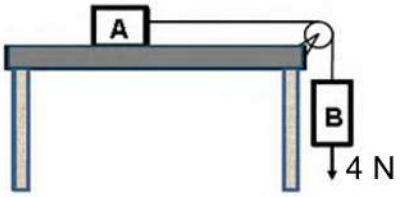
The table is now placed horizontal as shown in the diagram below.




3.3 How will the value calculated in QUESTION 3.2 be affected? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

3.4 Explain the answer in QUESTION 3.3. (1)

Block **A,** is now connected by a massless string passing over a frictionless pulley, to block **B** of mass 4 kg. A downwards force of 4 N is applied to block **B** as shown in the diagram below. The kinetic frictional force between Block **A** and the table is 23,52 N. Block A accelerates to the right.



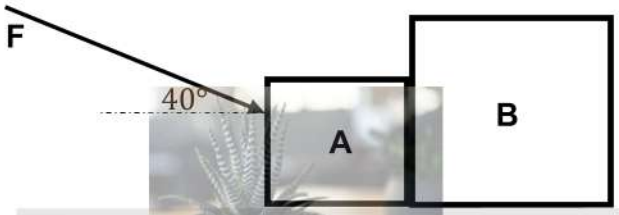

3.5 Draw a labelled free-body diagram for block **B**. (3)

3.6 Calculate the magnitude of the tension in the rope. (6)

**[17]**

**QUESTION 4**

An athlete trains by pushing a heavy box **A** of mass 23 kg, which is in contact with another identical box **B** of mass 31 kg, across a ROUGH surface of a field as shown in the diagram below. The athlete exerts a force **F** at an angle of 40° to the horizontal on box **A**. Each box experiences a frictional force of 45 N. The magnitude of the normal force acting on box **A** is 303,8 N. The boxes accelerate horizontally to the right as a system.




4.1 State Newton's First Law of Motion in words. (2)

4.2 Draw a labelled force diagram showing ALL the forces acting on box **A**. (5)

4.3 The magnitude of the force that box **A** exerts on box **B** is the same as the magnitude of the force that box **B** exerts on box **A**.

Which Newton's Law of Motion explains this statement. (1)

4.4 Calculate the magnitude of the:

4.4.1 Force **F**, acting on box **A**. (3)

4.4.2 Acceleration of the boxes. (5)

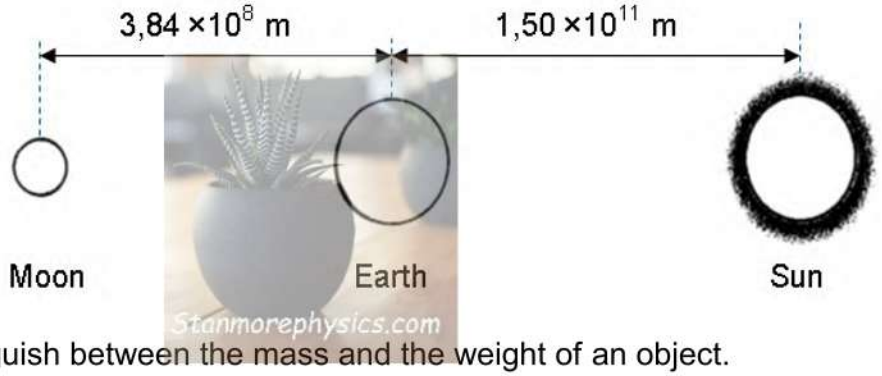
4.4.3 Force that box **B** exerts on box **A**. (2)

4.5 Use a relevant formula(e) to explain why the two boxes experience the same frictional force. (4)

**[22]**

**QUESTION 5**

During a lunar eclipse, the Earth, the Moon, and the Sun are aligned on the same plane such that the distance between the center of Moon and the Earth is $3,84 \times 10^{8}$ m and the distance between the Sun and the Earth is $1,50 \times 10^{11}$ m as shown in the diagram below. The masses of the Moon and the Sun are $7,35 \times 10^{22}$ kg and $1,99 \times 10^{30}$ kg respectively.




5.1 Distinguish between the mass and the weight of an object. (2)

5.2 State *Newton's law of universal gravitation* in words. (2)

5.3 Calculate the magnitude of the gravitational force exerted by the Sun on the Earth. (4)

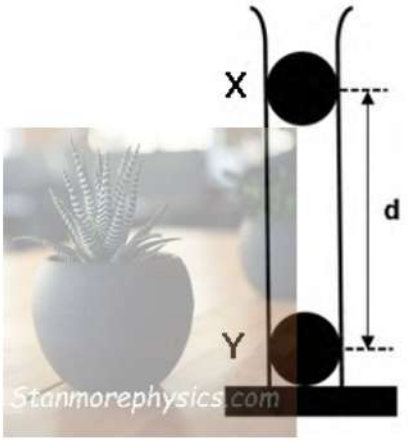
The gravitational force exerted by the Earth on the Moon is $1.99 \times 10^{20}$ N

5.4 Write down the magnitude of the force that the Moon exert on the Earth. (1)

5.5 Calculate the net force experience by Earth due to the Moon and the Sun. (3)
**[12]**

**QUESTION 6**

A polystyrene ball **Y** carrying a charge of $+30 \times 10^{-9}$ C is covered with a thin layer of graphite and placed in a glass cylinder. An identical ball **X** of mass 40 g, carrying a charge of $+100 \times 10^{-9}$ C is now placed in the measuring cylinder and is pushed away to a height **d** as shown in the diagram below.

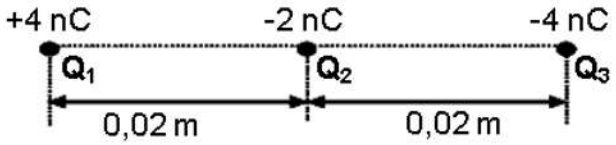



6.1 State *Coulomb's Law* in words. (2)

6.2 Draw a labelled free-body diagram showing ALL the forces acting on ball **X**. (2)

6.3 Calculate the distance **d** in mm, between ball **X** and **Y**. (6)

In the diagram below, $Q_1$, $Q_2$ and $Q_3$ are three stationary point charges placed along a straight line. The charges on $Q_1$, $Q_2$ and $Q_3$ are +4 nC, -2 nC and -4 nC respectively. The distance between $Q_1$ and $Q_2$ is 0,02 m and that between $Q_2$ and $Q_3$ is also 0,02 m.




6.4 Define the term *electric field at a point* in words. (2)

6.5 Draw the net electric field pattern due to charges $Q_1$ and $Q_3$. (3)

6.6 Calculate the net force exerted by $Q_2$ and $Q_3$ on $Q_1$. (6)

6.7 Calculate the net electric field experinced by $Q_1$. (3)

**[24]**

**DATA FOR PHYSICAL SCIENCES GRADE 11**

**PAPER 1 (PHYSICS)**

***GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11***

***VRAESTEL 1 (FISIKA)***

## TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

| NAME/*NAAM* | SYMBOL/ *SIMBOOL* | VALUE/*WAARDE* |
|---|---|---|
| Acceleration due to gravity / *Swaartekragversnelling* | g | 9,8 m•s$^{-2}$ |
| Universal gravitational constant / *Universelegravitasiekonstant* | G | 6,67 × 10$^{-11}$ N•m$^2$•kg$^{-2}$ |
| Speed of light in a vacuum / *Spoed van lig in 'n vakuum* | c | 3,0 × 10$^8$ m•s$^{-1}$ |
| Planck's constant / *Planck se konstante* | h | 6,63 × 10$^{-34}$ J•s |
| Coulomb's constant / *Coulomb se konstante* | k | 9,0 × 10$^9$ N•m$^2$•C$^{-2}$ |
| Charge on electron / *Lading op elektron* | e | -1,6 × 10$^{-19}$ C |
| Electron mass / *Elektronmassa* | $m_e$ | 9,11 × 10$^{-31}$ kg |
| Mass of earth / *Massa op aarde* | M | 5,98 × 10$^{24}$ kg |
| Radius of earth / *Radius van aarde* | $R_E$ | 6,38 × 10$^3$ km |

## TABLE 2: FORMULAE/*TABEL 2: FORMULES*

### MOTION/*BEWEGING*

| | |
|---|---|
| $v_f = v_i + a\Delta t$ | $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/*of* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ |
| $v_f^2 = v_i^2 + 2a\Delta x$ or/*of* $v_f^2 = v_i^2 + 2a\Delta y$ | $\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ or/*of* $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ |

### FORCE/*KRAG*

| | |
|---|---|
| $F_{net} = ma$ | $w = mg$ |
| $F = \frac{Gm_1m_2}{d^2}$ | $\mu_s = \frac{f_s^{max}}{N}$ |
| $\mu_k = \frac{f_k}{N}$ | |

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## ELECTROSTATICS/*ELEKTROSTATIKA*

| | |
|---|---|
| $F = \frac{kQ_1Q_2}{r^2}$ (k = 9,0 x $10^9$ N.m$^2$.C$^{-1}$) | $E = \frac{F}{q}$ |
| $E = \frac{kQ}{r^2}$ (k = 9,0 x $10^9$ N.m$^2$.C$^{-1}$) | $n = \frac{Q}{q_e}$ |

## ELECTROMAGNETISM/ *ELEKTROMAGNETISME*

| | |
|---|---|
| $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$ | $\Phi = BA\cos\theta$ |

## ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

| | |
|---|---|
| $I = \frac{Q}{\Delta t}$ | $R = \frac{V}{I}$ |
| $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$ | $R_s = R_1 + R_2 + \ldots$ |
| $W = Vq$<br>$W = VI\Delta t$<br>$W = I^2R\Delta t$<br>$W = \frac{V^2\Delta t}{R}$ | $P = \frac{W}{\Delta t}$<br>$P = VI$<br>$P = I^2R$<br>$P = \frac{V^2}{R}$ |

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