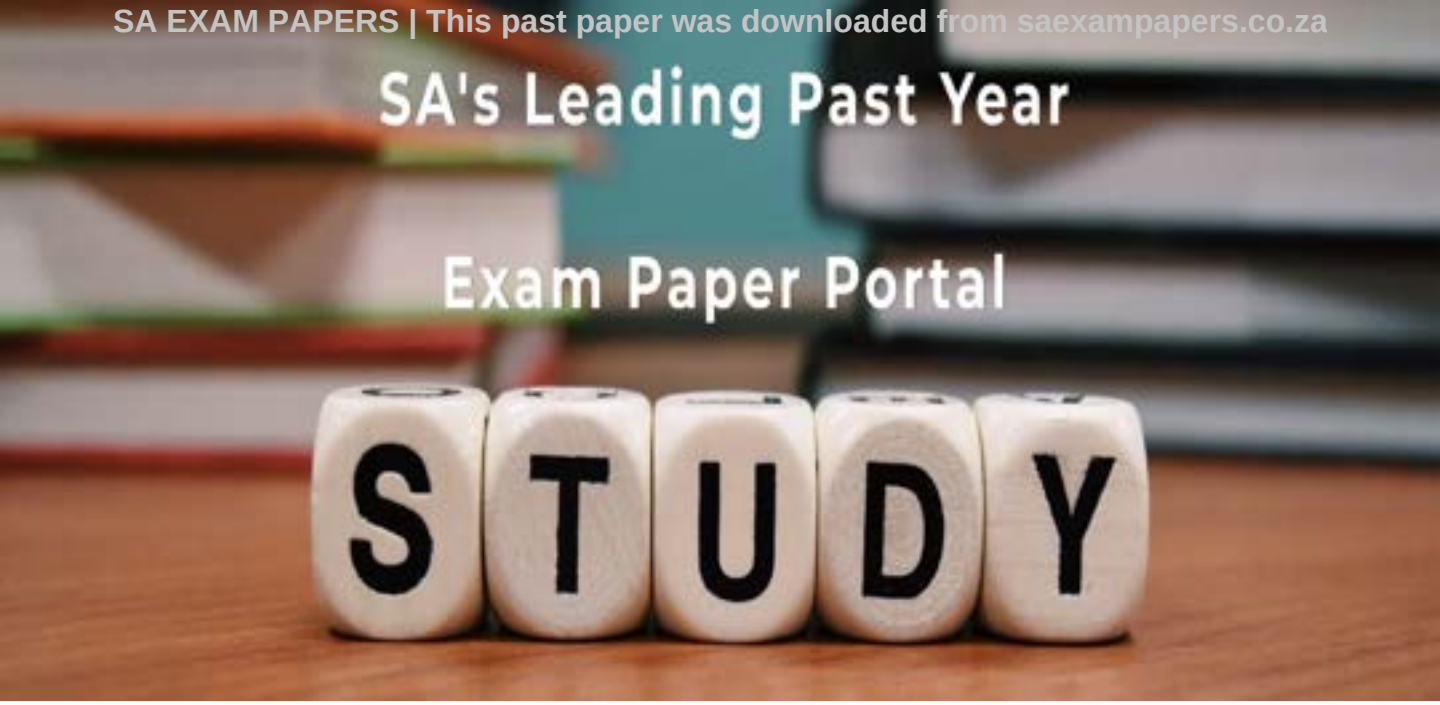


GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2024

MARKING GUIDELINES

TECHNICAL SCIENCE (PAPER 1) (11101)

9 pages

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1	A ✓✓	(2)
1.2	**REMOVED**	(2)
1.3	B ✓✓	(2)
1.4	D ✓✓	(2)
1.5	A ✓✓	(2)
1.6	C ✓✓	(2)
1.7	A ✓✓	(2)
1.8	B ✓✓	(2)
1.9	D ✓✓	(2)
1.10	D✓✓	(2)

[18]

QUESTION 2: MATCHING ITEMS

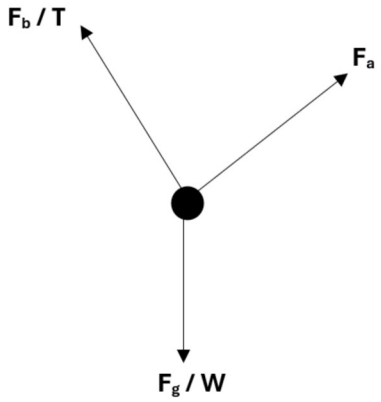
2.1	D ✓	(1)
2.2	H ✓	(1)
2.3	A ✓	(1)
2.4	F ✓	(1)
2.5	B ✓	(1)
2.6	G ✓	(1)
2.7	C ✓	(1)
2.8	E ✓	(1)

[8]

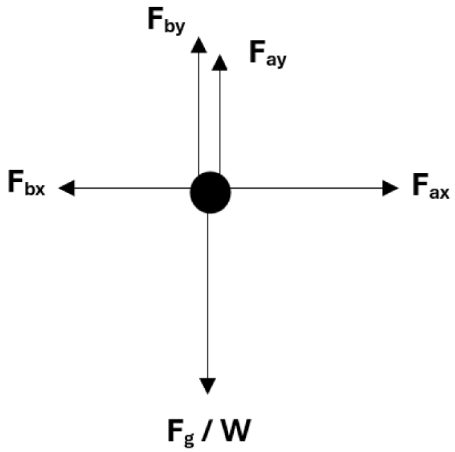
QUESTION 3

3.1 3.1.1 The body will remain at rest or continue to move in a straight line at a constant velocity unless it is acted by a net force. ✓✓ (2)

3.1.2



OR



(3)

CRITERIA	MARKS
Tension van A (T)	✓
Tension of B (F_b)	✓
Gravitational force (F_g)	✓

3.1.3 **Option 1**

W = mg ✓

9000 ✓= m x 9,8

$m = \frac{9000}{9,8}$

= 918,37 kg ✓ (3)

3.1.4 **Option 1**

$F_{net} = 0$

$F_{Ax} + T_{Bx} = 0$ ✓

$F_A\cos\Theta + (- T_B\cos\alpha) = 0$

6 500 cos30° ✓– Tcos45° ✓ = 0

$T = \frac{6\,500\cos30^\circ}{\cos45^\circ}$

= 7 960,84 N ✓

Option 2

$F_{net} = 0$

$F_{ay} + F_{by} + F_g = 0$

$F_A\sin\Theta + (- F_b\sin\alpha) = 0$

$6500\sin30^0 + F_b\sin45^0 - 9000 = 0$

$F_b\sin45^0 = 5\,750$

= 8 131,73 N (4)

3.2 3.2.1 When the net force is exerted on an object, the object will accelerate in the direction of the net force with the acceleration that is directly proportional to the net force and inversely proportional to the mass of the object. ✓✓ (2)

3.2.2 $F_{net} = ma$

$F_A + F_{bx} + F_f = ma$ ✓

$F_A + F_B\cos\Theta + F_f = ma$

$\underline{F_A + 70\cos 30^o}$ ✓ $- 25 = \underline{200 \times 2}$ ✓

$F_A = 364{,}38$ N to the right ✓ (4)

3.2.3 Increases ✓ (1)

3.2.4 Increasing the angle will increase the y component of F_B that is acting downward which will add to the gravitational force. Adding the component of F_B to gravitational force will increase the normal force. ✓✓ (2)

[21]

QUESTION 4

4.1 4.1.1 The total linear momentum of an isolated system remains constant in magnitude and direction. ✓✓ (2)

4.1.2 Σp before = Σp after

or

$(m_1 + m_2)v_i = m_1v_{1f} + m_2v_{2f}$ ✓

$(2\ 100 + 1\ 200)7$ ✓ $= 2\ 100v_f + 1\ 200 \times 10$ ✓

$23\ 100 = 2\ 100v_f + 12\ 000$

$V_f = 5{,}29\ m.s^{-1}$ ✓ (4)

4.2 4.2.1 The product of the net force acting on an object and the time the net force acts on the object.✓✓ (2)

4.2.2 $F_{net}\ \Delta t = \Delta P$

Increasing time decreases the net force./The relationship is inversely proportional. ✓✓ (2)

4.2.3 Equal ✓ (1)

4.2.4 During the collision the car is still moving at the same speed as it was. The airbags will be deployed and the body will hit the airbag with the same speed. ✓

The airbags will slow down the body by increasing the time of impact and decreasing the force of the impact. ✓

Time is inversely proportional to the force.✓ (3)

4.2.5

OPTION 1	**OPTION 2**
$F_{net}\,\Delta t = \Delta p$ ✓	$F_{net}\,\Delta t = \Delta p$
$F_{net}\,\Delta t = m(v_f - v_i)$	$F_{net}\,\Delta t = m(v_f - v_i)$
$-55000 \times \Delta t$ ✓ $= 1000(0 - 12)$ ✓	$55000 \times \Delta t = 1000(0 - (-12))$
$\Delta t = 0{,}22$ s ✓	$\Delta t = 0{,}22$ s

(4)

[18]

QUESTION 5

5.1 The total mechanical energy in an isolated system remains constant. ✓✓ (2)

5.2 $E_p = mgh$ ✓

$E_p = 250 \times 9{,}8 \times 30$ ✓

$= 73\,500$ J ✓ (3)

5.3 $E_k = \frac{1}{2}mv^2$ ✓

$E_k = \frac{1}{2} \times 250 \times 5^2$ ✓

$= 3\,125$ J ✓ (3)

5.4 The sum of kinetic energy and potential energy. ✓✓ (2)

5.5 $E_M = mgh + \frac{1}{2}mv^2$ ✓

$= \underline{2 \times 9{,}8 \times 2 + 0}$ ✓ (If 0 is omitted then 2/3)

$= 39{,}2$ J ✓ (3)

5.6 **Positive marking from 5.5**

$M_{Etop} = M_{Ebottom}$

$E_P + E_K = E_P + E_K$ ✓

$mgh + \frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$

$\underline{2 \times 9{,}8 \times 2 + \frac{1}{2} \times 2 \times 0^2}$ ✓ $= \underline{2 \times 9{,}8 \times 0 + \frac{1}{2} \times 2 \times v^2}$ ✓

$39{,}2 + 0 = 0 + v^2$

$v = 6{,}26\ m.s^{-1}$ ✓ (4)

[17]

QUESTION 6

6.1 Within the elastic limit, the stress is directly proportional to the strain. ✓✓ (2)

6.2
- Stress ball.
- Spring. (any two) ✓✓
- Kicking a rugby or soccer ball. (2)

6.3
- Power steering.
- Shock absorbers.
- Windshields.
- Brake.
- Dentists' chair.

(any two) ✓✓ (2)

6.4 6.4.1

$$\sigma = \frac{F}{A}$$

$$= \frac{F}{\pi r^2} \quad \checkmark$$

$$= \frac{6\,000}{\pi \times 0{,}025^2} \checkmark$$

$$= 3\,055\,744{,}91 \text{ Nm}^{-2} \quad \checkmark$$

$$= 3{,}06 \times 10^6 \text{ Nm}^{-2}$$

(4)

6.4.2

$$\varepsilon = \frac{\Delta l}{L} \checkmark$$

$$= \frac{0{,}003}{5} \checkmark$$

$$= 0{,}0006 \checkmark$$

$$= 6 \times 10^{-4}$$

(3)

6.4.3 **POSITIVE MARKING FROM 6.4.1 and 6.4.2**

OPTION 1	**OPTION 2**
$K = \frac{\sigma}{\varepsilon}$ ✓	$K = \frac{\sigma}{\varepsilon}$
$= \frac{3{,}06 \times 10^6}{6 \times 10^{-4}}$	$= \frac{3\,055\,744{,}91}{6 \times 10^{-4}}$
$= 5{,}1 \times 10^9 \text{ N.m}^{-2}$ ✓	$= 5{,}09 \times 10^9 \text{ N.m}^{-2}$

(2)

[15]

QUESTION 7

7.1 Distance between the plates, area of the plates and dielectric of material used. (any two). ✓✓ (2)

7.2 7.2.1

$$C = \frac{\varepsilon_o A}{d} \checkmark$$

$$= \frac{8{,}85 \times 10^{-12} \times 0{,}04}{0{,}002} \checkmark$$

$$= 1{,}77 \times 10^{-10} \text{ CV}^{-1} \checkmark$$

(Or the unit F can be used) (3)

7.2.2 **POSITIVE MARKING FROM 7.2.1**

$C = \frac{Q}{V}$ ✓

$1,77 \times 10^{-10} = \frac{Q}{12}$ ✓

$Q = 2,12 \times 10^{-9}$ C ✓

(3)
[8]

QUESTION 8

8.1 The electric current is proportional to the voltage and inversely proportional to the resistance when the temperature is constant.
OR the potential difference across the conductor is directly proportional to the current in the conductor at constant temperature ✓✓ (2)

8.2 8.2.1 $R_p = \frac{R_5 \times R_3}{R_5 + R_3}$ ✓

$= \frac{5 \times 3}{5 + 3}$ ✓

$R_{eq} = R_p + R_2$

$= 1,88 + 2$ ✓

$= 3,88\ \Omega$ ✓

OR

$\frac{1}{R_P} = \frac{1}{R_5} + \frac{1}{R_3}$ ✓

$= \frac{1}{5} + \frac{1}{3}$ ✓

$R_p = 1,88\ \Omega$

$R_{eq} = R_p + R_2$

$= 1,88 + 2$ ✓

$= 3,88\ \Omega$ ✓ (4)

8.2.2 $R = \frac{V}{I}$ ✓

$3,88 = \frac{3}{I}$ ✓

$V = IR$

$I = 0,77$ A
$= 0,77 \times 2$ ✓

$= 1,54$ V ✓ (4)

8.3 8.3.1 The rate at which energy is transferred. /The rate at which work is done. ✓✓ (2)

8.3.2 $P = \frac{V^2}{R}$ ✓

$= \frac{220^2}{18}$ ✓

= 2 688,89 W
= 2,67 kW
} ✓ (3)

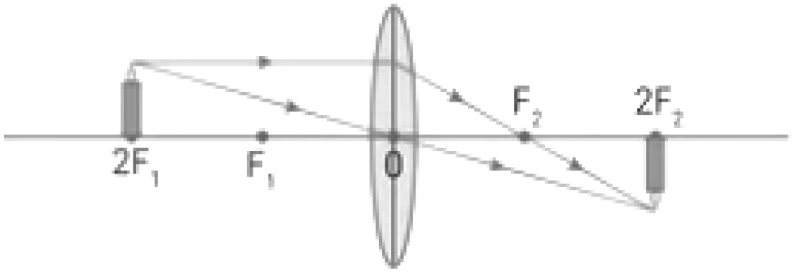
8.3.3
- Stove
- Heater
- Kettle

(any two) ✓✓

(Any other relevant appliances are correct) (2)
[17]

QUESTION 9

9.1



CRITERIA	MARKS
Object (at 2F)	✓
Inverted Image	✓
Image position (2F)	✓
Light ray passing through the centre	✓
Light ray passing through F_2.	✓
Correct Lens (Convex lens)	✓

(6)

9.2 9.2.1 Red ✓ (1)

9.2.2 Violet ✓ (1)

9.2.3 Dispersion ✓ (1)

9.2.4 The phenomenon whereby light breaks up into its component colours. ✓✓ (2)
[11]

QUESTION 10

10.1
- They originate from accelerated electric charges.
- Propagate as changing electric field and magnetic fields that are perpendicular to each other.
- They are transverse waves.
- They transfer energy.
- They can travel through the vacuum and a medium.
- They have a speed of 3×10^8 m·s^{-1} (any two) (2)

10.2 10.2.1 Infrared ✓ (1)

10.2.2 Infrared ✓ (1)

10.3 10.3.1 $E = hf$ ✓

$= 6,63 \times 10^{-34} \times 5,56 \times 10^{14}$ ✓

$= 3,69 \times 10^{-19}$ J ✓ (3)

10.3.2 $E = \frac{hc}{\lambda}$ ✓

$= \frac{6,63 \times 10^{-34} \times 3 \times 10^8}{390 \times 10^{-9}}$ ✓ ✓

$= 5,1 \times 10^{-19}$ J ✓ (4)

[11]

QUESTION 11

11.1 Commutator (split ring) ✓ (1)

11.2 Anticlockwise ✓ (1)

11.3 Electrical energy to mechanical energy ✓✓ (2)

11.4 DC generator has commutator (split rings) and an AC generator has slip rings. ✓✓ (2)

[6]

TOTAL: 150