higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(First paper)
NQF LEVEL 3

16 November 2022

This marking guideline consists of 11 pages.

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SECTION A

QUESTION 1

1.1 Inertia
1.2 Resonance
1.3 Electric field
1.4 Capacitance
1.5 Ohm's law

(5 × 1) **[5]**

QUESTION 2

2.1 D
2.2 F
2.3 H
2.4 E
2.5 G

(5 × 1) **[5]**

QUESTION 3

3.1 True
3.2 True
3.3 False
3.4 False
3.5 False

(5 × 2) **[10]**

QUESTION 4

4.1 B
4.2 D
4.3 A
4.4 C
4.5 C

(5 × 3) **[15]**

TOTAL SECTION A: 35

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SECTION B

QUESTION 5: MEASURES

5.1 $\text{Distance} = \text{speed} \times \text{time}$✓
$= 100 \text{ km/h} \times 30 \text{ min}$
$= 27{,}7 \text{ m/s} \times 1\,800 \text{ s}$✓
$= 49\,860 \text{ m}$✓ (3)

5.2 5.2.1 Potential difference
5.2.2 Electric current/Brightness of the bulb
(2 × 1) (2)
[5]

QUESTION 6: MECHANICS: LINEAR HORIZONTAL MOTION

6.1 Instantaneous (1)

6.2 The officer increased the speed of his car by 2 m for every second. (2)

6.3 $180 \text{ km/h} = 50 \text{ m/s}$

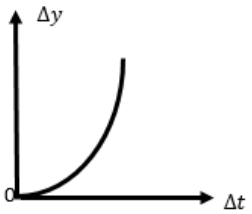
$v = \frac{d}{t}$✓

$d = v \times t$

$= 50$✓ $\times 25$✓

$= 1\,250 \text{ m}$✓ (4)

6.4



MARKING CRITERION	MARKS
Correct labels on the x- and y-axes	1
Correct shape of the graph	1

(2)

6.5 With the speed at which the man was travelling, the distance that he would cover before applying brakes is:

$v = d/t$✓
$\mathrm{d} = \mathrm{vt}$
$= 50 \times 0{,}25$✓
$= 12{,}5\ \mathrm{m}$✓

The car driver would have hit the cow as the cow is at the distance in which he is driving at 180 km/h.✓ (4)
[13]

QUESTION 7: MECHANICS: VECTORS AND PARALLEL FORCES

7.1 The point in a body✓ where the weight or gravity of an object appears to act or where the resultant torque is zero

OR

The point through which the resultant✓ of the weight of all the particles of the body acts✓

OR

The point in a body through which the weight of an object appears to act for any orientation of the object (2)

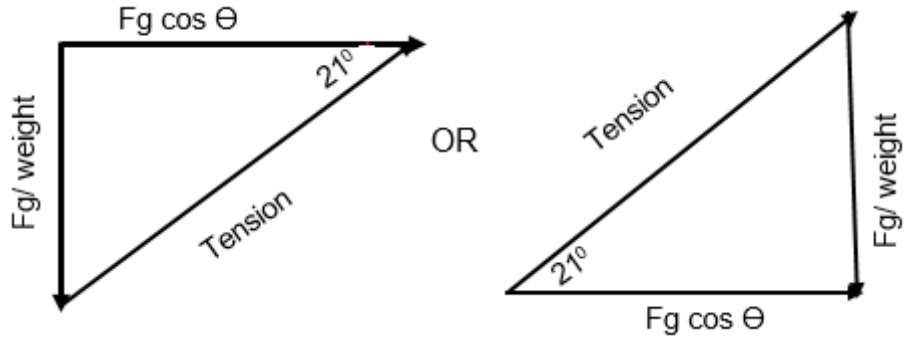
7.2 7.2.1

$$\mathrm{M_{CW}} = \mathrm{M_{ACW}}\checkmark$$
$$\mathrm{F1} \times \mathrm{d1} = \mathrm{F2} \times \mathrm{d2}$$
$$\mathrm{F_P} \times 0{,}90\checkmark = 160 \times 0{,}50\checkmark$$
$$\mathrm{F_P} = 89\ \mathrm{N}\ (88{,}9\ \mathrm{N})\checkmark$$ (4)

7.2.2 $\mathrm{Q} = (160 - 89)\checkmark$
$= 71\ \mathrm{N}\checkmark$ (2)

7.3 7.3.1 Tension (1)

7.3.2



MARKING CRITERION	MARK
Correct direction and label of Fg	1
Correct direction and label of FgcosΘ	1
Correct direction and label of tension	1
Correct position of 21°	1

(4)

7.3.3 $\cos\Theta = \frac{F(hor)/adjascent}{hypotunese}$✓

$\cos 21°$✓ $= \frac{F(hor)/ad}{6{,}5 \times 10^3}$✓

$F_{hor} = 6\,068{,}3$ N✓

OR

$F_{hor} = F\cos\Theta$✓
$= 6{,}5 \times 10^3$✓ $\times \cos 21°$✓
$= 6\,068{,}3$ N✓ (4)

[17]

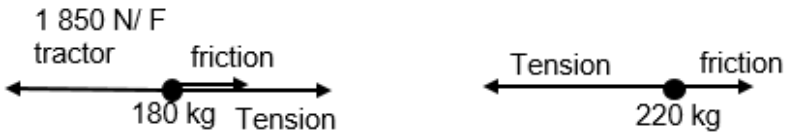
QUESTION 8: MECHANICS: NEWTON'S LAWS

8.1 8.1.1 It will continue in motion in the same direction at constant speed,✓ because no external forces are acting on the rock.✓ (2)

8.1.2 Newton's first law (1)

8.2 8.2.1 The acceleration of an object is directly proportional to the net force✓ and inversely proportional to the mass of the object.✓ (2)

8.2.2



MARKING CRITERION	MARKS
1 850 N/F tractor	1
Friction for both logs	1
Tension for both logs	1

(3)

8.2.3 Using the system approach: [180 + 220 = 400 kg]

$F_N = F_{grav}$
$= 400 \times 9{,}8$
$= 3\,920$ N✓

$F_{frict} = \mu \times F_N$✓
$= 0{,}45 \times 3\,920$
$= 1\,764$ N✓

$F_{net} = ma$✓
$1\,850$ N – $1\,764$ N $= 400 \times a$✓
86 N $= 400 \times a$✓

$a = \frac{86}{400}$
$= 0{,}22$ m·s^{-2}✓

OR

Use individual logs for the individual object analysis on the 220 kg back log:

$F_N = F_{grav}$✓
$= 220 \times 9,8$
$= 2\ 156$ N✓

$F_{frict} = \mu \times F_{norm}$
$= 0,45 \times 2\ 156$
$= 970,2$ N✓

$$Fnet = ma$$
$FA + (-T \pm \text{friction}) = ma$✓
$1\ 850 - (T + 970,2) = 220a$
$1\ 850 - T - 970,2 = 220a$
$879,8 - T = 220a \ldots(1)$

For the individual object analysis on the 180 kg back log:

$F_N = F_{grav}$
$= 180 \times 9,8$
$= 1\ 764$ N✓

$F_{frict} = \mu \times F_{norm}$
$= 0,45 \times 1\ 764$
$= 793,8$ N✓

$$Fnet = ma$$
$T + (\text{-friction}) = ma$
$T - 793,8 = 180\ a \ldots(2)$

$(1) + (2)$:

$+879,8 - T = 220\ a$
$-793,8 + T = 180\ a$
$86 = 400\ a$
$a = 86/400$
$a = 0,22\ m.s^{-2}$✓ (7)

8.2.4 Substitute *a* in (1) or (2):

$879,8 - T = 220a$✓
$879,8 - T = 220 \times 0,215$✓
$879,8 - T = 47,3$
$T = 832,5$ N✓

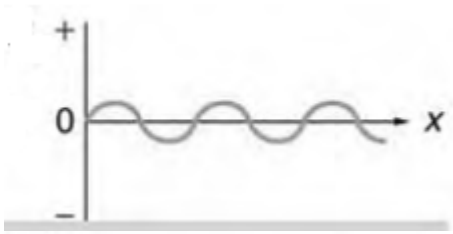
OR

$T - 793{,}8 = 180\ a \ldots (2)$
$T - 793{,}8 = 180 \times 0{,}215$✓
$T - 793{,}8 = 38{,}7$✓
$T = 832{,}5\ N$✓ (3)
[18]

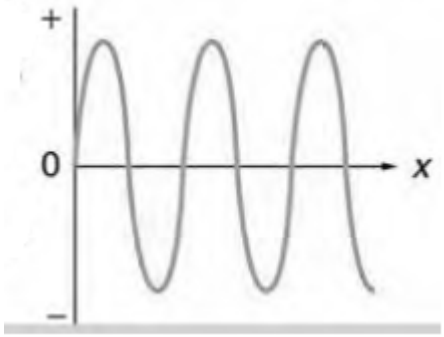
QUESTION 9: WAVES, SOUND AND LIGHT

9.1 9.1.1 Amplitude (1)

9.1.2 (a)



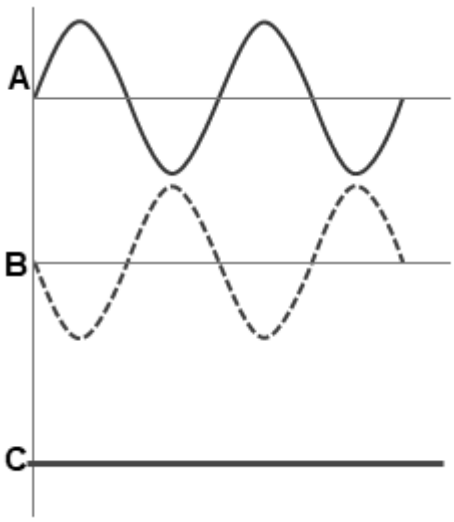
(b)



(2 × 2) (4)

9.2 9.2.1 Destructive interference (1)

9.2.2



MARKING CRITERION	MARKS
Pattern of B is the opposite of A	2
Resultant pattern at C is a straight line	1

(3)

9.3 $\text{Distance} = \text{v} \times \text{t}$✓
$= 345 \times 3 \text{ s}$
$= 1\,032 \text{ m}$✓ (2)

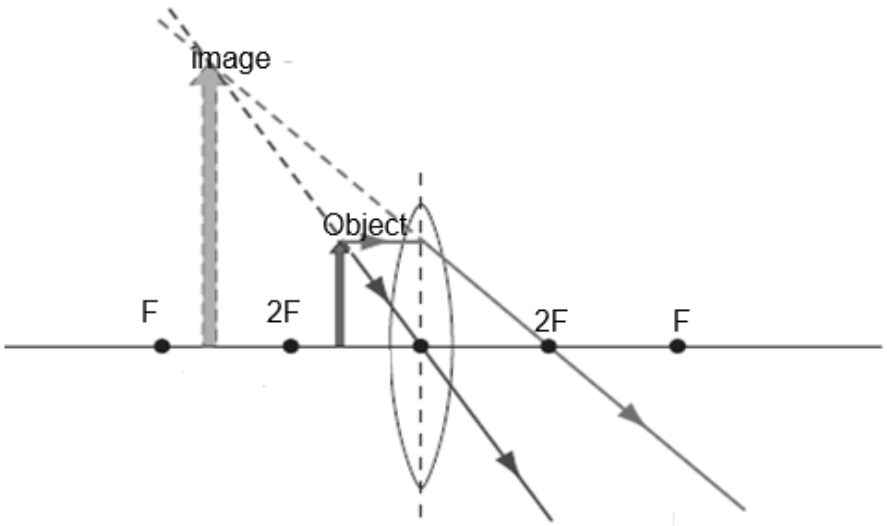
9.4 $\text{Air column} = \text{Resonant point}$
$l = \frac{3}{4}\lambda$✓
$0{,}675 \text{ m} = \frac{3}{4}\lambda$

$\lambda = 0{,}675 \times \frac{4}{3}$
$= 0{,}9 \text{ m}$✓

$v = f\lambda$✓
$v = 384 \times 0{,}9$✓
$= 345{,}6 \text{ m}$✓ (5)

9.5 9.5.1 Convex lens and concave lens (2)
9.5.2 Hyperopia/Far-sightedness (1)
9.5.3 Convex/Converging lens (1)

9.5.4



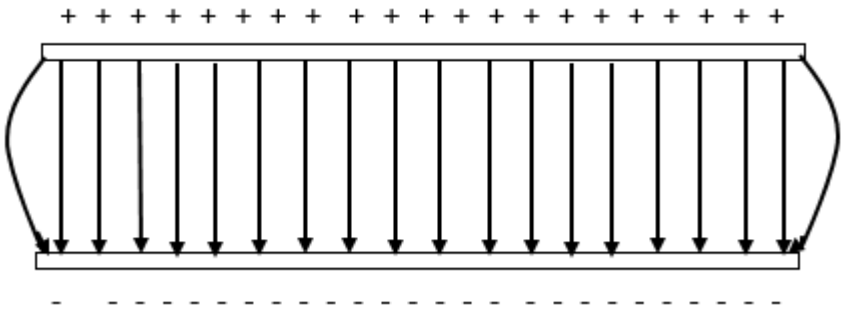
MARKING CRITERION	MARKS
Correct type of lens	1
Object smaller than image, placed between centre of lens and F but facing in same direction as image	1
Image bigger than object, placed between F and 2F but facing in same direction as image	1
Parallel ray from top of object cuts at F from the lens and seem to come from top of image	1
Ray seem to come from top of image, touched top of object and passes venter of the lens	1

(5)
[25]

QUESTION 10: ELECTRICITY AND MAGNETISM: ELECTROSTATICS AND ELECTROMAGNETIC INDUCTION

10.1 10.1.1 The electrostatic forces between two charges✓ are directly proportional to the product of the charges and inversely proportional to the square of the distance between them.✓ (2)

10.1.2



Marking criteria	Marks
Parallel rays from the positive to the negative plate	1
Rays curve at the edges	1
Rays are evenly spread between the plates	1

(3)

10.1.3 $V = Ed$ ✓
$= 3{,}0 \times 10^{6} \times 0{,}025$✓
$= 75 \times 10^{4}\,\text{V}$✓ (3)

10.2 10.2.1 Dielectric (1)

10.2.2 $\text{Area (A)} = (l \times b)$
$= 0{,}2 \times 0{,}03$
$= 0{,}006\ \text{m}$

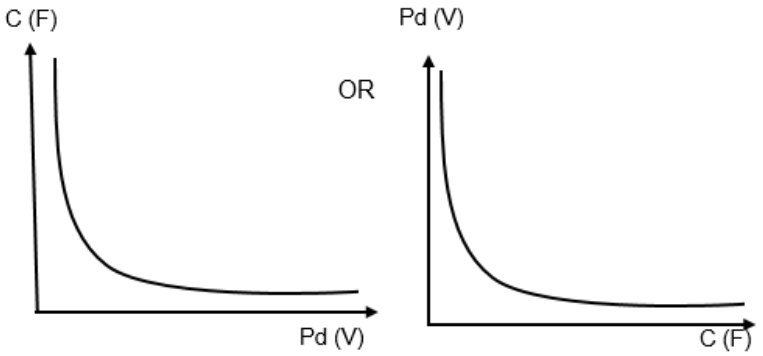
$C = \frac{\kappa\, \varepsilon o\, A}{d}$✓

$= \frac{1 \times 8{,}85 \times 10^{-12} \times 0{,}006}{0{,}001}$ ✓

$= 5{,}31 \times 10^{-11}\ F$✓

$\text{Q} = CV$✓
$= 5{,}31 \times 10^{-11} \times 12$
$= 6{,}4 \times 10^{-10}\ \text{C}$✓ (5)

10.2.3



MARKING CRITERIA	MARKS
Correct labels of the x- and y-axes	1
Graph of inverse proportion shown	1

(2)

10.3 10.3.1 From 1 to 2 (1)

10.3.2 Flemings' right-hand rule:✓ When you hold the thumb, forefinger and middle/second finger of the right hand at right angles to each other,✓ the thumb represents the direction of force (thrust), the forefinger represents the direction of electric current and the second/middle finger represents the direction of magnetic field.✓ (3)

[20]

QUESTION 11: ELECTRICITY AND MAGNETISM: ELECTRIC CIRCUITS

11.1 11.1.1 The rate at which work is done or energy is transformed into an electric circuit (2)

11.1.2 The electric heater✓ as it uses the most electric power according to the equation P = VI.✓ The more power an appliance uses, the more electric current is consumed because P α I.✓ (3)

11.2 11.2.1 Electromotive force or emf

OR

The total energy supplied per coulomb of charge by the chemical reaction occurring in the cell

OR

The total work done by a cell in moving charges through a circuit (1)

11.2.2 The battery has internal resistance✓ and therefore work per coulomb charge must be done by charges to move through the battery.✓ (2)

11.2.3

OPTION 1	OPTION 2
$P = I^2 R$✓ $4 = I^2(5)$ $I = 0,89$ A✓ $V5\Omega = IR$ $= 0,89(5)$ $= 4,47$ V✓ $V_T = V_{II} + V_s$ $10,5 = 4,47 + V_s$ $V_s = 6,03$ V✓ $Is = \frac{V_s}{R_s}$✓ $= \frac{6,03}{3}$ $= 2,01$ A $\varepsilon = IR + Ir$ $12 = 10,5 + 2,01r$ $r = 0,75\ \Omega$✓	$P = \frac{V^2}{R}$✓ $4 = \frac{V^2}{5}$ $V = 4,47$ V✓ $V_T = V_{II} + V_s$ $10,5 = 4.47 + V_s$ $V_s = 6,03$ V✓ $Is = \frac{V_s}{R_s}$✓ $= \frac{6,03}{3}$ $= 2,01$ A✓ $\varepsilon = IR + Ir$ $12 = 10,5 + 2,01r$ $r = 0,75\ \Omega$✓

(6)

11.2.4

OPTION 1	OPTION 2
$V_{II} = IR_{II}$✓ $4,47 = 2,01\ R_{II}$ $R_{II} = 2,22\ \Omega$ $\frac{1}{R_{II}} = \frac{1}{R} + \frac{I}{5}$✓ $\frac{1}{2,22} = \frac{1}{R} + \frac{I}{5}$ $R = 4\Omega$✓	$R = \frac{V_{II}}{I_{of\ R}}$ ✓ I of toy car $= 0,89$ A so I of R $= 1,12$ because Total I $= 2,01$ $R = \frac{4.47}{1,12}$✓ $R = 3,99\ \Omega \approx 4\Omega$✓

(3)

[17]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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