higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
NQF LEVEL 3
(First paper)

21 November 2024

This marking guideline consists of 9 pages.

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SECTION A

QUESTION 1

1.1 Kg m.s^{-2}/kg m/s^2
1.2 Inertia
1.3 Pitch
1.4 Law of Conservation of Mass
1.5 Wheatstone bridge

(5 × 1) **[5]**

QUESTION 2

2.1 E
2.2 A
2.3 F
2.4 C
2.5 B

(5 × 1) **[5]**

QUESTION 3

3.1 True
3.2 True
3.3 True
3.4 False
3.5 True

(5 × 2) **[10]**

QUESTION 4

4.1 B
4.2 B
4.3 D
4.4 C
4.5 D

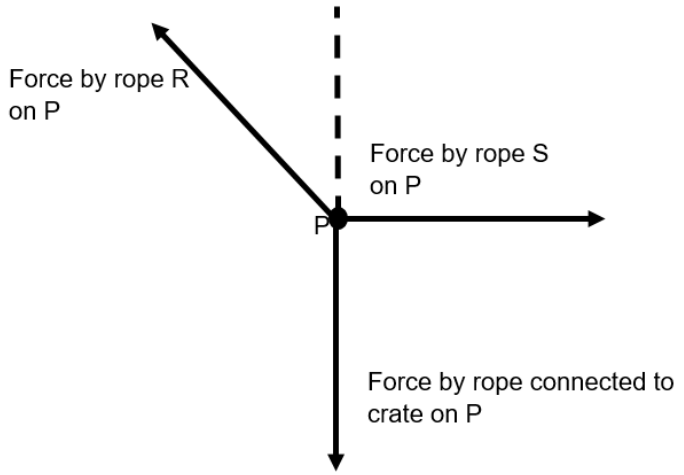
(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5

5.1



Criteria	Mark
Correct representation of force by rope R with an arrow	1
Correct representation of force by rope S with an arrow	1
Correct representation of force connected to crate with an arrow	1

(3)

5.2 5.2.1 $F_S(\text{to the right}) = \text{horizontal component of } F_R(\text{to the left}) = F_R \cos 20^0$ ✓

$= 5\,850 \cos 20^0$ ✓

$= 5\,497{,}2 \text{ N}$ ✓ (3)

5.2.2 W(down) = vertical component of FR (up)

$= F_R \sin 20^0$

$= 2000{,}8 \text{ N}$ ✓

$W = mg$ ✓

$2000{,}8 = m(9{,}8)$ ✓

$M = 205{,}2 \text{ kg}$ ✓ (4)

5.3 Increase (1)

5.4 If the F_R is pulled further to the left, the angle between the rope✓ and the horizontal becomes less than 20° (decrease), therefore the horizontal component and thus FS increase.✓ (2)

[13]

QUESTION 6

6.1 0 $m.s^{-2}$ (1)

6.2 The rate of the change in velocity (2)

6.3 80 $km.h^{-1}$ = 80/3.6 = 22,22 s
25 $km.h^{-1}$ = 6,94 $m.s^{-1}$
$S = ut + \frac{1}{2}at^2$ ✓

OR

$$x = vi\Delta t + \frac{1}{2}\, a\, \Delta t^2$$

Take the relative velocity of train B as zero
Difference in speed = 22,22-6,94

=15,28 $m.s^{-1}$ ✓

Time for Train A to catch up with train B

$$S = ut + \frac{1}{2}at^2$$

OR

$$x = vi\Delta t + \frac{1}{2}\, a\, \Delta t^2$$

$50 = 15{,}28\Delta t + ½\ (-2{,}1)\ \Delta t^2$ ✓

$50 = 15{,}28\ \Delta t\ -1{,}05\ \Delta t^2$

$1{,}05\ \Delta t^2 - 15{,}28\Delta t + 50 = 0$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-15{,}28) \pm \sqrt{(-15{,}28)^2 - 4(1{,}05)(50)}}{2(1{,}05)}$$ ✓

$$= \frac{15{,}28) \pm \sqrt{233{,}48 - 210}}{2{,}1}$$

$$= \frac{15{,}28 \pm \sqrt{233{,}48 - 210}}{2{,}1}$$

$$= \frac{15{,}28 \pm \sqrt{23{,}48}}{2{,}1}$$

$$t = 4{,}97s \ or\ 9{,}58s$$

$t = 4{,}97s$ ✓

The trains will collide at the shortest time. (5)

6.4 The relative speed at which train A will collide with train B

$v_f = v_i + a_{\Delta t}$ ✓

$= 22{,}22 + (-2{,}1)(4{,}97)$ ✓

$= 11{,}78\ m.s^{-1}$ ✓

At the time train A reaches train B, its relative speed is 11,78 $m.s^{-1}$ whilst that of train B is 6,96 $m.s^{-1}$ so the two trains will collide.✓ (4)

[12]

QUESTION 7

7.1 7.1.1 Towards the back of the truck at 10 $km.h^{-1}$. (2)

7.1.2 Towards the front of the truck. (2)

7.1.3 Newton's first law of motion.✓
A body will continue to be at rest, or continue to move at a constant velocity✓ unless a non-zero resultant force acts on it.✓ (3)

7.2 7.2.1 When a resultant force is exerted on an object of mass *m*, it causes the object to accelerate in the direction of the force.✓ The acceleration is directly proportional to the resultant force and inversely proportional to the mass of the object.✓ (2)

7.2.2 $F_{net} = ma$ ✓

$-28 = (4 + 10)a$ ✓

$a = -28/14$

$= -2\ m.s^{-2}$ ✓ (3)

7.2.3 $F_{res}(10kg) = ma$

$= 10 \times (-2)$ ✓

$= -20\ N$ ✓ (2)

7.2.4 Take the force of the 4 kg on the 10 kg block as T to the right.

Then for the 10 kg

$F_{res} = T - 28$ ✓

$-20 = T - 28$ ✓

$T = 8\ N$ ✓ (3)

[17]

QUESTION 8

8.1 The ratio of the force produced by a machine to the force applied to it, used in assessing the performance of a machine (2)

8.2 M = $\frac{load\ length}{effort\ length}$ ✓

$= \frac{20}{5}$ ✓

$= 4$ ✓ (3)

8.3 Greater (1)

8.4 A greater mechanical advantage implies that the angle of the ramp /height is less, making it easier to go up the ramp. (2)
[8]

QUESTION 9

9.1 9.1.1 Longitudinal waves (1)

9.1.2 (a) Compressions
(b) Rarefaction
(c) Wavelength
(d) Amplitude
(4 × 1) (4)

9.2 9.2.1 C
9.2.2 B
(2 × 2) (4)

9.3 $v = f\lambda$✓

= 20 x 17✓

= 340 m.s^{-1}✓ (3)
[12]

QUESTION 10

10.1 10.1.1

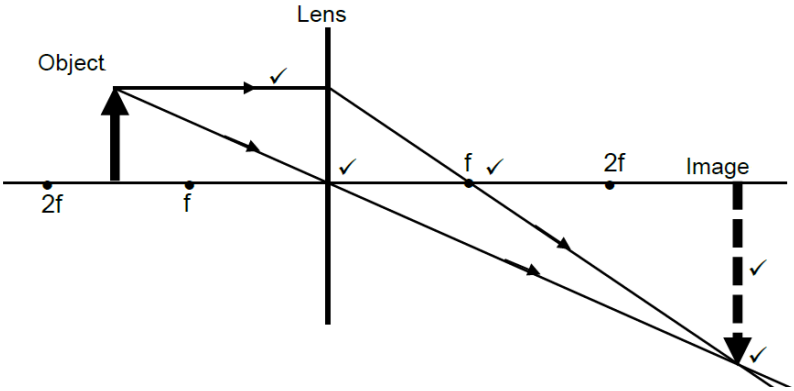
CONVEX LENS	CONCAVE LENS
• The lens is thicker in the middle than at the edges • The surface bulges out at the centre	• The lens in thinner in the middle than at the edges • The outer surface curves in

(Any 2 × 1) (2)

10.1.2 Far-sightedness/hyperopia (hypermetropia) (1)

10.1.3 Convex lens (1)

10.2 10.2.1



Marking criteria	Marks
Ray from object parallel to principle axis drawn or ray from object through f of lens drawn	1
Ray drawn from object through optical centre of lens does not refract	1
Ray from object parallel to principle axis through f after refraction or ray from object through f parallel to principle axis after refraction Ray from object parallel to principle axis through f after refraction or ray from object through f parallel to principle axis after refraction	1
Two rays cross beyond 2f	1
Image indicated by inverted arrow	1

(5)

10.2.2 Focal point (1)

10.2.3 Real (1)

[11]

QUESTION 11

11.1 The induced emf is directly proportional to the rate of the change in magnetic flux linked with the conductor (2)

11.2 The right-hand rule (1)

11.3 From b to a (1)

11.4 As the magnet moves closer to the solenoid, the magnetic flux linkage through the solenoid increases and the emf is induced. (2)

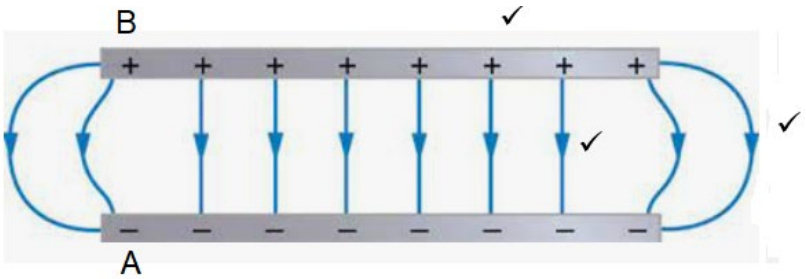
11.5 No (1)

11.6 Inside the coil the magnetic field lines run parallel✓ and there is no change in the magnetic flux linkage as it moves through the inside of the coil.✓ (2)

11.7 South (S) (1)
[10]

QUESTION 12

12.1 12.1.1



Marking criteria	Marks
Field lines move from **B** to **A**	1
Field lines curve at the edges of the plates	1
Field lines are uniform between the plates	1

(3)

12.1.2 $E = \frac{V}{d}$ ✓

$= \frac{2000}{0,1}$

$= 20\ 000\ V.m^{-1}$ ✓

F = Eq ✓

= 20 000 × (3×10^{-8}) ✓

= 6×10^{-4} N ✓ (5)

12.2 12.2.1 A device that can store (energy in the form of) an electric charge. (2)

12.2.2 Dielectric (1)

12.3 12.3.1 An electric field is a region of space in which an electric charge experiences a force. (2)

12.3.2 Q = ne ✓

Q = (3,125 ×10^{10}) (1,6 × 10^{-19})✓

Q = +5 × 10^{-9} C✓ (3)

12.3.3 E = $\frac{KQ}{r^2}$ ✓

E = $\frac{(9\ x\ 10^{9})\ (5\ x\ 10^{-9})}{0{,}8^2}$ ✓

E = 70,31 N·C-1 away from the charge ✓ (3)

12.3.4 Greater than (1)

12.3.5 The electric field at a point due to a point charge is inversely proportional to the square of the distance between the point and the charge, $\mathrm{E}\ \alpha\ \frac{Q}{r^2}$ ✓✓ (2)

[22]

QUESTION 13

13.1 Current. (The variable on the vertical axis) (1)

13.2 The potential difference across a conductor is directly proportional to the current, provided the temperature remains constant.

OR

The current in a conductor is directly proportional to the potential difference across it, provided the temperature remains constant. (2)

13.3 (4,9; 6,4) (2)

13.4 The temperature of the conductor increases at high currents, increasing resistance. (2)

13.5 Gradient = $\frac{\Delta y}{\Delta x}$ ✓

= $\frac{6{,}4-0}{4-0}$ ✓

= 1, 6 ✓ (3)

[10]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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