higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ENGINEERING SCIENCE N2

29 July 2021

This marking guideline consists of 7 pages.

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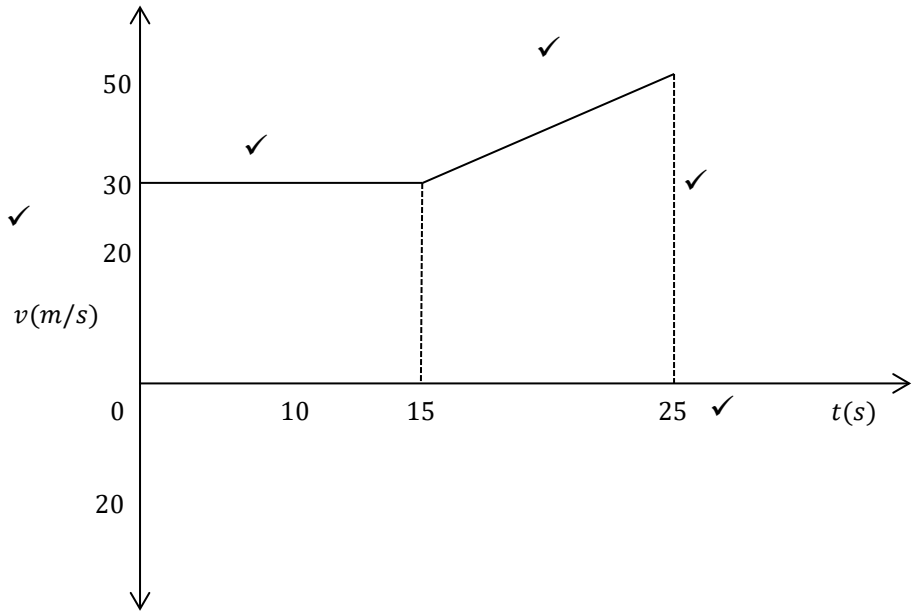
QUESTION 1

1.1 1.1.1 Straight distance from starting point to end point

1.1.2 Rate of velocity change

(2 × 1) (2)

1.2 1.2.1



(5)

1.2.2 $a = \frac{v_{15s-25s}}{t_{15s-25s}}$

$= \frac{50-30}{25-15}$✓

$= 2\ m/s^2$✓ (2)

1.2.3 $S_{0-25s} = L \times B + L \times B + \frac{1}{2}bh$

$= (15)(30)$✓ $+ (10 \times 30)$✓ $+ \frac{1}{2}(10)(20)$✓

$= 850\ m$✓ (4)

1.2.4 $v_{0-25s} = \frac{S_{0-25s}}{t_{0-25s}}$

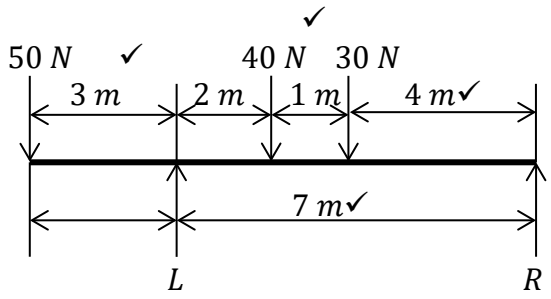
$= \frac{850}{25}$✓

$= 34\ m/s$✓ (2)

[15]

QUESTION 2

2.1



(4)

2.2 Take moments about L:

$$\sum \curvearrowleft F = \sum \curvearrowright F$$
$$(40 \times 2) + (30 \times 3) = (R \times 7) + (50 \times 3)\checkmark\checkmark$$
$$R = 2,857\ N\checkmark$$

Take moments about R:

$$\sum \curvearrowleft F = \sum \curvearrowright F$$
$$(L \times 7) = (30 \times 4) + (40 \times 5) + (50 \times 10)\checkmark\checkmark$$
$$L = 117,143\ N\checkmark$$

(6)

[10]

QUESTION 3

3.1 Energy object or body✓ possesses or has as result of its position✓ (2)

3.2 3.2.1

$$E_P = mgh$$
$$= (5 \times 9,8 \times 8\checkmark$$
$$= 392\ J\checkmark$$

(2)

3.2.2

$$v^2 = u^2 + 2gs$$
$$= (0)^2 + 2(9,8)(2)$$
$$= 6,261\ m/s\checkmark$$

$$E_{K(B)} = \frac{1}{2}mv^2$$
$$= \frac{1}{2}(5)(6,261)^2\checkmark$$
$$= 98\ J\checkmark$$

OR

$$E_P = mgh$$
= 5 x 9.8 x (8 – 2)
= 294 J✓

$$E_P\ @\ 8m - E_P\ @\ 6m = 392 - 294\checkmark$$
$$= 98J\checkmark$$

(3)

[7]

QUESTION 4

4.1 It is the ability to do work (1)

4.2 4.2.1

$$W_C = 20 \times 30$$
$$= 600\text{N}\checkmark$$

$$W_D = \frac{1}{2}bh + L \times B$$
$$= \frac{1}{2}(30)(600)\checkmark + (30 \times 5\,000)\checkmark$$
$$= 159\,000\,J\ OR\ 159\,KJ\checkmark$$

OR

$$W_D = F_{AVE} \times s$$
$$= \frac{5\,000+5\,600\checkmark}{2} \times 30\checkmark$$
$$= 159\,000\,J\ OR\ 159\,KJ\checkmark$$ (4)

4.2.2

$$P = \frac{W}{t}$$
$$= \frac{159\,000}{300}\checkmark\checkmark$$
$$= 530\,W\checkmark$$ (3)

4.3

$$F_{UP} = F_{\parallel} = mgSin\theta$$
$$= 40 \times 9{,}8 \times Sin20°\checkmark$$
$$= 134{,}072\,N\checkmark$$ (2)

[10]

QUESTION 5

5.1 5.1.1

$$N_A T_A = N_B T_B$$
$$750 \times 25 = N_B \times 50\checkmark$$
$$N_B = 375\,r/min\checkmark$$ (2)

5.1.2

$$VR = \frac{N_A}{N_B}$$
$$= \frac{750}{375}\checkmark$$
$$= 2:1\checkmark$$ (2)

5.2
- Differential wheel and axle lifting device
- Differential winch
- Weston differential pulley

(Any 2 × 1) (2)

5.3 5.3.1

$$MA = \frac{LOAD}{EFFORT}$$
$$= \frac{0{,}8 \times 9{,}8}{0{,}06 \times 9{,}8}\checkmark$$
$$= 13,33\checkmark$$ (2)

5.3.2 $VR = \frac{effort\ dist}{load\ dist}$

$effort\ dist = VR \times \frac{\pi(d_1 - d_2)}{2}$✓
$effort\ dist = 20 \times \frac{\pi(300-240)}{2}$✓ = 1884.956mm✓ (3)

5.3.3 $\eta = \frac{MA}{VR} \times 100\%$
$= \frac{13,33}{20} \times 100\%$✓
$= 66.67\%$ (2)

5.4 5.4.1 $v = \pi DN$
$= \pi \times 0,3 \times 50$✓
$= 47,124\ m/s$ ✓ (2)

5.4.2 $P = (T_1 - T_2)V$
$P = (5 \times 500 - 500)47.124$ ✓
$T_1 = 94.248kW$✓ (2)
[17]

QUESTION 6

6.1.1 $F_{\parallel} = mgSin\theta$
$= 75 \times 9,8Sin40°$✓
$= 472,449\ N$✓ (2)

6.1.2 $F_{\perp} = mgCos\theta$
$= 75 \times 9,8Cos40°$✓
$= 563,043\ N$✓

$\mu = \frac{F_{\mu}}{F_N}$
$0,4 = \frac{F_{\mu}}{563,043}$✓
$F_{\mu} = 225,217\ N$✓

$F_{APP} = F_{\parallel} + F_{\mu}$
$= 472,449 + 225,217$✓
$= 697,666\ N$✓ (6)

6.2 $Pressure = P_a + \rho gh$
$Pressure = 101.3 + 1 \times 9,8 \times 5$✓ (2)
$Pressure = 150.35KPa$✓ **[10]**

QUESTION 7

7.1 Bimetal strips used to operate thermostat (1)

7.2 $\Delta l = l_o \,.\alpha\,.\Delta t$
$\alpha = 0.007245/(5 \times (89 - 26)$✓
$= 23 \times 10^{-6}$ /°C✓

Metal of the bar is Aluminium✓ (3)

7.3 7.3.1 Amount of heat energy required to raise temperature of 1 kg (unit of mass) of substance by1 degree Celsius

7.3.2 Heat which causes no change in temperature/Heat during change of phase between water and steam

7.2.3 Heat causing rise in temperature applicable to a single phase which may be ice, water and dry steam.

(3 × 2) (6)
[10]

QUESTION 8

8.1 Pure substance that cannot be broken down into simpler substance by chemical methods (2)

8.2
- Copper
- Sodium
- Fluorine

(Any 2 × 1) (2)

8.3
- Water
- Sodium chloride
- Ammonia

(Any 2 × 1) (2)

8.4
- Positive ions
- Negative ion

(2)
[8]

QUESTION 9

9.1 They are indirectly or inversely proportional to each other (2)

9.2
- It causes the brushes of motors to spark
- Eddy currents produced cause heat
- Electronic apparatus can be damaged by lightning at a distance
- May cause malfunctioning of electronic apparatus (3)

9.3 9.3.1
$$R_T = R_1 + \frac{R_2 \times R_3}{R_2 \times R_3}$$
$$= 3 + \frac{6 \times 4}{6+4} \checkmark\checkmark$$
$$= 5{,}4\ \Omega \checkmark$$ (3)

9.3.2
$$I_T = \frac{V_T}{R_T}$$
$$= \frac{12}{5{,}4} \checkmark$$
$$= 2{,}222\ A \checkmark$$ (2)

9.3.3
$$V_{\parallel} = I_T R_{\parallel}$$
$$= 2{,}222 \times 2{,}4$$
$$= 5{,}333\ V \checkmark$$

$$I_{6\Omega} = \frac{V_{\parallel}}{R_2}$$
$$= \frac{5{,}333}{6} \checkmark$$
$$= 0{,}889\ A \checkmark$$ (3)

[13]

TOTAL: 100

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