MARKING GUIDELINE

NATIONAL CERTIFICATE
AUGUST EXAMINATION
ENGINEERING SCIENCE N1

26 JULY 2012

This marking guideline consists of 8 pages.


MARKING GUIDELINE

\( \checkmark = 1 \text{ mark} \)
\( \checkmark \checkmark / \checkmark = \frac{1}{2} \text{ mark} \)

QUESTION 1:

1.1 Rate of change \( \sqrt{\ } \) of displacement. \( \sqrt{\ } \)

1.2
1.2.1 False \( \checkmark \)
1.2.2 False \( \checkmark \)
1.2.3 True \( \checkmark \)
1.2.4 True \( \checkmark \)

1.3

\[
\begin{align*}
\text{Graph:} & \\
\text{Distance (m)}: & 1000, 900, 800, 700, 600, 500, 400, 300, 200, 100 & \\
\text{Time (s)}: & 5, 4, 3, 2, 1, 0 & \\
\end{align*}
\]

1.3.1 \( m = \frac{\Delta y}{\Delta x} \)
\( m = \frac{1000}{5} \checkmark \)
\( m = 200 \checkmark \)

or

\( m = \frac{1000 - 800}{5} \checkmark \)
\( m = \frac{3 - 4\sqrt{2}}{5} \checkmark \)

1.3.2 From the graph:
\( v = \frac{\Delta s}{\Delta t} \)

1.3.3
\( v = \frac{1000}{5} \checkmark \)
\( v = \frac{200}{s} \checkmark \)

From the graph:
3,25 seconds \( \checkmark \)

1.4.1 75 m \( \checkmark \)
1.4.2 585 m \( \checkmark \)

1.5. The weight of a body is \textbf{the force} \( \checkmark \) by which the \textbf{earth attracts} \( \checkmark \) it.
The amount of \textbf{matter} \( \checkmark \) a body \textbf{consist of} \( \checkmark \).
QUESTION 2:

2.1 2.1.1 The force that will hold a system of forces in balance. ✓

2.1.2 The sum of the clockwise moments ✓ is equal to the sum of the anti-clockwise moments. ✓

2.1.3 Ratio between the distance the moved by the effort ✓ and the distance moved by the load ✓.

(3)

2.2

Drawing ✓
Equilibrant ✓
Angle ✓

2.3 2.3.1

\[ MA = \frac{\text{Load}}{\text{Effort}} \]
\[ MA = \frac{200 \times 9.8}{100} \]
\[ MA = 19.6 \] ✓

(2)

2.3.2 \[ VR = \text{Ropes supporting movable pulley} \] ✓

\[ VR = 4 \] ✓

(2)

2.4 Torque wrench ✓

2.5 \[ T = F \times r \]
\[ T = 55 \times 0.85 \] ✓
\[ T = 46.75 \text{N.m} \]

(2)

2.6

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QUESTION 3

3.1 An amount of work is done when a force of 1N moves through a distance of 1 metre.

3.2

\[ W = \text{area of rectangle} \]
\[ W = 4900 \times 12.6 \, \checkmark \]
\[ W = 61740 \, \text{J or} \, 61.74 \, \text{kJ} \, \checkmark \]

3.3 Gegee:
\[ v = 90 \, \text{km/h} \, (25 \, \text{m/s}) \]
\[ P = 35 \, \text{kW} \, (35 \, 000 \, \text{W}) \]

3.3.1
\[ v = \frac{90}{3.6} = \frac{25m}{s} \]

3.3.2
\[ P = F \times v \]
\[ F = \frac{P}{v} \sqrt{2} \]
\[ F = \frac{35 \, 000}{25 \sqrt{2}} \]
\[ F = 1400 \, \text{N} \, \checkmark \]
3.3.3 \[ p = \frac{w}{t} \]
\[ W = Pt \]
\[ W = 35000 \times 150 \]
\[ W = 5250000 \]
\[ W = 525MJ \]

3.4 The rate at which work is done \( \sqrt{\text{Arbeidstempo}} \)

QUESTION 4:

4.1 4.1.1 A: Thermometer \( \sqrt{\} \)
4.1.2 B: Thermo Coupling \( \sqrt{\} \)
4.1.3 C: Pyrometer \( \sqrt{\} \)

4.2 COMPARE | MERCURY | COLOURED ALCOHOL
--- | --- | ---
Transparant | 4.2.1: NO \( \sqrt{\} \) | 4.2.2: YES \( \sqrt{\} \)
Sticks to glass | 4.2.3: NO \( \sqrt{\} \) | 4.2.4: YES \( \sqrt{\} \)
Uniform expansion | 4.2.5: YES \( \sqrt{\} \) | 4.2.6: NO \( \sqrt{\} \)

4.3 Temperatures changes \( \sqrt{\} \)
Colour changes \( \sqrt{\} \)
Volume changes \( \sqrt{\} \)
Change of phases \( \sqrt{\} \)
Change of resistance \( \sqrt{\} \)

4.4 Given:
\( Q = 58500 \text{ J} \)
\( m = 2 \text{ kg} \)
\( t_o = 20^\circ \text{C} \)
\( c = 390 \text{ J/kg }^\circ \text{C} \)

4.4.1 \[ Q = mc \Delta t \]
\[ \Delta t = \frac{Q}{mc} \]
\[ \Delta t = \frac{58500}{2 \times 390} \]
\[ \Delta t = 75^\circ \text{C} \]

4.4.2 \[ \Delta t = t_f - t_o \]
\[ t_f = \Delta t + t_o \]
\[ t_f = 75 + 20 \]
\[ t_f = 95^\circ \text{C} \]
4.5 Irons ✓
    Stoves ✓
    Air conditioners ✓
    Heater ✓
    Hair Dryer ✓

ANY TWO (2)

4.6 Given: Gegee:
    \( l_o = 4m \)
    \( \Delta l = 5.5\text{mm} \) (0.0055m)
    \( t_o = 10^\circ\text{C} \)
    \( t_f = 95^\circ\text{C} \)

\[
    l_f = l_o + \Delta l \sqrt{\frac{t_f}{t_o}}
\]
\[
    l_f = 4 + 0.0055 \sqrt{\frac{95}{10}}
\]
\[
    l_f = \frac{4.0055m}{4005.5\text{mm}} \checkmark
\]

(2)

4.7 Heat capacity: whole body temperature increase with 1°C ✓
    Specific heat capacity: every 1kg of body increase with 1°C ✓

(2) [18]

QUESTION 5 / VRAAG 5:

5.1 Solid: Particles moves very little. ✓
    Liquid: Particles moves more than in a solid. ✓
    Gas: Particles moves very fast. ✓

(3)

5.2 5.2.1 Melting (Fusion) ✓
    5.2.2 Condensation ✓
    5.2.3 Solidification ✓

(3)

5.3 5.3.1 Smallest part of an element ✓ that will still have the unique properties ✓ of the element.

5.3.2 Smallest part of a compound (matter) ✓ that will still have the unique properties ✓ of the compound.

(2)

5.4 5.4.1 Electron – negative ✓
    5.4.2 Proton – positive ✓
    5.4.3 Nucleus – positive ✓
    5.4.4 Neutron – neutral ✓

(4) [12]
QUESTION 6:

6.1 6.1.1 The difference in electrical pressure $\sqrt{}$ between the negative and positive poles $\sqrt{}$. (1)

In a direct current circuit the current that flows in the circuit is directly proportional to the potential difference $\sqrt{}$ and indirectly proportional to the resistance $\sqrt{}$ of the circuit. (1)

6.1.3 The resistance measured between two opposite areas $\sqrt{}$ of 1 cubic of the material $\sqrt{}$ at a specific temperature. (1)

6.2 6.2.1 $\sqrt{}$ (½)

6.2.2 $\Delta$ $\sqrt{}$ (½)

6.2.3 $\frac{1}{|\Delta|}$ $\sqrt{}$ (½)

6.2.4 $\frac{V}{\sqrt{}}$ (½)

6.3 6.3.1 Battery, Generator / Alternator (DC / GS), Dynamo $\sqrt{}$ (1)
6.3.2 Generator / Alternator (AC / WS) $\sqrt{}$ (1)

6.4

\[ R = \frac{V}{I} \]
\[ R = \frac{120}{220} \sqrt{} \]
\[ R = 1000 \_ \sqrt{} \]

(2)

6.5 An electrical circuit consists of three resistors connected in series. The values of the resistors are as follows: 13 $\Omega$, 28 $\Omega$ and 136 $\Omega$.

6.5 6.5.1

$\sqrt{}$ (2)

6.5.2

\[ R_t = R_1 + R_2 + R_3 \]
\[ R_t = 13 + 28 + 136 \_ \sqrt{} \]
\[ R_t = 177 \_ \sqrt{} \]

(2)

6.5.3

\[ I = \frac{V}{R} \]
\[ I = \frac{24}{177} \sqrt{} \]
\[ I = 0.136 A \_ \sqrt{} \]

(2)
6.6 **Different metals** √ have **different resistance** √ to the flow of electricity. (1)

6.7 No effect, no increase or decrease in resistance. √ (1)

6.8 -Current √
-Resistance √
-Time

(Any TWO) (1)

6.9 6.9.1 \[ P = V \times I \]
\[ I = \frac{P}{V} \]
\[ I = \frac{100}{220} \checkmark \]
\[ I = 0.455 \, A \, \checkmark \] (2)

6.9.2 \[ R = \frac{V}{I} \]
\[ R = \frac{220}{0.455} \checkmark \]
\[ R = 483.516 \, \Omega \, \checkmark \] (2)

6.10

One mark each for the following:
- PRIMARY CIRCUIT √
- SECONDARY CIRCUIT √
- RELAY SWITCH √
- OVERALL DRAWING √

TOTAL: 100