



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N2

1 AUGUST 2018

This marking guideline consists of 8 pages.

QUESTION 1: CONDUCTORS AND CABLES

- 1.1
- Open (in free air)
 - In ducts
 - Buried (underground)
- (3)
- 1.2
- 1.2.1 False
- 1.2.2 False
- (2 × 1) (2)
- 1.3
- $$P = VL \times IL \times \cos\theta$$
- $$I = P/(VL \times \cos\theta)$$
- $$= 15 \times 1\,000/(220 \times 0,9)✓$$
- $$= 75,758\text{ A}✓$$
- (2)
- 1.4
- It is the maximum voltage drop allowed in a circuit between the supply point and the socket outlet.✓ It is regulated at 5% of the supply voltage.✓
- (2)
- 1.5
- Permissible voltage drop = 5% × voltage supply
- $$= 5\% \times 220$$
- $$= 11✓$$
- Minimum = 220 – 11
- $$= 209\text{ V}✓$$
- (2)
- [11]**

QUESTION 2: SWITCHGEAR, CONTACTORS AND RELAYS

- 2.1
- Ensure the two ends to be joined are isolated.
 - Make off-ends to the correct length leaving several strands of armouring uncut.
 - Strip the insulation as far back as required.
 - Join the conductors by means of crimping ferrules.
 - Join the strands of armouring which were left uncut to ensure earth continuity.
 - Insert the spacers supplied between the conductors and armouring strands.
 - Roughen the ends of the PVC sleeve.
 - Cut the ends of the plastic joint box off to the correct cable diameter.
 - Clip the joint box around the joint and seal the ends by taping them up with adhesive tape supplied.
 - Mix resin carefully to avoid bubbles and pour it carefully into the joint box.
 - Allow resin to set.
- (Any 6 × 1) (6)

2.2

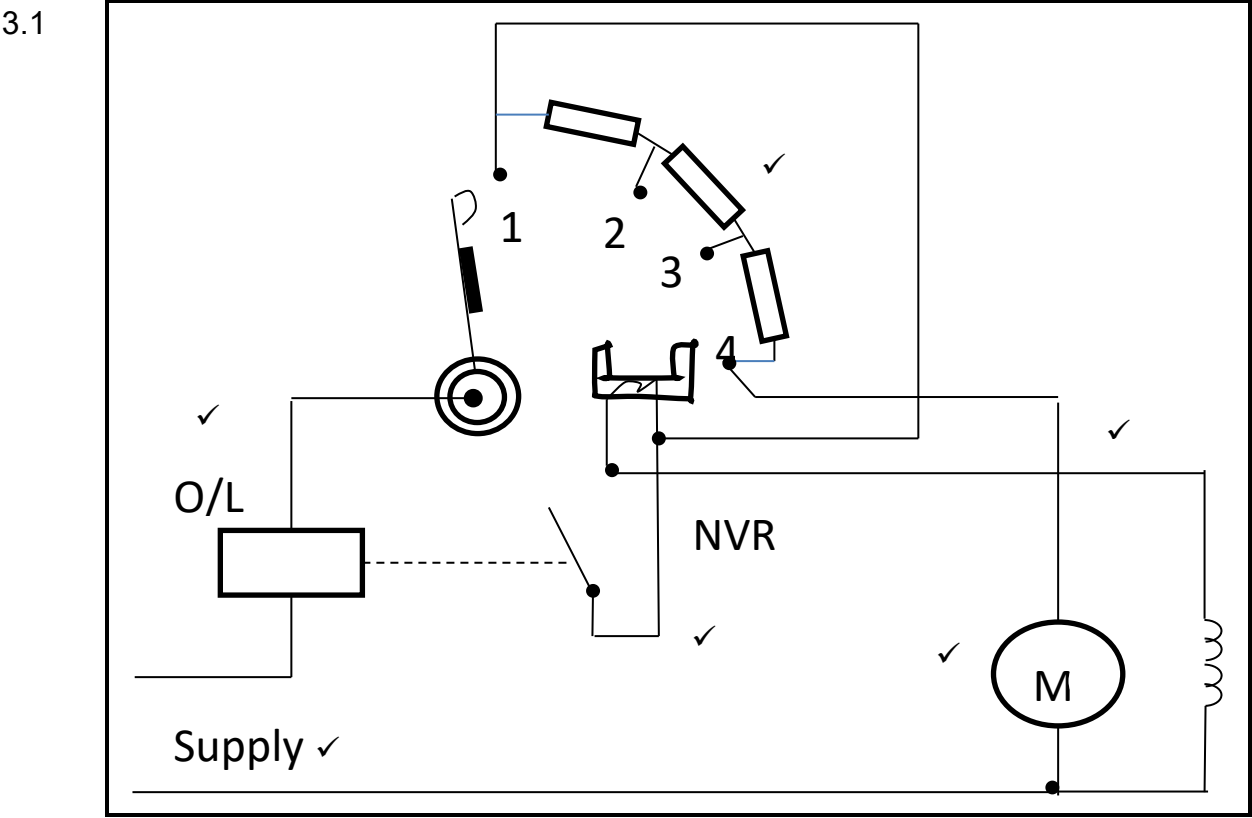
COMPARISON	DISCONNECTORS	RELAYS	CONTACTORS
2.2.1 Operation	Switched manually✓	By means of a coil (solenoid) and can be operated remotely✓	By means of a coil (solenoid) and can be operated remotely✓
2.2.2 Function	To open contactors wide enough to isolate a circuit✓	To open and close contacts in order to open or close a circuit✓	To open and close contacts in order to open or close a circuit✓

(3)

(3)

[12]

QUESTION 3: DC MOTORS AND STARTERS

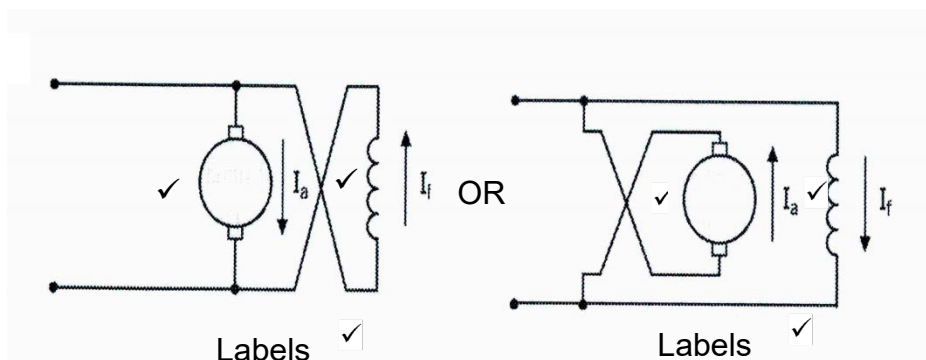


NB. Use the table below for mark allocation

Correctness of drawing	3
Any 3 Labels	3
TOTAL	6

(6)

3.2



NB. Use the table below for mark allocation

Correctness of drawing	2
(Labels = $2 \times \frac{1}{2}$)	1
TOTAL	3

(3)

3.3 The shunt and series fields of a cumulatively compounded motor are connected in such a way that they assist each other ✓ whereas in a differentially compounded motor, they are connected in such a way that they oppose each other. ✓

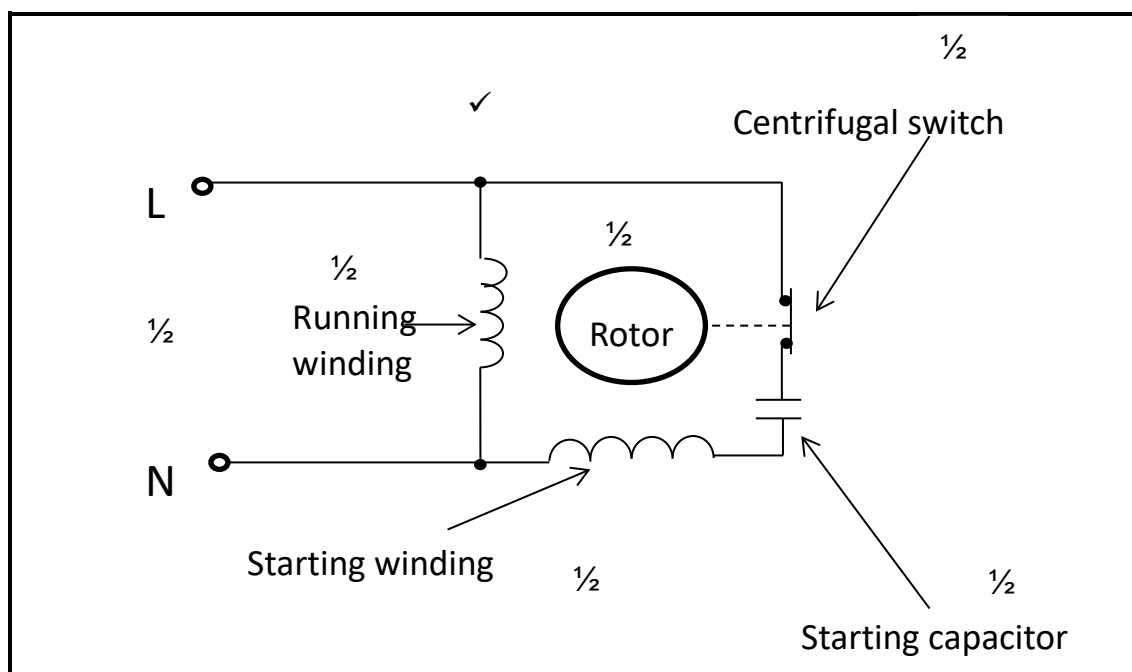
(2)

3.4 It has a low starting torque. ✓

(1)

[12]**QUESTION 4: AC MOTORS AND STARTERS**

4.1



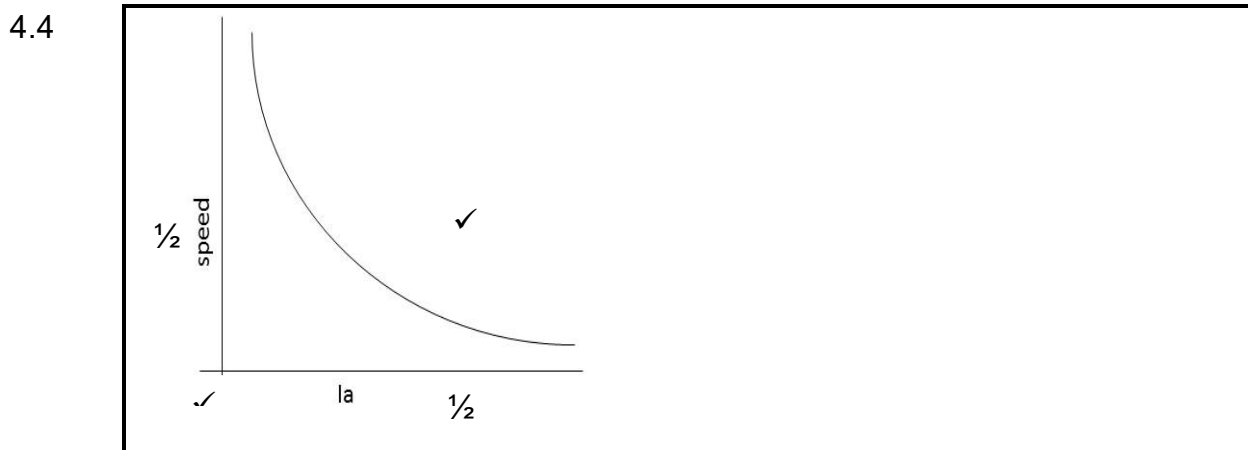
NB. Use the table below for mark allocation

Correctness of drawing	1
(Labelling = $6 \times \frac{1}{2}$)	3
TOTAL	4

(4)

- 4.2
- Wound rotor
 - Squirrel-cage rotor
- (2)

- 4.3 A squirrel-cage rotor is the rotating part (rotor) used in the most common form of an AC induction motor. ✓ It consists of a cylinder of steel with aluminium or copper conductors embedded in its surface. ✓
- (2)



NB. Use the table below for mark allocation

Construction of Axes = $(2 \times 1/2)$	1
Labelling of axes = $(2 \times 1/2)$	1
(Curve)	1
TOTAL	3

(3)

- 4.5
- 4.5.1
- The time delay must be shortened according to the size of the overload: no time delay for a short circuit.
 - Very little time delay if the rotor is locked. The more overload, the less time delay
- 4.5.2
- The tripping value must be about 20% above the motor full-load current rating.

(2 × 2) (4)

[15]

QUESTION 5: EARTHING

- 5.1 Earthed is connected to the general mass of earth as to ensure ✓, at all times, an immediate discharge of electrical energy ✓ without danger. ✓
- (3)

- 5.2
- 5.2.1 False
- 5.2.2 True
- 5.2.3 False
- 5.2.4 True

(4 × 1) (4)

- 5.3 An earth conductor coming from the earth terminal in the distribution board ✓ is connected to the stove. ✓ From the distribution board the earth continuity conductor goes to the earth electrode. ✓
- (3)

- 5.4 The aim of bonding is to bring all the bonded parts ✓ to the same electrical potential. ✓

OR

Bonding is the connecting of all exposed conductive parts ✓ by means of a conductor with at least a cross-sectional area of 2,5 mm² of copper. ✓ (2)
[12]

QUESTION 6: PROTECTION

- 6.1
- Two dissimilar metals are welded together.
 - One end is secured while the other end is free to move.
 - The trip contacts are connected to the free end. (3)
- 6.2 A voltage surge ✓ far above the rated voltage ✓ will activate the protection. (2)
- 6.3 The earth- leakage relay must be as close as possible to the supply point of the circuit, ✓ normally directly after ✓ the consumer's disconnector. ✓ (3)
- 6.4 Its purpose is to isolate the circuit from the supply ✓ as soon as a dangerous earth-fault current is detected. ✓ (2)
[10]

QUESTION 7: MEASURING INSTRUMENTS

- 7.1 A frequency meter is used to measure the number of cycles ✓ produced per second ✓ by an alternating-current supply. (2)
- 7.2
- 7.2.1 No
It should be connected in parallel with the source (2 × 1/2) (1)
- 7.2.2 No
It should be connected in series with the source (2 × 1/2) (1)
- 7.3 The product of power and time (energy) are determined when a disc connected to a metering unit, is rotated through a magnetic field. ✓ The speed of rotation is proportional to the power consumed. ✓ (2)
[6]

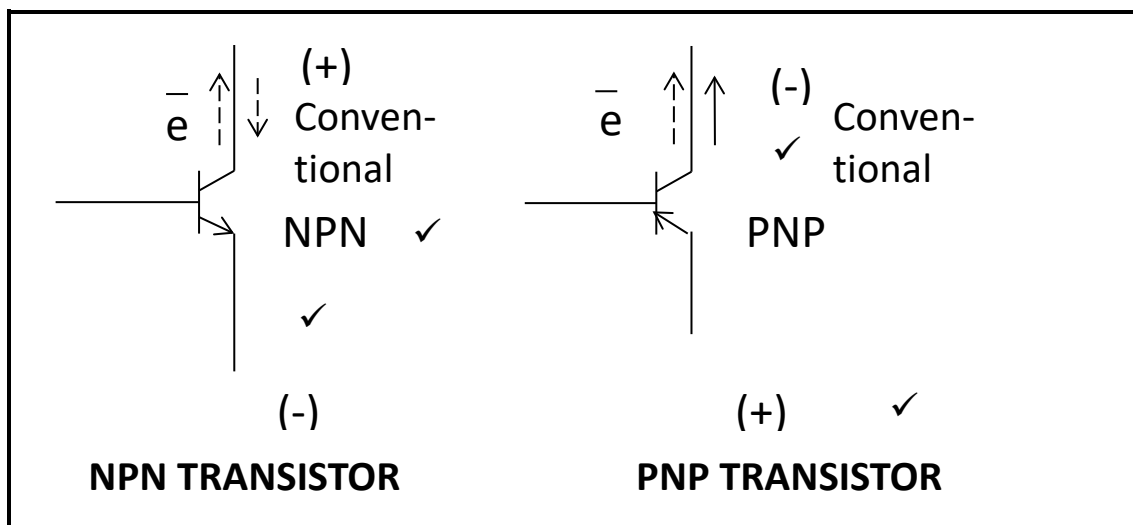
QUESTION 8: TRANSFORMERS

- 8.1 8.1.1 $V_{PH2} = V_{L2} / \sqrt{3}$
 $= 380 / \sqrt{3}$
 $= 219,393 \text{ V} \checkmark$ (1)
- 8.1.2 $\eta = p_2/p_1 \checkmark$
 $P_1 = 500 \times 1\,000/0,96$
 $= 520,833 \text{ kW} \checkmark$
 $P_1 = \sqrt{3} \times V_L \times I_L \times \cos \theta \checkmark$
 $I_L = 520,833 \times 1\,000 / (\sqrt{3} \times 11\,000 \times 0,9)$
 $I_L = 30,374 \text{ A} \checkmark$ (4)
- 8.2 They are used to compensate for the voltage drop at the consumers point,
 \checkmark when there is a high demand for electricity. \checkmark (2)
- 8.3 8.3.1 $V_1/V_2 = N_1/N_2$
 $240/16 = 800/N_2$
 $\therefore \text{Number of secondary turns} = 54 \checkmark$ (1)
- 8.3.2 $V_1/V_2 = I_2/I_1$
 $240/16 = 8/I_1$
 $\therefore \text{Primary current} = 0,533 \text{ amperes} \checkmark$ (1)
- 8.3.3 $N_1 : N_2$
 $800 : 54$
 $14,8 : 1$ is the turns ratio \checkmark
 Also accept $15 : 1$ (1)
- 8.3.4 Voltage per turn
 $800 : 240 \checkmark$
 $3,33 : 1$
 $\therefore \text{Voltage per turn is } 3,33 \text{ volts} \checkmark$ (2)

[12]

QUESTION 9: ELECTRONICS

9.1

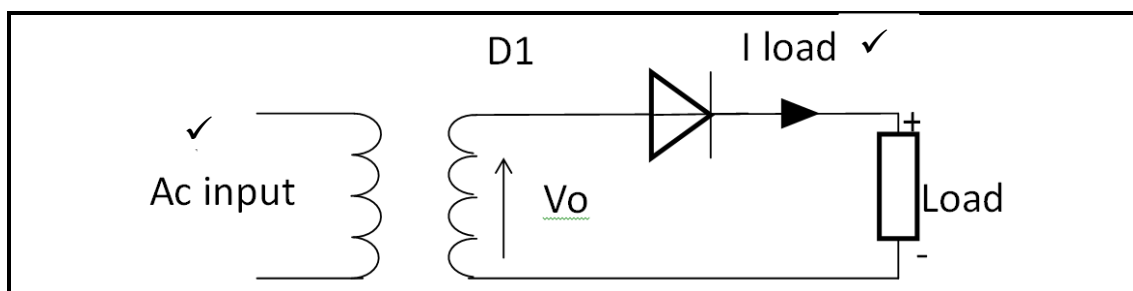


NB. Use the table below for mark allocation

Correctness of Drawings	2
Labelling	2
TOTAL	4

(4)

9.2



NB. Use the table below for mark allocation

Correctness of Drawings	1
Labelling	1
TOTAL	2

(2)

9.3 Continuous rating refers to the continuous maximum steady current that a diode can conduct without exceeding a safe allowable temperature. (2)

9.4 A thyristor requires a trigger pulse to start conducting and a thyristor only conducts current in one direction. With a control circuit a thyristor can be triggered at accurate values to start conducting. By controlling the firing angle at which a thyristor is triggered, load control can be achieved. (2)

[10]**TOTAL: 100**