PERFECT GAS

$$PV = mRT$$

P= PRESSURE
V= VOLUME
m= NO_OF MOLECULES
R= CONSTANT (8.314 J/mol K)(SPECIFIC GAS CONSTANT)
T= TEMPERATURE

IDEAL GAS

IT IS SIMPLIFIED AS REAL GAS WITH COMPRESSIBILITY IS SET TO 1.

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COMPRESSIBILITY

Q13 DESCRIBE IDEAL AND PERFECT GAS MODEL.

THE EQUATION $PV = mRT$ IS STATED FOR AN IDEAL (OR) PERFECT GAS

THE IDEAL GAS LAW APPLIES WITHOUT RESTRICTIONS ON THE SPECIFIC HEAT. THE COMPRESSIBILITY FACTOR Z IS SET TO 1.

Q14 DESCRIBE THE REAL GAS EFFECT.

- COMPRESSIBILITY EFFECTS (Z ALLOWED TO VARY FROM 1.0
- VARIABLE HEAT CAPACITY (SPECIFIC HEAT VARY WITH TEMPERATURE)
- VAN DER WAAL FORCE (RELATED TO COMPRESSIBILITY, CAN SUBSTITUTE OTHER EQUATIONS OF STATE.
- NON EQUILIBRIUM THERMODYNAMICS EFFECTS
- ISSUES WITH MOLECULAR DISSOCIATION AND ELEMENTARY REACTION WITH VARIABLE COMPOSITION.

BOYLE'S LAW

CHARLE'S LAW

AVOGRADO'S

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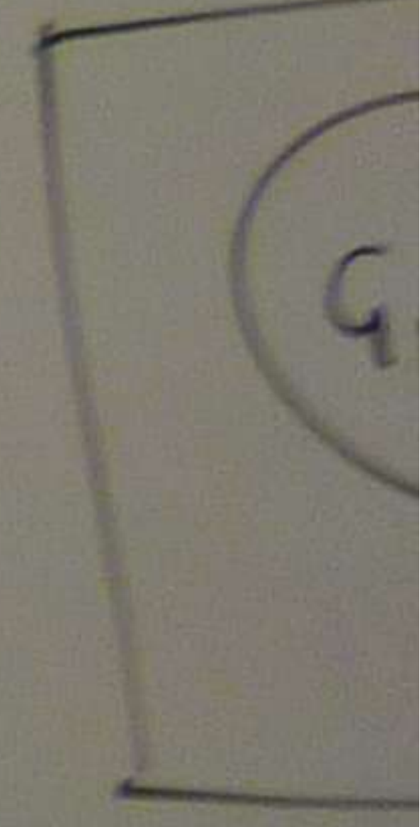

P_T

IN THIS BUILDING

Q13 DESCRIBE IDEAL AND PERFECT GAS MODEL.

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BOYLE'S LAW $P.V = \text{CONSTANT}$

CHARLE'S LAW $\frac{V}{T} = \text{CONSTANT}$

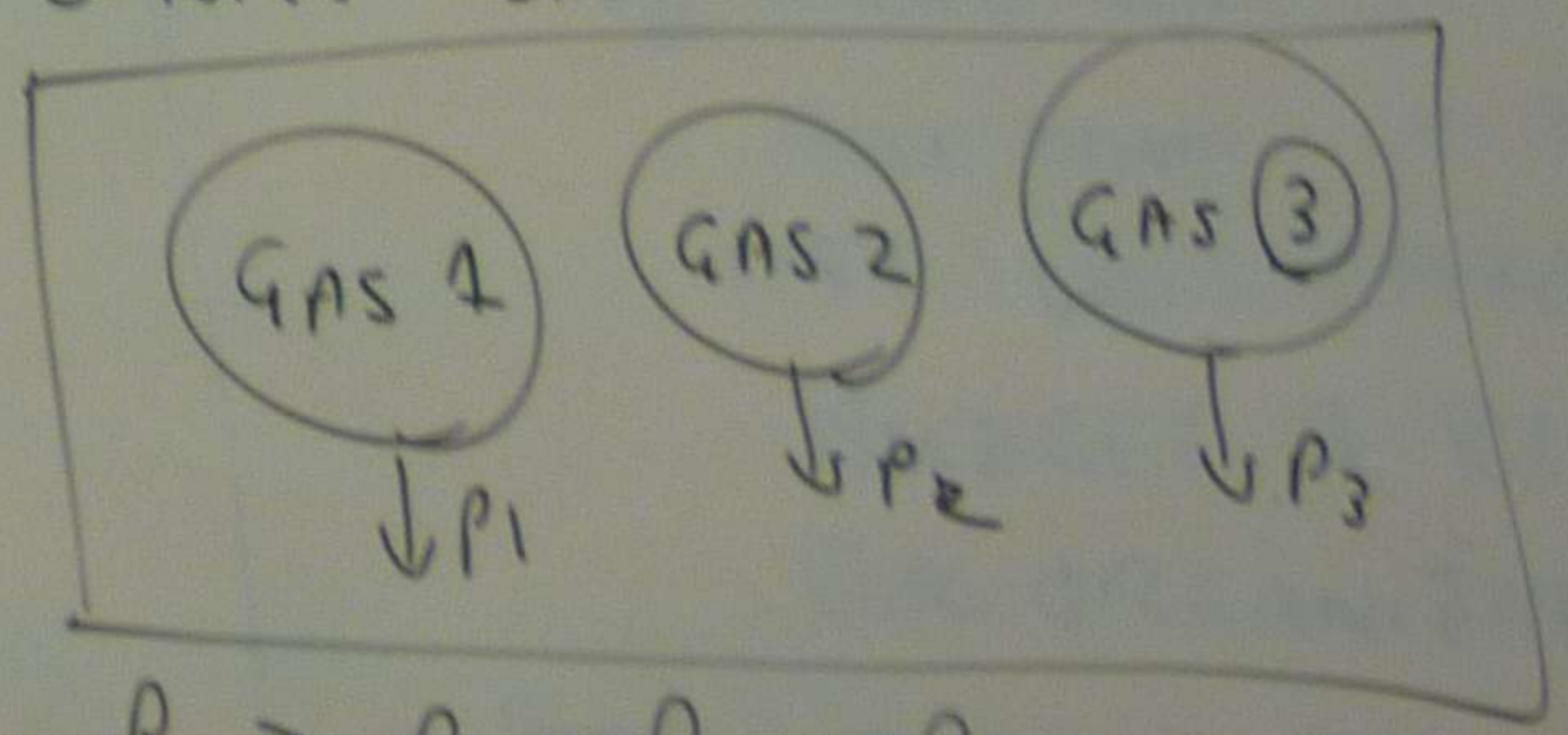
AVOGRADO'S LAW

Q15 WRITE AVAGRADO'S LAW.

"EQUAL VOLUME OF PURE GASES CONTAIN THE SAME NUMBER OF PARTICLES".

$$\frac{V}{n} = \frac{RT}{P}$$ CONSTANT LAW.

Q16 WRITE DALTON'S LAW.



$$P_T = P_1 + P_2 + P_3$$

= CONSTANT

CONSTANT

RADO'S LAW.

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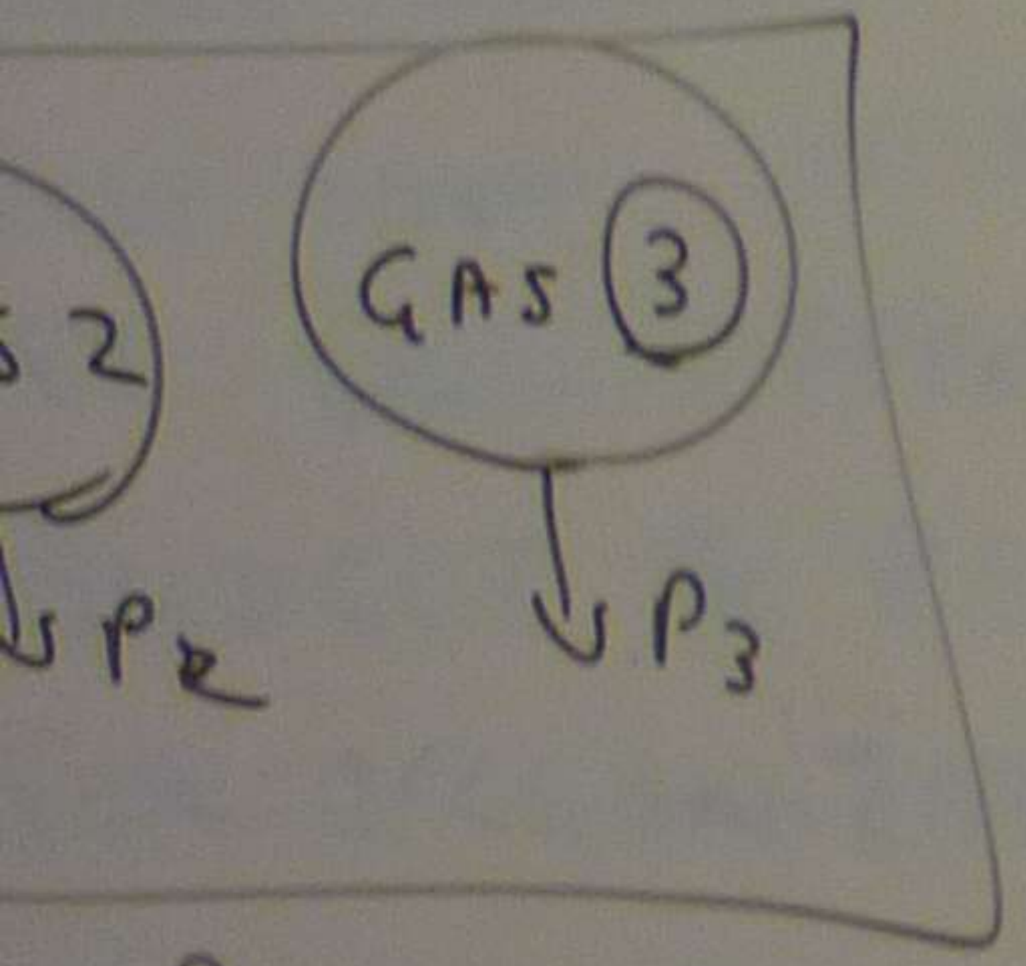

$+P_3$

" THE PRESSURE OF A MIXTURE OF GASES IS EQUAL TO THE SUM OF THE PRESSURES OF ALL OF THE CONSTITUENT GASES ALONE"

$$\text{PRESSURE}_{\text{TOTAL}} = \text{PRESSURE}_1 + \text{PRESSURE}_2 + ---- + \text{PRESSURE}_m$$

Q17 WHAT IS REYNOLD'S NUMBER?

THE REYNOLD'S NUMBER IS THE RATIO OF INERTIAL FORCE ($v_s \rho$) TO VISCOUS FORCES (μ/L)

IT CAN BE USED TO CHARACTERIZE THE FLOW.

VISCOSITY

A PHYSICAL PROPERTY, IS MEASURED OF HOW WELL ADJACENT MOLECULES STICK TO ONE ANOTHER.

Q18 EXPLAIN THERMODYNAMIC EQUILIBRIUM

" WHEN ENERGY TRANSFER CEASES FROM A SYSTEM, THIS CONDITION IS REFERRED TO AS THERMODYNAMIC EQUILIBRIUM.

IT ALSO IMPLIES

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"WHEN ENERGY TRANSFER CEASES FROM A SYSTEM, THIS CONDITION IS REFERRED TO AS THERMODYNAMIC EQUILIBRIUM.

IT ALSO IMPLIES THAT EXTERNAL FORCES ARE BALANCED AND ALL CHEMICAL REACTIONS WITHIN THE SYSTEM ARE BALANCED.

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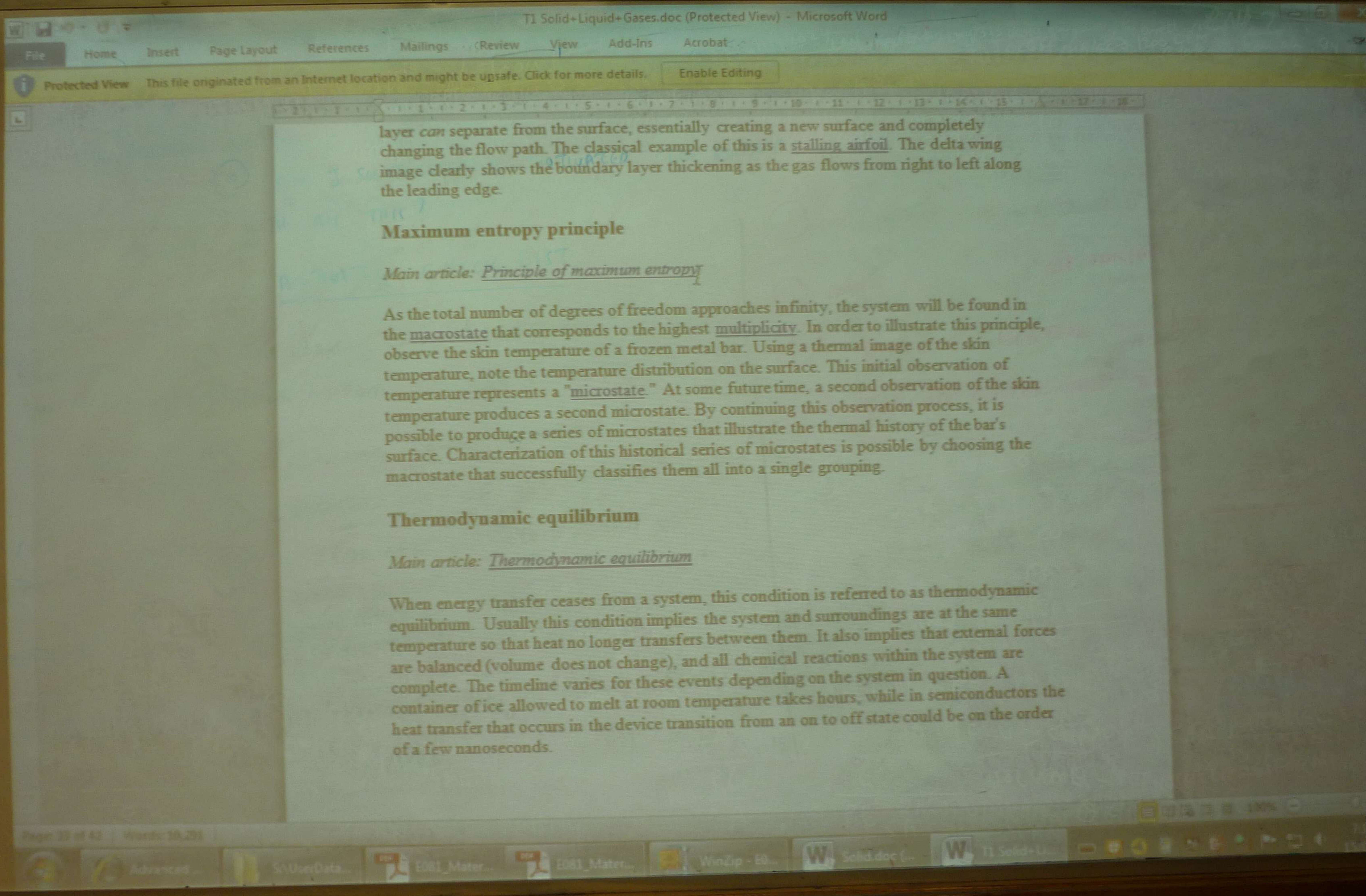

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layer *can* separate from the surface, essentially creating a new surface and completely changing the flow path. The classical example of this is a stalling airfoil. The delta wing image clearly shows the boundary layer thickening as the gas flows from right to left along the leading edge.

Maximum entropy principle

Main article: Principle of maximum entropy

As the total number of degrees of freedom approaches infinity, the system will be found in the macrostate that corresponds to the highest multiplicity. In order to illustrate this principle, observe the skin temperature of a frozen metal bar. Using a thermal image of the skin temperature, note the temperature distribution on the surface. This initial observation of temperature represents a "microstate." At some future time, a second observation of the skin temperature produces a second microstate. By continuing this observation process, it is possible to produce a series of microstates that illustrate the thermal history of the bar's surface. Characterization of this historical series of microstates is possible by choosing the macrostate that successfully classifies them all into a single grouping.

Thermodynamic equilibrium

Main article: Thermodynamic equilibrium

When energy transfer ceases from a system, this condition is referred to as thermodynamic equilibrium. Usually this condition implies the system and surroundings are at the same temperature so that heat no longer transfers between them. It also implies that external forces are balanced (volume does not change), and all chemical reactions within the system are complete. The timeline varies for these events depending on the system in question. A container of ice allowed to melt at room temperature takes hours, while in semiconductors the heat transfer that occurs in the device transition from an on to off state could be on the order of a few nanoseconds.

0.5GV/m.[1] However very thin layers (below, say, 100 nm) become partially conductive because of electron tunneling. Multiple layers of thin dielectric films are used where maximum practical dielectric strength is required, such as high voltage capacitors and pulse transformers. Since the dielectric strength of gases varies depending on the shape and configuration of the electrodes, it is usually measured as a fraction of the dielectric strength of Nitrogen gas.

Dielectric strength (in MV/m, or 10^6 Volt/meter) of various common materials:

Substance	**Dielectric Strength (MV/m)**
Helium (relative to nitrogen)[2]	0.15
Air [3]	3.0
Alumina[2]	13.4
Window glass[2]	9.8 - 13.8
Silicone oil, Mineral oil[2][4]	10 - 15
Benzene[2]	163
Polystyrene[2]	19.7
Polyethylene[5]	18.9 - 21.7
Neoprene rubber[2]	15.7 - 26.7
Distilled Water[2]	65 - 70
High Vacuum (field emission limited)[6]	20 - 40 (depends on electrode shape)
Fused silica[7]	25–40 at 20 °C
Waxed paper[8]	40 - 60
PTFE (Teflon, Extruded)[2]	19.7
PTFE (Teflon, Insulating Film)[2][9]	60 - 173
Mica[2]	118

[edit] Units

In SI, the unit of dielectric strength is volts per meter (V/m). It is also common to see related

T2 Dielectric strength.doc (Protected View) - Microsoft Word

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Silicone oil, Mineral oil	10 - 15
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PTFE (Teflon, Insulating Film)[2][9]	60 - 173
Mica[2]	118

[edit] Units

In SI, the unit of dielectric strength is volts per meter (V/m). It is also common to see related units such as volts per centimeter (V/cm), megavolts per meter (MV/m), and so on.

In United States customary units, dielectric strength is often specified in volts per mil (a mil is 1/1000 inch).[10] The conversion is:

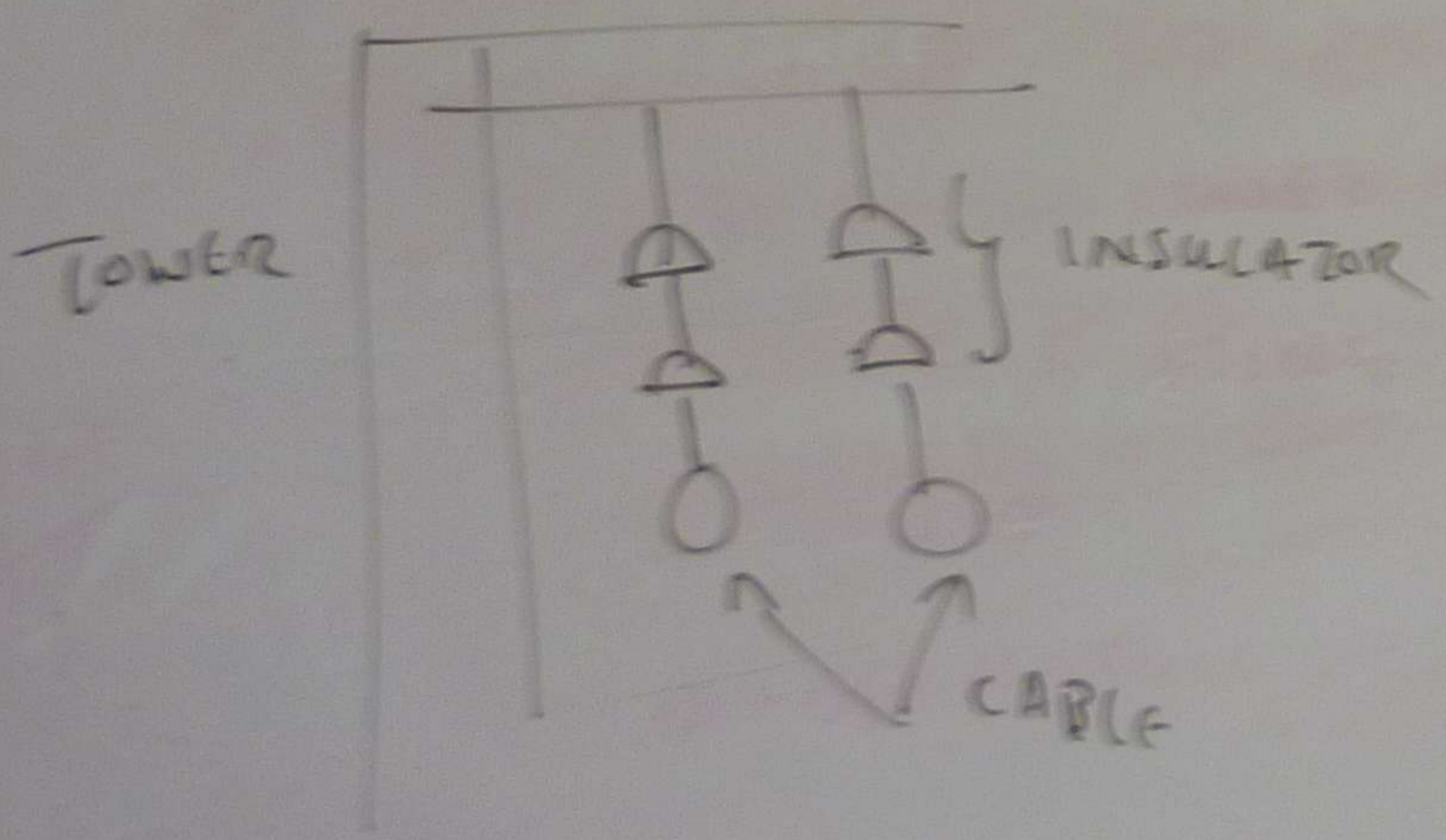
$$1\ \mathrm{V/m} = 2.54 \times 10^{-5}\ \mathrm{V/mil}$$
$$1\ \mathrm{V/mil} = 3.94 \times 10^{4}\ \mathrm{V/m}$$

[edit] See also

DIELECTRIC STRENGTH

- OF AN INSULATING MATERIAL, THE MAXIMUM DIELECTRIC FIELD STRENGTH THAT IT CAN WITHSTAND INTRINSICALLY WITHOUT BREAKING DOWN

Q19 BRIEFLY EXPLAIN TRANSMISSION LINE INSULATION.



PIN, SUSPENSION INSULATOR STRINGS PREVENT THE ELECTRICAL CURRENT FLOW IN CONDUCTORS NOT TO REACH THE TOWER FRAME.

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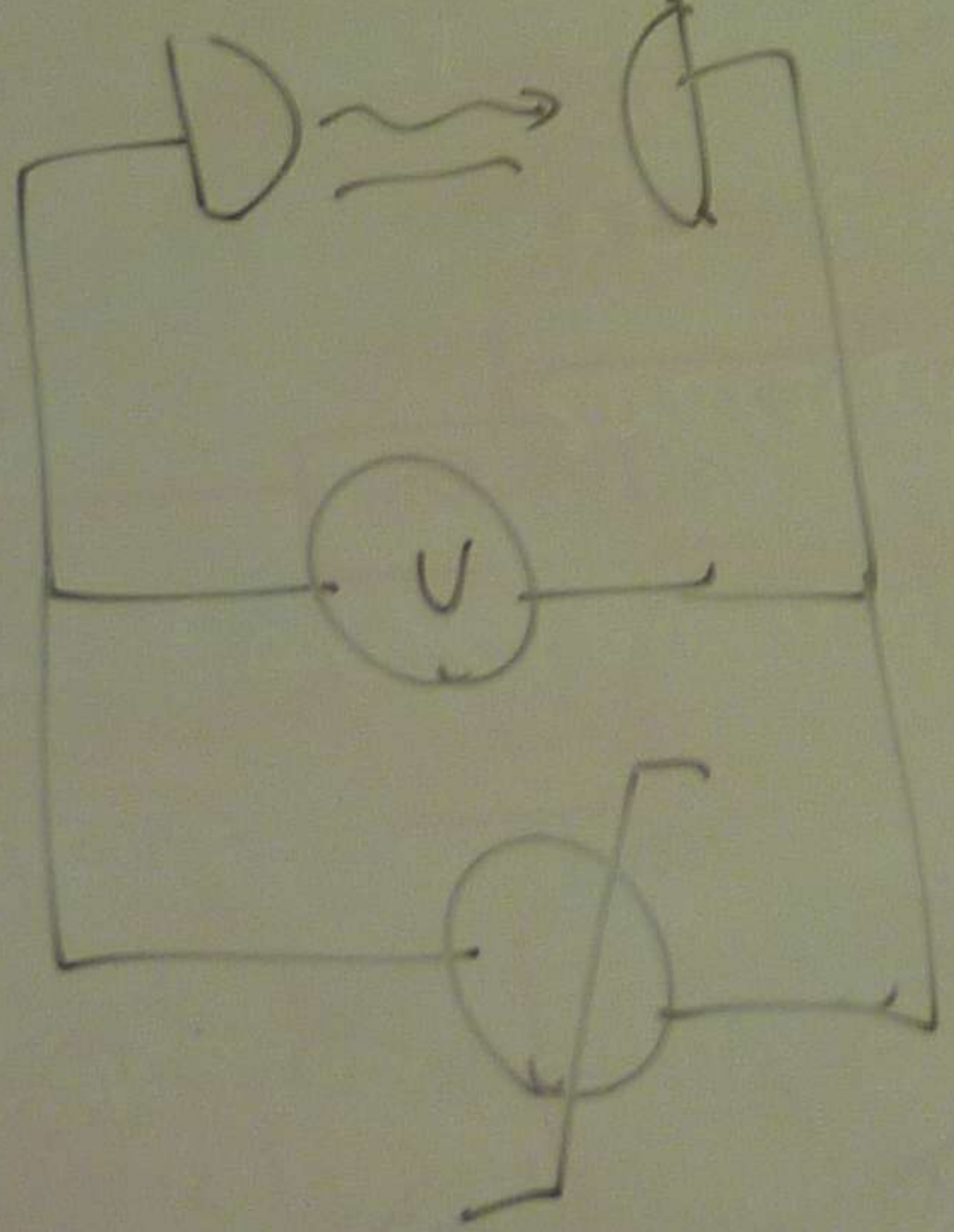
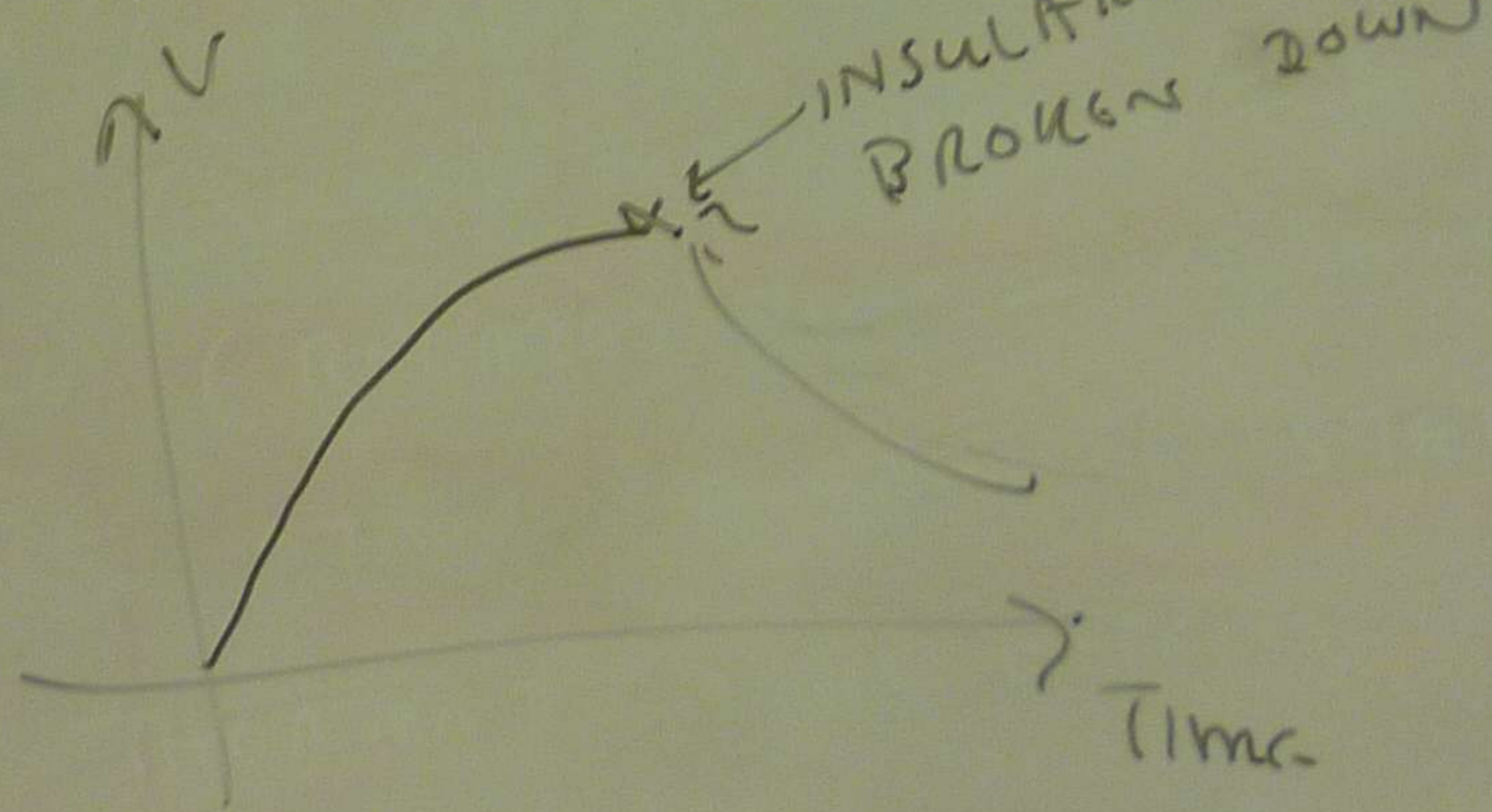
Q20 DESCRIBE INSULATION BREAK DOWN.

WHEN THE EXTERNAL FIELD STRENGTH IS TOO HIGH THE DIELECTRIC STRENGTH IS BROKEN DOWN AND ELECTRICAL CURRENT WILL FLOW THROUGH THE INSULATOR.

Q21 EXPLAIN VOLT TIME CHARACTERISTICS OF BREAK DOWN.





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— SLOWLY INCREASE THE

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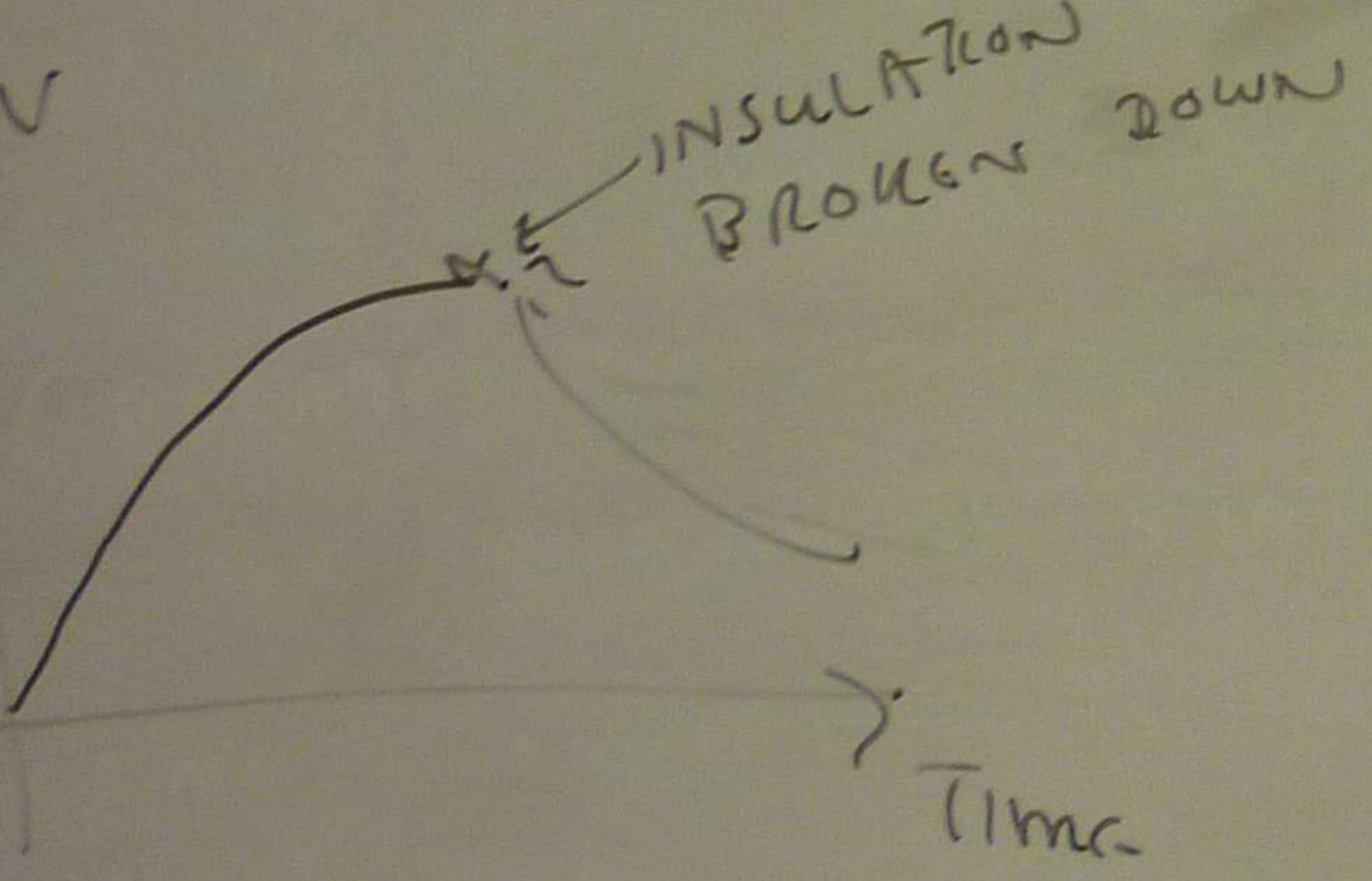

- MAKE A SMALL HOLE IN TEST PIECE
- SLOWLY INCREASE THE VOLTAGE
- PLOT THE TIME & AMOUNT OF VOLTAGE GIVEN TO TEST PIECE UNTIL IT IS BROKEN DOWN.

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strength of 5000 V /mm. Again the test voltage is calculated to be 11,180 V but now the breakdown voltage of the material is 10,000 Volts (2 x 5000). This is clearly less than our test voltage and attempting to use 11,180V to test this coating would result in the creation of more holes.

In this instance high voltage holiday detection may still be used to locate flaws in the coating, but some further testing is required to ensure that this method is valid.

Referring to the example above of a 2mm coating with a dielectric strength of 5000 V / mm, the validation test would be as follows:

1. Make a small hole in a test piece.
2. With the electrode over the hole slowly increase the voltage until the spark jumps the gap. Note the voltage (which in this instance, on a 2mm coating, would be ~ 5000 V).
3. To determine the test voltage, use a value midway between the test voltage calculated using the NACE formula (in this case 11,180 V) and the minimum voltage determined from the above test (~5000V). This works out to be 8090 V. ((11,180 – 5000) / 2) +5000).
4. Now make some more holes in the test piece (making sure there is more than 20mm between each hole), this time at angles, and using your test voltage (in our example 8090V) ensure that it is possible to locate the faults.

This method of finding the test voltage is fine if all you are looking for is cracks in the coating (that is complete faults that go all the way through the coating to the substrate). Indeed, many standards only require this type of fault to be detected. However, with