HIGHER VOCATIONAL SUPPLEMENTARY PROFESSIONAL ENGLISH OF REFRIGERATION AND AIR CONDITIONING

(高职制冷空调专业英语补充讲义)

主审：汤荣生

编写：廖洪鹏、王启祥

广东交通职业技术学院航海工程系

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前言

目前,我院高职空调与制冷专业学生在学完大学英语课程之后,要想顺利地阅读专业书刊及资料,尚存在不少困难。这主要是由于学生尚未掌握足够多专业书刊及资料中所常用的词汇,词组和语法结构知识所致。编注本补充讲义的目的,既在于提供这方面的学习材料,更为重要的是可以弥补现用教材中此部分内容的严重不足,以便使学生能在较短时间内迅速提高阅读专业书刊及资料的能力。

本补充讲义是为英语水平达到大学英语 2 到 3 级的高职班的学生编写的。本补充讲义从实际工作的需要出发,结合空调与制冷专业的特点,语言流畅,专业词汇覆盖面广,内容由浅入深.使用本补充讲义时,可根据不同的需要,要求和授课时数,由教师选取其中的若干部分作为讲解内容。并建议采用自学——提问——讨论的教学方式,即课前由学生独立自学所指定的内容,课堂上由学生或教师提问并开展讨论。这样一来,不仅有利于迅速提高学生阅读专业书刊及资料的能力,而且也可更好地理解和掌握讲解内容。

本补充讲义由廖洪鹏、王启祥俩位教师共同编写.航海工程系系主任,高级讲师汤荣生担任主审。由于编写者的业务和水平有限,在本补充讲义的注解与译文中,不妥与谬误之处在所难免,恳请使用者和专家给予批评指正。

编写者

于 2002 年 8 月

(1) Fans and Blowers

Throughout industry, the need to move large quantities of air or convey products is ever present. To meet the air-and product-handling requirements, a variety of fans and blowers are most often employed. It is rare not to find① one or more fans or blowers in each department of an industrial or manufacturing complex. In many ways fans and blowers noise is one of the easiest and most straightforward acoustical problems to solve. We shall now develop a systematic approach to controlling fan and blower noise. Fans will be considered first, followed by blowers. In this text, blowers will refer to the high-pressure rotary positive displacement type② which would better be described as compressors.③

The fans we shall focus attention on are those used to move large volumes of air for ventilation, dust or oil mist collection, drying operations, etc., which are relatively low-speed low-static-pressure units. The majority of fans can be classified as either axial or centrifugal, and we shall deal with each on an individual basis.④

New Words

acoustical problem *n.* 声学问题
axial *a.* 轴向
blower *n.*风机
centrifugal *a.*离心
classified *pp* 被分类
collection *n.*收集
convey *vt.*搬运
department *n.*部门
ever present 由来是
fan *n.*风扇
focus *n.*焦点，中心 *vt.*集中
handle *n.*手柄 *vt.*处理，拿
in many ways 在许多方面
majority *n.*大多数
manufacturing complex 制造集团
oil mist *n.*油雾
product *n.*产生
dust *n.*灰尘
requirement *n.*要求
quantity *n.*量
solve *vt.*解
static pressure *n.*静压
straightforward 直接的，简单的
throughout *prep.*整个，全体
variety *n.*变化，多种
ventilation *n.*通风

Notes

① It is rare not to find:很少找不到,或总常见到。
② Rotary positive displacement type:回转的容积式风机,一般指罗茨鼓风机。
③ In this text, blowers will refer to the high-pressure rotary positive displacement type, which would better be described as compressors.
这是一个主从复合句。罗茨鼓风机的性质是高压容积式的,更接近于空气压缩机,which 是指 blower。
④ on an individual basis: 分别来处理

(2)Air Compressors

The most common type of machine used for the compression of air is that known as a

piston-compressor and consists of a cylinder provided with valves and a piston.

The work performed in the air-cylinder of a compressor can best be studied from an indicator diagram.① If the compression is effected very slowly in a conducting cylinder, so that the air within may lose heat by conduction to the atmosphere as fast as heat is generated by compression, the process will be isothermal, at the temperature of the atmosphere. Also if the compressed air is distributed for use in compressed air motors② or engines without a change of temperature, and the process of expansion in the compressed air motors or engines is indefinitely slow and consequently isothermal, then (if the loss caused by friction in pipes is neglected) there would be no waste of power in the whole process of transmission③ The indicator diagram would then be the same per pound of air in the compressor as in the air motor, although the course of the cycle would be the reverse-that is, it would retrace itself.

Adiabatic compression and expansion take place approximately if the expansion and compression are performed very quickly, or when the air is not cooled during compression-in such a case the temperature of the air rises.

New Words

adiabatic *a.* 绝热的
atmosphere *n.* 大气
consequently *ad.* 因而,所以
cycle *n.* 循环
conducting cylinder *n.* 导热的气缸
distribute *vt.* 分配
generate *vt.* 产生
indefinitely *ad.* 不定地,无限地
isothermal *a.* 等温的
perform *vt.* 实行,完成
piston *n.* 活塞
piston-compressor 活塞式压缩机
provide *vt.* 准备,供给,假设
retrace *vt.* 回程,返回
take place 发生
valve *n.* 器阀

Notes

①与容积的关系曲线的图,图中面积即为一个循环的功。

②indicator diagram：示功图,即以压力与容积为二个坐标的表示活塞来回一次时气缸内压力与容积的关系曲线的图,图中面积即为一个循环的功。

③air motors：气动马达,由压缩空气驱动的动力机械。

④then (if the loss caused by friction in pipes is neglected) there would be no waste of power in the whole process of transmission.

这是虚拟条件从句,上半句说了温度没有变化且反应很缓慢而看成等温过程,后半句就在此得出整个过程没有功率损失。

(1)Saturated and Superheated Vapors

As was explained in the chapter on the properties of perfect gases, a vapor is a fluid, which can be readily transformed into a liquid by a moderate reduction in temperature or increase in pressure. ①It is essentially a gas near its point of condensation.

At every pressure, there is a fixed temperature, called the temperature if vaporization, at which a liquid can be changed into a vapor by the addition of heat. A vapor at the temperature of vaporization is called a saturated vapor. When a vapor is heated so that its temperature is greater than the vaporization temperature corresponding to its pressure, it is said to be superheated vapor. ②Superheated vapors when far removed from their vaporization temperature behave nearly according to the laws of perfect gases.

(2)Theory of Vaporization

When heat energy is transmitted to a liquid, its temperature will rise with only a slight volume change until the temperature of vaporization is reached.③ This is always a definite temperature for any given pressure, and it depends upon the character of the liquid. Thus the temperature of vaporization of water at the atmospheric pressure of 14.7 lb. per sq. in. abs.④ is 212 deg. fahr., while that at a pressure of 150 lb. per sq. in. abs. is 358.4 deg. fahr. On the other hand, the vaporization temperature of ammonia liquid at a pressure of 150 lb. per sq. in. abs. is 79 deg. fahr.

When the temperature of vaporization of a liquid is reached, any further heat transmitted to the liquid causes the liquid to change to a vapor. During this process, if the pressure remains constant and no temperature increase will occur until all the liquid has been changed to a vapor.

In the vaporization of the liquid, since the temperature remains constant, no energy is absorbed in increasing the mean velocity of the molecules. A change of state of aggregation as well as considerable change in volume take place during vaporization, with the result that most of the energy absorbed in the process is used in tearing the molecules apart, so that it resides within the vapor as latent of potential energy.

When vaporization is incomplete the vapor is termed wet saturated vapor. In this condition some of the liquid is present in the vapor.

A dry saturated vapor carries with it no liquid that has not been evaporated. The percentage dryness of a vapor is called its quality. Thus the quality of steam is 0.98 when 1 lb. of it consists of 97 per cent dry saturated steam and 3 per cent water. Whereas the volume of a vapor increases with the quality, the temperature is constant throughout the whole process of vaporization for any given pressure. Thus the temperature of water vapor corresponding to 150 lb. per sq. in. abs. is 358.4 deg. fahr. , no matter whether the quality is 0.10, 0.75 or 1.00.

After complete vaporization, the pressure still remaining constant, the absorption of further energy by the vapor will cause an increase in temperature as well as an increase in volume. In this condition the substance is superheated. A superheated vapor may then be defined as one whose temperature is higher than that of saturated vapor at the same pressure.

New Words

absorption *n.*吸收
ammonia *n.*氨
behave *vi.* & *vt.* 行为，动作
condensation *n.* 凝结
evaporate *vi.* 蒸发,脱水
liquid *n.*液体
molecule *n.* 分子
latent *a.* 潜在的
reduction *n.* 减小，降低
reside *vi.* 居留,存在
tear *vt.* 分开,撕裂
vaporization *n.*汽化
aggregation *n.*聚合,凝聚
atmospheric pressure n.大气压力
character *n.* 特性
fahr = fahrenheit 华氏温度
moderate *a.* 缓慢的,适当的
perfect gas 理想气体
quality *n.* 品质
saturated vapor 饱和蒸气
superheated vapor 过热蒸气
transmit *vt.*传送
whereas *conj.*所以,而,却
dryness *n.*干燥

Notes

① As was explained in the chapter on the properties of perfect gases, a vapor is a fluid which can be readily transformed into a liquid by a moderate reduction in temperature or increase in pressure.

在 as 后省略了一个形式主语 it,在理想气体的性质这一章中所说明的,这是个起副词作用的从句,说明在前,所以用过去被动态。主语是 vapor, which 是 fluid 的代词,适当地降低温度或增大压力,这种流体就很容易转变为液体(既蒸汽变为水),这一点是蒸汽不同于理想气体之处。

②When a vapor is heated so that its temperature is greater than the vaporization temperature corresponding to its pressure, it is said to be superheated vapor.

这里三个句子中 so that 以前主语是 vapor, 后面一个句子中主语是 vapor 的 temperature,最后一个句子的主语 it 是 vapor 的代词。

③…its temperature will rise with only a slight volume change until the temperature of vaporization is reached.

until 以前是液体,温度升高时容积变化很小 until 后汽化为汽体了,其容积变化就大了,所以如果把句子对照成完整的汉语,应该是 after the temperature of vaporization is reached, its temperature will rise with a sudden volume change,这样就要比原文繁琐了,这是英语中这个连词的特点。

④lb. per sq. in. abs.=pounds per square inch absolute 每平方英寸多少磅的绝对压力

PART Ⅲ

(1)Irreversible Processes

Irreversible adiabatic processes are those in which not only no heat is added or abstracted but also a portion or all of the energy involved in the process may reappear in the working medium as energy at the end of the process.① In such a process the entropy does not remain constant but increases, and the degree of irreversibility may be measured by the increase of entropy at the end of the process.

The flow of steam in a nozzle and the throttling calorimeter are two practical examples of irreversible processes.

In the steam nozzle, energy in the fluid is transformed into kinetic energy. The expansion in the nozzle is adiabatic in the sense that no heat is added or abstracted. Owing to friction and turbulence of flow, not all the energy available from the process is transformed into kinetic energy. And the portion necessary to overcome friction and to produce turbulence appears as unavailable energy at the end of the process. As a result, the energy transformed into kinetic energy is less than it would have been had the process been reversible without friction or turbulence,② and, likewise, the energy remaining in the working substance is greater than with non-turbulence flow and its entropy at the end of the process has been increased.

In the case of the throttling calorimeter discussed in the previous chapter, the thermodynamic process involved is adiabatic but the apparatus is so constructed that no work energy is transmitted from the working substance. As a result, the energy contained in the working substance as it enters the process equals that contained as it is leaving the process. The throttling process is one of maximum irreversibility in that the work energy taken from the working substance is zero and the change of entropy is a maximum.

(2)Properties of Perfect Gases

In thermodynamics the working substance, or heat medium, through which the heat engine converts heat into work, is in the condition of either a gas or a vapor. The laws governing the action of the classes of substance differ. For this reason the subject of thermodynamics is divided into the thermodynamics of gases and the thermodynamics of vapors.

A gas may be defined as a fluid which remains in the gaseous state when subjected to moderate changes in pressure or in temperature.③ Oxygen, hydrogen, nitrogen, air and carbon dioxide are examples of gases.

Vapors are fluids which are readily transformed into liquids by a moderate reduction in temperature or increase in pressure. Examples of vapors are steam and ammonia.

Relation between Pressure, Volume and Temperature of a Perfect Gas. In practically all heat engines, work is done by changes of volume of a fluid, and the

amount of work performed depends only on the relation of pressure to volume during such change and not at all on the form of the vessel containing this fluid. ④

Extensive experimentation has led to the recognition of certain laws regarding pressure, volume, and temperature changes. These laws are followed so very closely by gases under such moderate conditions of temperature and pressure that the stability of the gases is not greatly modified by moderate changes in volume. ⑤ Gases lose their stability when subjected to pressures in which the molecules are crowed close together. ⑥ From experiment a set of laws has been formulated which would be followed exactly by a perfectly stable gas. Such a gas is designated as a perfect gas. In thermodynamic calculations all gases are ordinarily considered as perfect gases. Vapor, however, do not follow the laws of perfect gases.

New Words

abstract *vt.* 取出 *a.* 抽象
apparatus *n.* 仪器
in the sense that 意思是
irreversibility *n.* 不可逆
thermodynamic *a.* 热力的
turbulence *n.* 紊流
unavailable *a.* 没有用的
ammonia *n.* 氨
convert *vt.* 转换
designate *vt.* 叫做，指出
experimentation *n.* 实验
gaseous state *n.* 气体状态
hydrogen *n.* 氢
modify *vt.* 限制，规定，修改
not at all 根本不是
perform *vt.* 完成
regarding *presp.* 关于
steam *n.* 蒸气
transform *vt.* & *vi.* 转变
vessel *n.* 容器
adiabatic *a.* 绝热的
entropy *n.* 熵
irreversible *a.* 可逆的
reappear *vt.* 重现
throttling calorimeter 节流式量热器
work substance=working medium 工质，工作媒质
carbon dioxide 二氧化碳
crowed close together 紧紧地挤在一起
formulation *n.* 用公式表示
heat medium *n.* 热的媒质
moderate change 适当变化(指不突变)
nitrogen *n.* 氮
perfect gas *n.* 理想气体
recognition *n.* 认识，了解，点清
stability *n.* 稳定性
thermodynamics *n.* 热力学
vapor *n.* 蒸气，气，气化物

Notes

① Irreversible adiabatic processes are those in which not only no heat is added or abstracted but also a portion or all of the energy involved in the process may reappear in the working medium as energy at the end of the process.
这是一个主从复合句，主句中 Irreversible adiabatic processes 是主语，in which 以后是补语从句，which 是 process 的代词，从句中有二组谓语，一是 is added or abstracted；另一是 may reappear；这样的过程称为不可逆绝热过程。

② … the energy transformed into kinetic energy is less than it would have been had the process been reversible without friction or turbulence, ….

在此将可逆的与不可逆的二种情况下能量转换成动能的量作了比较，可逆过程不用克服摩擦及紊流，所以能全部转换成动能，于是不可逆过程转换成有用能就少了。

因为实际上一点摩擦及紊流都没有是不可能的，所以在此要用虚拟语气的被动态 would have had.

③ A gas may be defined as a fluid which remains in the gaseous state when subjected to moderate changes in pressure or in temperature.

Which 是 fluid 的代词，保持气态；when 后面省略了 it is，应是 when it is subjected to…，这是 gas 的定义。承受压力或温度的缓慢变化时保持为气态，符合这个条件的称为气体。

④ In practically all heat engines, work is done by changes of volume of a fluid, and the amount of work performed depends only on the relation of pressure to volume during such change and not at all on the form of the vessel containing this fluid.

这是二个并列句子的复合句，上半句 work 是主语，is done 是动词，In practically all heat engines 是主语的定语。在热机中产生的功是由于流体的容积变化带来的；and 这个连接词后又是另一子句，其中 amount 是主语，depends 是其动词。只取变化过程中压力与容积的关系，而根本不决定于流体的容器的形状。

⑤ These laws are followed so very closely by gases under such moderate conditions of temperature and pressure that the stability of the gases is not greatly modified by moderate changes in volume.

这是由 so…that 连接起来的主从复合句，气体在适当温度及压力的条件下如此严格地遵守这些定律，所以气体的稳定性不会轻易受容积缓慢变化的影响而作大的改变。前面主语是 laws，后面句子的主语是 stability。它不会被 greatly modified. 两子句都是现在被动态。

⑥ Gases lose their stability when subjected to pressures in which the molecules are crowed close together.

这是由二个子句组成的主从复合句，主语是 gases，when 后面省略了 it is，在此 it 是 gases 的代词，当气体承受压力；which 是 gases 的代词，当这个气体受压而其中分子紧紧挤在一起时 gases 失去其稳定性；when 以后是条件状语，提出了主句 Gases lose their stability 的必要条件。

Lubricants

It has long been recognized that if a pair of sliding bodies are separated by a fluid or fluidlike film, the friction between them is greatly diminished. The principle of supporting a sliding load on a friction-reducing film is known as lubrication. The substance of which the film is composed is a lubricant, and to apply it is to lubricate. These are not new concepts nor, in their essence, particularly involved ones.① But modern machinery has become many times more complicated since the days of the oxcart lubricated by animal fats, and the demands placed on the lubricant have become proportionally more exacting. Even though the basic aim still prevails-the prevention of metal-to-metal contact by means of an intervening layer of fluid or fluidlike material②-modern lubrication has become a complex study.

All liquids will provide lubrication of a sort,③ but some do it a great deal, better than others. Mercury, for example, lacks the ability to wet a metal surface. Alcohol, on the other hand, readily wets a metal surface but lacks the viscosity necessary to form a load-carrying film.

Gases, particularly air, offer potential lubrication where loads are low. Dental drills, gyroscopes, dynamometers, and blowers have been successfully lubricated with gases.

Solid lubricants, either alone or mixed with a liquid lubricant, can be used under conditions of very high pressure, high temperature, and chemically reactive environments.

Oils and gases are the most widely available and most commonly used type of lubrication. Their use offers the following advantages:

- Ease of initial application and renewal.④
- Wide range of properties available to meet specific needs.⑤
- Ability to remove frictional heat from moving parts.
- Protection of metal surfaces against rusting and other types of corrosion.
- Sealing against dust particles, sand and other foreign matter.
- Lower cost than other types of lubrication.

For use under spacecraft conditions, oils and greases may be limited by the following factors:

- Inability to operate at extreme temperature(either high or low)and over extended temperature ranges.⑥
- Evaporation, which is accelerated by vacuum operation.
- Creepage or migration over surfaces and away from the parts they are intended to lubricate.
- Radiation stability.

New Words

recognize *vt.*认识
slide *vi.*滑动
fluid *n.*液体
film *n.*薄膜
diminish *vt.*减小
creepage *n.*蠕动，爬行
intend *vt.*意欲，打算
stability *n* 稳定性
pair *n.*对，成对
fluidlike *a.*液态的

friction-reducing film 减摩薄膜
lubrication *n.* 润滑
lubricant *n.* 润滑剂
particularly *ad* 特别地，详细地
oxcart *n.* 牛车
fat *n.* 脂肪
complicate *vt.* 复杂
exacting *a.* 苛求，繁重的
even though 既使，尽管
liquid *n.* 液体
a great deal 很大，很多
lack *vt.* 缺少
viscosity *n.* 粘度
dental drill 牙齿钻
dynamometer *n.* 测力计
condition *n.* 条件
environment *n.* 环境
available *a.* 可利用的，可得到的
renewal *n.* 更新
property *n.* 特性
sealing *n.* 密封
factor *n.* 因素
extreme *a.* 极端的
accelerated *pp.* 加速
inability *n.* 无能
evaporation *n.* 蒸发
vacuum *n.* 真空
friction *n.* 摩擦
principle *n.* 原理
load *n.* 负载
concept *n.* 概念
essence *n.* 本质
demand *n.* 需要
proportionally *ad.* 成比例地
prevail *vi.* 获胜，占优势，有效
intervening *presp.* 在……中间
sort *n.* 种，类别
mercury *n.* 汞，水银
alcohol *n.* 酒精
load-carry film 承受负载的薄膜
gyroscope *n.* 陀螺仪
blower *n.* 鼓风机
either…or… 或……或……，指两者之一都可
pressure *n.* 压力
chemically reactive 化学反应
grease *n.* 润滑脂
advantage *n.* 优点
initial *a.* 开始的，最初的
corrosion *n.* 腐蚀
foreign matter 杂质
spacecraft *n.* 宇宙飞船
migration *n.* 迁移，离子徙动
radiation *n.* 辐射
protection *n.* 保护

Notes

① These are not new concepts nor, in their essence, particularly involved ones.
这些并不是新的观念，在本质上也不难理解。
Nor：也不；involved ones：难理解的，involved 在此是形容词，意为复杂难懂。

② Even though the basic aim still prevails-the prevention of metal-to-metal contact by means of an intervening layer of fluid or fluidlike material②-modern lubrication has become a complex study.
the prevention of metal-to-metal…or fluidlike material 与 basic aim 是同位语，目的是避免金属对金属接触。

③ …lubrication of a sort…一种润滑剂；of a sort 有质量低劣的意思“也算是一种”。

④ initial application and renewal 前者是指一开始就应用，后者指更换新润滑油，意思是不论新机器注润滑油或者旧机器换油都很方便。

⑤ Wide range of…specific needs. 对各种要求有很宽的适应性。

⑥ Inability to operate…temperature ranges.
没有能力在极端的温度下（极高与极低）工作，也没有能力在很宽的温度范围下工作。

句中 at extreme temperature 与 over extended temperature ranges 是二个介词短语修饰不定式 to operate；extended：伸展的，指温度范围。

PART V

Evaporation and Condensation of Water

When you boil a kettle of water, you can see steam coming out of of the spout. This is because the boiling water gives off water vapour①, which we can see only as steam. The water in the kettle gets less and less②, because it is changing into vapour. Or we can say that it is vaporizing or evaporating. It cannot evaporate without heat.

If you hold a cold surface③ in the steam, you can see tiny drops of water being made on it④. This is because the water-vapour gets cool when it touches the cold surface. Then it changes back into liquid water. This process is known as condensation.

Water vapour makes clouds. With the help⑤ of the sun's heat, water is changed to vapour from the earth's surface⑥, and when it meets a body of cold air⑦ this water vapour changes to water in the form of millions and millions⑧ of tiny drops of water. These may joint together until they are so heavy⑨ that they fall down.

New Words

kettle n.壶
boil vt.煮沸
boiling water 沸水
vaporizing presp.气化
without presp.缺少,没有
tiny a.很小的
touch vt.接触
liquid n.液体
condensation n.凝结
earth n.地球,地面
million n.百万
together a.一起,同时
heavy a.重
spout n.壶嘴
steam n.水蒸气
vapour=vapor n.蒸气
evaporate vt.蒸发
surface n.表面
drop n.滴
change vt.变化
process n.过程
cloud n.云
meet vt.遇到
join vi.结合
until presp.一直到…
fall vi.落下

Notes

① …gives off water vapour:放出水蒸气。 give off 发,放。 在汉语中 steam 与 vapour 都是水蒸气,英语中 vapour 包括各种液体汽化出来的气态物质而 steam 则只指水蒸气。
② …gets less and less:逐渐减少 less and less 不断减少
③ cold surface:指表面冷的东西。
④ tiny drops of water being made on it:小水滴在其上形成。 being made on it 是分词短语这是被动态进行式的修饰词,形容正在表面形成。 It 是 surface 的代词。
⑤ With the help of:借助于
⑥ earth's surface:地面,地表
⑦ a body of cold air: 一团冷空气; Body 在此形容一大块,不是一点。
⑧ millions and millions: 形容多到无其数

⑨ so heavy that…如此重，以至落下。 so…that…常用作连系词。

PART VI

That Liquid State of Matter

A simple operational definition of a liquid is that it is a medium which takes the shape of① a container without necessarily filling it. In contrast, a gas both takes the shape and fills the container whilst a solid neither takes the shape nor fills it. There are, however, materials which are difficult to place on this definition. A few polymeric materials appear to be solid but with time they will flow to the shape of a container. Glasses behave similarly although their flow rate may be immeasurably slow at normal temperature.

The operational distinction between a solid and a liquid must therefore be made more precise by referring to the time response to an applied force. We say that a material shows elastic behaviour if it returns to its original shape following the application then removal of a force. It shows inelastic or plastic behavior if it is permanently distorted by the force.

The response of solids to a force is mainly elastic(at last for low strain), and that of liquids is mainly inelastic. However, the skipping of stones on the surface of water shows that elasticity is not completely absent in a liquid and the flowing of glass is an illustration of inelastic behavior. The polymer known colloquially as "silly putty" which can be moulded into an elastic ball but which will flow slowly under an applied force is a material in which both elastic and inelastic behavior are easily illustrated.②

At first sight③ the operational distinction between a liquid and a gas might appear to be more rigorous. However, there is a simple experiment to show that this is not so.

If one takes a sealed tube containing liquid in equilibrium with④ its vapour then the top of the liquid is indicated by an interface(meniscus). If the temperature of the tube is raised the density of the liquid will decrease and that of the gas increase until eventually a temperature is reached at which both densities will be equal. At this point all distinction between liquid and vapour disappears and this is shown by the disappearance of the interface.

The temperature at which this occurs is called the critical temperature. As we shall see later the pressure in the tube is also a characteristic property of the liquid which is called the critical pressure. For most liquids this pressure is very high(e.g. for water it is 218 atm⑤) so that great care is needed in carrying out the experiment.

On applying increasing pressure to a substance at a temperature above its critical temperature it simply becomes more dense. there is no point at which one can say it passes from being a gas to being a liquid. This unification of the two states of matter is expressed by using the term fluid to encompass both gas and liquid. Below the critical point gas and liquid are distinct states which can exist in equilibrium with each other. Above the critical point the two states become one.

Supercritical fluids are being increasingly used for extraction processes. For example, supercritical CO_2 is being used commercially to decaffeinate green coffee beans. The advantages of such a process are that CO_2 is pharmacologically inert, the extractant can be recovered simply by lowering the pressure and coffee flavours are, apparently, not extracted.

A further brief comment on terminology: the words vapour and gas are often used interchangeably. Vapour is usually used when the phase is in contact with its liquid or solid. For example vapour pressure is the equilibrium pressure in the gas (vapour) above a liquid or solid. One could logically always use vapour for the phase below the critical temperature because only