МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ
РОССИЙСКОЙ ФЕДЕРАЦИИ
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Кафедра иностранных языков технических специальностей

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Часть I

Кафедра иностранных языков технических специальностей
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Text 1: BEATING THE INFORMATION SECURITY THREAT

Increasing computerisation and the sharp growth in e-commerce has undoubtedly revolutionised the way in which businesses trade. However, with increased opportunities come increased risks. Gerry Ashton, sector specialist for information security at LRQA in the UK, considers the importance of good management systems in helping counter threats to network security and considers the benefits that ISO/IEC 17799:2000 can bring. Information and IT systems are vital business assets and their availability, integrity and confidentiality are critical to maintaining an organisation's ability to function. Systems that have not been protected are vulnerable to any number of risks and there are indications that many organisations are still not taking the risks as seriously as they should.

This is supported by the findings from the most recent Department of Trade and Industry (DTI) Information Security Breaches Survey 2002, involving 1,000 telephone interviews, face-to-face in-depth interviews and an on-line web site poll with those responsible for information security in their organisation. Issued every two years, this is the sixth survey undertaken by the DTI and is intended to help UK businesses better understand the threats posed. Some key statistics from those surveyed show:

- 44 per cent of UK businesses have suffered at least one malicious security breach in the past year
- the average cost of a serious security incident was £30,000
- only 27 per cent of UK businesses have a documented security policy.

The 2002 survey indicates that while information security is now more widely understood and significant progress has been made in designing appropriate controls to counteract the risks, the threats have also increased. Organisations are reacting to the increased risks by implementing effective information security management systems (ISMS) and having these certified to BS 7799 part 2.

Certification to the assessable part of this ISMS standard will give an organisation a key advantage over competitors by providing invaluable additional credibility. It enables an organisation to make a public statement of capability without revealing its security processes or opening its systems to second party audits. It will also give the organisation confidence in the integrity and security of its own systems and processes as measured against the best industry practices.

Compliance with BS 7799 helps to demonstrate both to internal and external stakeholders that a company has taken action to safeguard their information systems and any data. It clearly benefits organisations, their customers and their trading partners if management information, critical data and IT systems are secure. Accredited certification from LRQA helps provide companies with the increased confidence that they meet best practice while also seeing the tangible business benefits an external statement from a recognised body can bring.

Text 2: THE MARK OF QUALITY

Wherever you look these days there are logos, marks and brands vying for attention. Each in its own unique way is trying to project an image, convey a message or build awareness in order to win more business. With such a proliferation of marks it can be difficult for consumers to distinguish between them. Often the marks are taken at face value because there is very little the purchaser can do to verify the claims or check the authenticity of the product marks themselves.

There are areas where consumers have clearly learnt to discriminate using their knowledge of the market. Products sometimes sell on the merits of the brand, for example Nike for sports shoes and Intel for Pentium micro-processors. Customers recognise the Nike 'tick' and the Intel 'swirl' trademarks and associate them with quality good. The quality level may not be any better than competitors products but the marketing surrounding these marks builds a strong brand awareness and gives the products an image that customers are willing to trust.

Some countries have developed quality reputations for a whole range of products, for example “Made in Germany”, has been synonymous with robust and reliable manufacture, and consumers have learnt to seek out such labels. However, in the growing global market, the place of manufacture is now becoming less important and brand strength is being heavily promoted to project messages such as leadership, consistency and reliability. This also applies to quality marks, particularly in the quality assurance certification market where global awareness is an important factor and the concept being sold is not easily branded.

In our business, ISO 9000 certification has become a recognised but also a mis-used term. The distinction between accredited and unaccredited certification is lost on many people. As a result, the value of accreditation is not being fully realised. Unaccredited services are being sold in competition with accredited services at a fraction of the cost to unsuspecting companies unaware that there is a difference and that they are buying a lower grade service.

The growing number of marks indicating ISO approval does little to help the consumer. It is not surprising that unaccredited certification of a quality system appears, on face value, no different from accredited. The marks are so similar as to be indistinguishable and the freedom to trade allows both types of organisation to function in a market place. The only way to differentiate between these certification services is to increase customer awareness and this is the theme being explored in this edition of LRQ Review.

It there is no value in accreditation then the certification community could be wasting considerable time and money. In order for there to be a difference we need better informed purchasers. Buyers should be encouraged to question what a supplier's certification covers. 'ISO 9000' itself should not be taken as a mark of quality. Buyers may be surprised, when the question is asked, that it doesn’t cover the items they wish to purchase, or it they investigate even further, that the organisation providing the certification service is not accredited for the service being offered. Most certification companies have limited accreditation coverage and the products

certified may be outside this list. LRQA has global UKAS coverage for ISO 9000 and ISO 14000 for products across all industry and service sectors.

The challenge for accreditors should be to reduce the number of marks, license a single mark that is only available from in accredited certifier and aim for global impact. There should be a single mark that is instantly recognisable, acceptable to all meets the global need for clarity and cannot be used by organisations outside of the accreditation network. The growing availability of the internet provides a wonderful opportunity to establish an accredited ISO certification site allowing searches to be made of organisations with accredited approvals. Only time will tell if the International Accreditation Forum rises to the challenge.

Text 3: QUALITY THROUGH THE AGES

Quality has always been an important issue but how has the concept been identified and communicated through the centuries?

Quality marking began when Egyptian and Roman stonemasons and carpenters would mark their products with a symbol to show their workmanships In medieval times, marks and symbols were used to identify the work of builders and craftsmen, and as a stamp of quality. Quality marks have always been used in art. Painters sign their work, while pieces of porcelain and pottery are marked with the year, factory and artist. These marks help to identify between genuine and counterfeit articles, and add a rarity value to the work.

The act of marking moved on from simply identifying a craftsman to providing the assurance that a product was of a good quality. Hallmarks, for example, distinguish source and quality in gold, silver and platinum. They have been in use since the fourteenth century when the English King Edward I decreed that no gold or silver could be sold until tested by the "Guardians of the Craft" and struck with the King's Mark. Hallmarks are important because they guarantee to the consumer that the item has been independently tested to be of the stated minimum purity. They also inform and protect vendors from unintentionally mis-describing an article. The presence of a hallmark avoids the necessity of re-testing a piece whenever it is valued or offered for resale.

Once products became mass produced both industry and consumers needed to know that the goods and services they were buying were of a consistent quality and comparable in different markets.

This led to a growth in standardisation within the industrialised nations at the end of the nineteenth century. Such standards bodies were British Standards Institute (BSI) in the UK, Deutsches Institut fur Normung (DIN) in Germany and Association Francaise de Normalisation (AFNOR) in France. The International Organisation for Standardisation (ISO) was formed in 1947 to create and regulate international standards. It now represents national standards bodies from 130 countries and its mission is to promote the development of standardisation and related activities in the world with a view to facilitating the international exchange of goods and services.

From the late nineteenth century, product test marks were introduced for specific products and materials to demonstrate quality conformity. The American Society of Mechanical Engineers (ASME) was founded in 1880 and is responsible for developing technical standards, especially for boilers. Today, it also focuses on research, technical and education issues.

Manufacturers soon saw that if their product was easily identifiable it had enhanced value. Trademarks were developed and are used to identify goods by distinguishing them from others. A registered trademark also gives protection from unfair competition. Trademarks helped to create the whole realm of product branding as consumers realised that a certain brand name or trademark represented a perceived level of quality. Some of the most recognisable trademarks are Coca-Cola, Shell and the Volkswagen “VW”.

A number of international organisations realised that they had a duty to protect individuals or corporations from unsafe practices and so developed their own marks, some of which have since become statutory. An example of one of these is the Plimsoll Line, also known as the International Load Line, which indicates the loading limit for cargo ships. The Merchant Ships Act of 1875 provided for the marking of the loading limit on every cargo ship including the maximum depth to which it could be loaded. In 1930 this became the International Load Line and today it is used by 54 nations.

Probably one of the most common product test marks today is CE Marking. CE Marking was developed to create a harmonised system for product conformity. Minimum requirements must be met before a product can be marketed anywhere in the European Union. These requirements are primarily related to the features of a product which might affect health and safety, and the protection of the consumer and the environment.

In recent years consumer protection has become increasingly important. It was always assumed that the consumer could take responsibility for checking goods and services for quality, safety and reliability by common sense, testing before purchase and confronting the seller personally if dissatisfied. Today, however, the technological complexity of products, the remoteness of outlets from the original producer and pressures from advertising have led to this responsibility moving to the producer. In 1962 US President Kennedy said that the consumer had "...the right to safety, to be informed, to choose and to be heard...". This led to the extension of product marking and improved product labelling.

One of the world's best known product marks is the Woolmark. The Woolmark was launched in 1964 and is the symbol of quality assurance in pure new wool. The mark can be seen on 71 per cent of all apparel wool traded worldwide, which equates to over 300 million products per annum. Another type of product mark is the watermark. Watermarks are used to distinguish between different types or grades of paper. They were first used in Italy before the end of the thirteenth century. Now common in banknotes, watermarks give consumers an assurance that the note is genuine and carries its specified value.

Consumer protection can also be seen through the marking of services. The UK government has introduced a Charter Mark scheme for public service

organisations which provides recognition that they provide a first class service. To achieve a Charter Mark an organisation has to have made real improvements in service quality and has ideas on improvements for the future. In addition it must set clear and stringent performance standards, publish performance figures, and consult users on improvements that can be made. Following a number of food safety scares in recent years food labelling has taken on a new priority. In the UK the recently formed Food Standards Agency sets out to protect consumers through effective monitoring and enforcement. It also promotes accurate and meaningful labelling to support consumer choice.

The US Food & Drug Administration (FDA) aims to ensure truthful labelling for food, cosmetics, medicines, medical devices and radiation emitting products and sets labelling standards relating to the make-up of each product and to ensure proper usage. The importance of such regulation can be seen by the fact that the FDA is responsible for over $1 trillion worth of products – this accounts for 25 cents of every dollar spent annually by American consumers.

Product testing and other safety schemes led to the development of international standards for management systems. Consequently certification bodies were established to assess systems against these standards. The use of the LRQA mark today by an approved company gives assurance to the company concerned and its customers that its management systems have been assessed by a third party. The additional use of accreditation marks give further credibility to the approval by demonstrating that the certification body itself has also been independently assessed.

Text 4: CUSTOMER SATISFACTION

Customer satisfaction has become an integral component of ISO 9001:2000 and the new mantra for 21st century business. LRQA is ensuring that its own customers are central to driving the business forward. LRQA will use its customers' opinions to improve service levels and define strategy.

LRQA has over eight years experience in measuring customer satisfaction in an increasing number of countries. This is used to match customer expectations with their actual experience, as well as prioritizing what is important to our market. This helps LRQA continually improve the service delivery process as well as focusing on the operational issues of most importance to customers.

Driving operations

Our current customer satisfaction analysis has helped us to identify changes to our product and service offerings. Consequently, we have improved our services in-line with our customers' expectations, for example:

- we found that our customers want a consistent service and a consistent interpretation of standards, so we have placed significant investment in training our assessors to achieve consistency; this is supported by the delivery of our services through a single global management system.
- we found that our customers appreciate assessors with industry experience, so we introduced a marker-leading system for defining assessor

competence, to ensure that every customer receives the most appropriate assessor for their business.
- we found that some customers appreciate the benefits of having the same assessor for every visit, so we introduced assigned assessors upon request.

However, the burning issue for LRQA is not just gathering customer intelligence to improve existing operations, but using the feedback to help shape our future business. So, LRQA is taking its use of customer satisfaction information to a new level.

Taking customer satisfaction to a new level

LRQA already has basic processes and historical data in place. However, we now want to ensure that, locally and globally, LRQA is responding to customer feedback for the long term benefit of both our customers and our business. Customer satisfaction analysis will continue to be an integral component of our business decision making and a source for continuous improvement – from product development to assessing staff training needs. To achieve this we are embarking on an improvement project which addresses three key stages of our customer satisfaction measurement.

Process

We plan to introduce some new approaches to customer satisfaction measurement, these include:

- working to increase the volume of completed customer surveys to give us more valuable and credible analysis
- expanding our best evaluation methods to every country, thus ensuring we obtain real-time feedback that may require immediate action
- improving the speed of turnaround from surveying to reporting, to provide management with current and accurate analysis
- introducing new methods of measurement to suit each customer and market, whilst increasing the volume of feedback, this will include online and telephone surveying, focus groups and interviews.

Analysis and reporting

The review analysis and reporting of customer satisfaction data will involve:

- increasing the business focus – analysing by key performance indicators, by specific departments and by core business issues
- increasing the customer focus – analysing our performance by sector, with specific sizes of business and by core customer issues
- increasing the product focus – analysing our performance of specific services and matching product development plans to customer needs.

Action

Perhaps most crucially for our customers, we will implement action plans as a result of the customer satisfaction measurement process, that deliver tangible improvements to our service. These action plans form part of the management

information mix, used to help our decision makers around the globe act in the best interests of our customers and LRQA.

Market leaders involve their customers in the development of their business, directly or indirectly. LRQA has for some time advocated the use of customer satisfaction measurement via the products and services that we provide. Through this knowledge and experience, we are looking to ensure that the future for LRQA is not only strong and successful, but centrally driven by our customers.

Text 5: INDEPENDENT ASSURANCE – PROVIDING CONFIDENCE TO YOUR STAKEHOLDERS

Environmental and social responsibility is becoming a growing concern for companies, with legislation and standards being implemented to ensure companies provide accurate and comprehensive performance information and data. Changes in corporate governance, the growth in socially responsible investment funds and more demanding expectations from consumers demonstrate the need for companies to prove their credentials.

Changing demands

Over the last decade the type of information a company presents to its stakeholders has evolved from financial accounts to performance, future policy and sustainability indicators. The event of September 11 and the issues surrounding western capitalism highlight the need for companies to demonstrate that they are taking a responsible approach to business.

Internationally, governments are reviewing their existing legal frameworks to increase the disclosure of performance relating to environmental and social issues, in addition to the financial health of company. At the present time, the preferred approach to this extended form of the 'annual accounts' is voluntary. However, research has shown that this aim is not being met. In the UK, for example, changes to the Companies Act are being considered to make this reporting requirement mandatory. Some countries already have some form of mandatory reporting requirement.

The credibility of the information disclosed is an important issue and one that companies need to address. Independent verification can play an important role in providing third party confirmation of a company's information. Much like a financial auditor that reviews the accuracy of accounts, companies are increasingly requesting a similar check of their environmental and social data. LRQA is able to offer a number of services relating to verification.

Corporate reporting

Corporate reporting reviews a company's report to ensure that it addresses stakeholder concerns on environmental and social performance. The role of the verifier, such as LRQA, is to validate that the report is balanced, fair, complete, unbiased and that it provides a relevant account of the company's business.

Currently there is no specific standard on corporate reporting so a company can choose what information to publish. However, the recently launched AA 1000 Assurance Standard provides a consolidated approach to the assurance process. More that 600 international companies have produced an environmental report. The majority of these reports are based on international guidelines such as the Global Reporting Initiative (GRI), World Business Council for Sustainable Development and / or the European Union Eco-Management and Audit Scheme (EMAS) Regulation.

Other environmental declarations

These can be used by a company that needs to corroborate the accuracy of information issued to the general public, a third party such as vendor, award scheme, industry sector scheme or as part of a legal application. The information tends to originate from a system and the process of producing a 'certificate of verification' is to validate the system outputs, such as: 1) product related information; 2) significant environmental aspects; 3) objectives, targets and future improvement programmes; 4) emission and performance data.

One of LRQA's core strengths is management systems certification. We are therefore already familiar with standards and the methods of implemention. So, we are able to identify easily any deficiencies and mis-reporting and ensure that these are discussed and rectified.

Greenhouse gas emissions

The Kyoto Protocol commits signature countries to Annex 1 to reduce their greenhouse gas (GHG) emissions by an agreed amount over a commitment period. In April 2002, the UK introduced a new policy initiative known as the 'Emission Trading Scheme' which allows UK companies to get early experience of emissions trading. As part of this scheme, all reported GHG emissions are subject to independent third party verification. This is currently a UK scheme, although the European Commission has proposed that EU-wide trading at a site level should start in 2005.

This service confirms the participant's figures submitted to the Department for Environment, Food & Rural Affairs and generates a 'verification opinion' based on finding and related to materiality. LRQA is an accredited verifier for this scheme and our participant clients account for around ten per cent of emission reductions for 2006. LRQA has been involved in many of the consultation phases of this scheme and we provide a consistent and reliable risk-based assessment derived from detailed knowledge of the scheme.

EcoPorts

The EcoPorts Foundation and Lloyd's Register in Rotterdam have developed a standard to encourage best practice in the environmental management of ports. This standard, known as Port Environmental Review System (PERS), defines good practice for reviewing and reporting significant aspects. It is aimed specifically at environmental protection and sustainable development. Once a port authority has

completed the PERS documentation it can apply for a 'certificate of verification'. Having PERS means that the public can be confident that the port authority is aware of its environmental impacts and legal responsibilities.

Why choose verification?

There are a number of reasons why a company may choose to use independent verification. A report can promote an improved public image for a company and the fact that this image has been sanctioned by a third party create business advantages in a society that is increasingly conscious of the need to prove itself to be a good corporate citizen. Verification also provides a company with an opportunity to identify specific gaps in performance indicators, a comprehensive evaluation of its data collection system, identifies process improvements and provides an indication of the data's materiality, together with a list of errors discovered during the audit. From the stakeholder viewpoint, verification offers improved credibility and confidence in the published information, assurance that the information is reliable and faithfully produced and demonstrates that the company is committed towards transparent accountability and reporting.

It is important that the verifier provides an objective assessment conducted by competent personnel and supported by an international structure to ensure the credibility of the verification process. LRQA is able to offer such a service and as part of the Lloyd's Register Group, we are recognised globally as a company that provides an independent and impartial service. LRQA is able to establish the integrity of a company's management systems to generate the data and information communicated to stakeholders. We can also validate the accuracy and completeness of a company's performance data.

Text 6: GLOBAL COMPANY: GLOBAL SERVICE

Swedish based international Group SKF, the leading manufacturer of rolling bearings achieved ISO 9000, QS-9000 and ISO 14001 for its environmental management system (EMS).

All SKF companies worldwide have ISO 9000 and those SKF companies dealing with automotive customers are certified to the automotive standard QS-9000. We felt it necessary to set up a tough schedule to retain and strengthen our leadership in the bearing industry. We had noticed that a number of important customers were starting to express interest in ISO 14001. We decided to act quickly as a demonstration to our customers of SKF's contribution to the environment.

Global approval

The widespread geographic location of the SKF sites made the task of achieving global approval to ISO 14001 particularly difficult. The SKF manufacturing facilities are spread over five continents with a concentration of sites in Europe and the United States. SKF's certification to ISO 14001 covers all its established manufacturing units, located on 63 sites in 17 countries. Our certification includes sites in countries such as India, South Africa and Poland where

environmental awareness has been traditionally lower than in Western Europe and the United States. The factories in these countries have had a difficult job in reaching the very high standards required by ISO 14001 certification, but they have all worked extremely hard to ensure success.

Global capability

SKF's global EMS project was overseen Mike Abbott – group manager-environmental affairs at SKF – and facilitated at country level by 18 coordinators. A global approach by a company to certification means that the assessment body must also have a global capability and LRQA can provide such a service. SKF had built up a good relationship with LRQA from QMS business. We knew that LRQA would be able to meet our global requirements for environmental management system certification.

LRQA's global service enables it to offer coordination from a single point, consistency of approach and local assessors and local with local knowledge to meet the needs of each specific site. SKF already had over a hundred ISO 9000 and QS-9000 based approvals with LRQA. The QMS programme started ten years ago when needs of the business were different and each unit sought certification as a separate entity.

With EMS the approach was different. The decision was taken to seek certification for the entire group as one entity which brought new challenges. Tim Dowling acted as the account manager for the EMS element of SKF's business. He takes up the story: "My role in the certification process was to be closely involved in client liaison for the smooth implementation of the assessment process and to ensure it met SKF's needs. This meant liaising with the SKF Group manager and the 18 country coordinators. Once we had decided the way in which the assessment was to be carried out, my greatest challenge was to make sure that the certification happened within the agreed time scale.

LRQA is able to offer coordination from a single point. Based in Coventry, Olibhe Collins, international EMS customer service coordinator, looks after SKF account and acts as the day-to-day interface between LRQA offices around the world and SKF. Olibhe outlines her role: "I'm responsible for the administration for the SKF Group global certification. Once the sites to be assessed for each quarter were agreed, I prepared the quotes and contracts for each site. I then planned and organized the assessment visits and this meant liaising with LRQA offices worldwide as well as the SKF sites".

Another important element of LRQA's service is consistency of approach in the assessments. David Dooley is the LRQA coordinating assessor responsible for all technical aspects of the assessments and reviewing the reports. He comments: "The most critical element of my role as the coordinating assessor is to ensure consistency of approach by all of the LRQA assessors worldwide. We achieved this by maintaining technical a close contact with the client regarding technical interpretations and feeding this information to all the assessors via guidance documents. With more than 35 assessors involved in the overall assessment and maintenance of the approval it is essential to ensure that they are all carrying out

assessments in a consistent way".

Global benefits

SKF has already found it is achieving positive benefits from implementing an EMS certified to ISO 14001. The company's vision is to be the leader in its business and to be recognised worldwide as the leader. SKF believes that its global certification to ISO 14001 helps the company to achieve its vision by adding customer value, developing employees and creating shareholder value.

We believe that we will improve customer value by meeting or exceeding the environmental standards our customers impose on us. The certificate provides assurance to our shareholders and others that SKF takes its environmental responsibility seriously and can help our customers meet their responsibilities.

ISO 14001 also helps to improve shareholder value by contributing to the long term stability of the Group. Environmental accidents can be expensive to rectify and lead to adverse publicity and loss of reputation. An effective EMS can help minimize the potential for accidents and provide effective plans for dealing with situations. This can help to protect the environment as well as the company's reputation and its share value.

SKF has also found that the certification is helping to develop its employees. Extensive training was carried out to ensure staff had sufficient environmental awareness to operate the management system. Over 20,000 staff were trained during the project and this will extend to all SKF employees. The system gives more responsibility to employees. SKF has found that responsibility and authority must be delegated to all levels in the company to ensure the system operates efficiently and provides real benefits to the organisation.

SKF has already identified a number of internal benefits from implementing the EMS. EMS has improved our general housekeeping and our ability to monitor and ensure compliance with legal requirements. We have also noticed cost savings from improvements in our waste recycling. In the longer term we hope the system will continue to produce cost reductions through less waste and fewer accidents.

SKF is committed to its environmental management system and believes that it will continue to deliver business benefits. We can sum up the company's thoughts about the ISO 14001 approval: ISO 14001 will develop in the same way as the quality standard, ISO 9000. Those companies that achieved ISO 9000 early had a distinct competitive advantage. As more companies realised the benefits of ISO 9000 and imposed it on suppliers, it became an essential tool for business in many industries. The same development is likely with ISO 14001, and we expect it to become essential to our future business.

Text 7: LRQA BENEFITS EA

The Environment Agency is a well-known name within industry as it is involved in its regulation. One of the major areas of responsibility for this public body is to provide a service of consistent and effective regulation.

Established in 1996, the Environment Agency (EA) is responsible for protecting and enhancing the environment in England and Wales and aims to provide a better environment for present and future generations.

The EA operates through eight regional and 22 area offices with head office functions based in Bristol and London. It has a vast range of responsibilities to do with regulation, monitoring and understanding the processes that affect it. The main responsibilities include:

- regulating over 2,000 industrial processes with the greatest pollution potential
- regulating the disposal of radioactive waste at about 1,000 sites
- regulating the treating, keeping, and disposal of controlled waste, involving 7,500 sites and over 80,000 carriers and brokers
- administering the registration of businesses and redemption schemes
- preserving and improving the quality of rivers, estuaries and coastal waters relating to flood defence.

The EA is currently developing an integrated management system (IMS) which will apply to all key business processes in the organisation and will affect, to some degree, all of the Agency's 9,500 staff. The IMS will incorporate quality, environmental and health and safety management systems. These systems will need to follow the IMS principles. The EA is already operating a robust quality management system (QMS) which applies to the regulatory work in Integrated Pollution Control and the regulation of radioactive substance.

To find out how this system has evolved we need to go back to pre-EA days. The system was initially conceived in 1991 in what was then Her Majesty's Inspectorate of Pollution (HMIP). This body was responsible for the regulation of activities carried out by major operators and included the nuclear industry. The operational work was carried out regionally by inspectors. John Edwards, EA manager of the national service for the integrated management system, explains:

"One of the main reasons for having a QMS was to help achieve a consistency of service across the eight regions. Many organisations operate sites located in various regions, we needed to be sure that our advice wasn't contradictory and that we responded to applications in a consistent way throughout the country.

"Our initial problem was to find a way of translating the standard, that is primarily engineering orientated, to an organisation that delivers a service. We wanted a quality manual that was relevant to our operations rather than one based on the ISO 9001 clauses. We had an initial meeting with LRQA about interpreting the standard. We then set up a number of work groups to establish how we would define terms such as customer, contract and so on. The work groups established the HMIP interpretation of ISO 9001 and this formed the basis of our quality manual in which the key process was seen as regulation.

We wanted the QMS to help us provide a consistent service

The development of the quality system included ten work groups of inspectors from the eight regions. Each group was responsible for defining a set of existing regulatory procedures, identifying the purpose and scope and then flow charting the

activities. Once this was done and agreed by the group the new procedure was written. A consultation process then took place involving all the inspectors. John believes that although this was time consuming it produced a robust set of procedures and helped to develop ownership and commitment to the system. The system was assessed to ISO 9001 in October 1995 by LRQA. John observes:

"We achieved our ISO 9001 certificate at the end of 1995 and we believe that we were the first major regulator to go down this route. In April of the following year the Environment Agency was set up, formed by the merger of the National Rivers Authority, Waste Regulation Authorities and Her Majesty's Inspectorate of Pollution. This was a time of uncertainty for all staff in the new EA and the challenge for us was to maintain the QMS. After a presentation to the directors it was agreed that the quality system should be used as an example of best practise. This enabled the system to be taken forward into the Agency and we were delighted to receive the certificate renewal in November 1998."

However, the certification renewal was only achieved by the hard work and commitment of those involved in the QMS. Being part of the EA meant that the QMS had to change to be effective in the new organisation. John elaborates:

"Getting the agreement of the directors to continue with the QMS was only half the battle, we then had to adapt the system to ensure it was effective and relevant in the new EA. Again we found input from our LRQA assessor, Mike Gelderd, was invaluable. To carry out the transition we established change management plans and these helped us achieve a smooth transition. These plans identified the key issues in the QMS that needed to be addressed, such as updating procedures, reporting lines and internal communications conveying the changes. Time scales were established for the changes and the plans were used as a management tool to monitor and control progress. This process took over a year and a half to complete."

The recent three year certificate renewal is seen very much as an Agency milestone. The QMS is now a well-established system within the EA and it plays an important role in the developing IMS. The QMS is used as a tool for management improvement. Internal quality audits are carried out at each location at least once a year. The results from these audits provide valuable information which is used to help bring about improvements. During an audit issues that are causing a problem are identified. Once identified it is raised as an issue so that a solution can be found.

The EA is required to contribute to achieving sustainable development and thus help provide a better environment. To help achieve this it has produced a strategy supported by a series of action plans and guidance documents. The action plans covering Integrated Pollution Control and the regulation of radioactive substances are relevant to the activities assessed by LRQA. The action plans set out the Agency's objectives and targets for implementing the strategy. These are supported by local plans which identify, assess, prioritise and solve local environmental issues relating to the EA's work to protect and enhance the environment and include input from the local community. This initiative aligns well with the developments in the ISO 9000:2000 which will include provision for continual improvement. Mike Gelderd, LRQA assessor, comments:

"The requirement for continual improvement is only implicit in the current ISO 9000 standard. However, the new standard will include provision for continual improvement. It is encouraging to see an organisation already using this clause to its benefit."

John is in no doubt about the value of third party certification. He concludes:

"Certification brings about the bonus of external audit and hence the requirement to prove implementation and improvement. External assessment by a third party ensures an organisation is doing just that."

Text 8: KEEPING THE CUSTOMER SATISFIED

LRQA is committed to providing a service that is of value to its customers. Customers satisfaction surveys have been run for the past four years and these are now conducted in ten countries. The survey gives LRQA a way of ensuring that it is providing an effective service and helps to identify future customer requirements.

LRQA uses the results of the customer satisfaction survey in several different ways. At an operational level it helps us to maintain the elements in which customers' expectations are met or exceeded by our service delivery. It also gives us information enabling the introduction of new programmes, where appropriate, to make changes to increase or enhance service performance. At a strategic level the survey forms an integral part of the business planning process. It is a key non-financial measure and one that is driven entirely by the customer. As a management system certifier it is crucial to LRQA that we keep developing our knowledge about our customers and their attitudes so we can service their needs more effectively.

Survey results

Now in its fourth year and run in ten countries, it is interesting to see that today the survey results show that the same elements of service are still ranked as highly as ever. Customers focus on the technical issues, such as how we interpret the ISO standard, as well as other aspects such as consistency of assessors during each visit. However, the environment in which any organisation exists is subject to continual change and therefore expectations or attitudes about that organisation are also subject to change. An example of such a change is highlighted by one area of questioning in the survey which asks how long has the client held an approval. When questionnaires are split based on this question, we begin to see customer expectation scores rise the longer the approval has been held. By monitoring these changes in attitude and taking appropriate action we are able to ensure that our clients continue to get the best service available in the management systems marketplace.

Presently LRQA conducts this survey around the world, including the UK, the USA, Japan, Australia and Korea. Consolidation of these results reveals some interesting facts such as the lack of cultural difference towards service delivery across world markets. There is certainly a globally consistent view of what are the top service elements with little variance within the results.

Future developments. LRQA will ensure that customer satisfaction surveys

continue to play an important role in providing customers with the service they want. Our future developments include running the survey in more countries, which will serve to further our understanding of customer issues globally. We believe that the introduction of more programs will enhance our performance and help us to continually improve. The results of a pilot survey carried out by the German business centre in Cologne are currently being analysed. This pilot survey uses the same line of questioning as the present survey but incorporates two new areas. The survey has two additional questionnaires which are aimed at the marketing or sales managers and the managing directors. It is hoped that these will give LRQA an insight into variations in the perception of management system by different functions of the same organisation.

As an organisation we are committed to our customer satisfaction survey. However, we understand that the results, although valuable, are not the reasons for conducting the survey. The value of the research is delivered by ensuring that we take action based upon the findings. This means using the results to feedback directly into the business to effect changes that will impact positively on the relationships we have with our customers and our understanding of their requirements.

Text 9: ISO 9001 & ISO 9004 UPDATE

LRQA is committed to keeping you up-to-date with the developments of the new ISO 9000 standard. In this article Sandy Sutherland, LRQA's corporate technical manager, identifies the main areas of comment to the second Committee Draft (CD2).

In late January 1999 the members of the working group responsible for developing the ISO 9001 and 9004 standards met at the University of Colima in Mexico. The previous working group meeting in late June of last year resulted in CD1 being produced. This was widely circulated via ISO member bodies for comment. At the Colima meeting the working group reviewed the responses to CD1 and taking these into account produced the second Committee Draft (CD2).

Needless to say, there were numerous general comments and around 5,200 specific comments. Overall the comments indicated significant support for the structure and the contents of CD1 but they also highlighted a number of areas that required improvements. A good correlation was noted between the issues highlighted in the verification and validation reports developed within the ISO working group and the high-level comments submitted by member bodies. Additionally, there were also inputs from various liaison groups and a number of proposals for consideration. The effort to achieve greater compatibility between the ISO 9000 and ISO 14000 standards was strengthened by the input from a joint task group consisting of environmental and quality management systems experts.

In response to all these comments and inputs, the following areas for improvement to the CD1 drafts were identified and tackled by the drafting task groups during the meeting:

- the need to clarify the terms 'process approach' to management and the 'process model'

- the requirements for ‘tailoring’ and ‘reduced scope’ in ISO 9001 need clarification. This is in response to the planned withdrawal of the ISO 9002:1994 and ISO 9003:1994 standards, when the revised ISO 9001 and ISO 9004 standards are published
- ‘tailoring’ is highlighted as a specific issue of concern to the regulated industries, such as medical devices, and to the regulation authorities, such as the European Commission
- the need for improved consistency in the terminology within the standards
- the need for greater clarity to help ease the understanding of the texts
- the need to improve compatibility with the ISO 14000 environmental management system standards
- the wording of some requirements in ISO 9001 needs to be improved to facilitate their auditability.

The meeting was successful in producing drafts of ISO/CD2 9001:2000 and ISO/CD2 9004:2000. These will be available through the various national standards bodies during March 1999. The national standards bodies will gather comments on the CD2 drafts and will decide if these can proceed to ballot and onto the next stage of development, a draft international standard (DIS).

It was agreed and supported by the representatives of the technical committee responsible for the ISO 14001 standard, who also participated in the drafting of ISO/CD2 9001:2000 standard, that significant progress has been made in improving the compatibility between the ISO 9001 and ISO 14001. This will be one of most obvious differences that readers will note when comparing CD1 and CD2 versions of ISO 9001.

Considerable efforts were also made to ensure that the CD2 reflected the need for requirements to be expressed in a manner that was both attainable and auditable. The measurement if customer satisfaction and the need to continually improve the quality management system were identified as particularly important.

A significant change in the presentation of ISO 9004 was considered during the meeting. ISO 9001 and ISO 9004 will be maintained as separate documents to meet the needs of users of the standards. However, the presentation of ISO 9004 could be amended to include the ‘requirements’ clauses from ISO 9001 in text ‘boxes’ in relevant places in ISO 9004. It was agreed that this change in presentation would be used for the revised CD of ISO 9004.

The working group will meet again during September 1999 to review the results of the CD ballots and associated comments. In the event of positive ballot results, the working group will prepare to revise the texts of the CD2s into the next formal draft stage, the DIS.

LRQA is committed to keeping customers up-to-date with the changes to the standards. LRQA assessors are kept informed about the changes and their potential impact, they will be able to advise you during customer visits. We are also producing a newsletter, the Standard Issue, designed to keep you updated with relevant information about the new standards.

PART 2

Reporting

Throughout history, human beings have made many discoveries about themselves and their environment. However, modern science did not really begin until people started reporting their observations and discoveries and communicating their ideas. This was not always done. In ancient Greece, a secret society of mathematicians, known as the Pythagoreans, hid their findings from the world. In the Middle Ages the alchemists went to great lengths to conceal their discoveries. Today, scientists report their findings and detail their experimental methods in journals, inviting others to perform experiments to verify or disprove the results. Each discovery suggests new paths of investigation, leading to the increasingly rapid expansion of scientific knowledge.

Most discoveries are not accomplished by one person but by a sharing or exchange of information with researchers building on each other's work. The development of atomic energy, for example, was based on the work of Albert Einstein, Niels Bohr, Enrico Fermi, and many other scientists in Europe and America. The development of the computer and the project that put a man on the moon are other examples of great scientific achievements that were joint efforts. This type of cooperation is dependent upon intelligent, accurate reporting.

USING ENGLISH TO REPORT

Different tenses arc used to report past actions. The simple past tense is the most frequently used in scientific writing.

A COMPLETED ACTION

This one-celled organism ate, grew, responded to its surroundings, reproduced itself, and spread throughout the oceans.

(These actions have taken place a long time ago and are completed.)

Simple past tense: ate, grew, responded, reproduced, spread

Probably those first tiny organisms were not all alike.

(This sentence reports a condition rather than an action.)

Simple past tense: were

…their characteristics were passed onto the next generation.

(The passive form is used because the action is more important than the performer of the action.)

Simple past tense, passive form: were passed

AN UNCOMPLETED ACTION

The date, more than 400.000 species of plants and 1.200.00 species of animals have developed.

(This is an action that has taken place over a period of time, is taking place now, and will probably continue into the future.)

Present perfect tense: have developed

All life has probably evolved from that single original cell …

(This action is also incomplete, that is, life is still evolving.)

Present perfect tense: has evolved

AN ACTION COMPLETED BEFORE A GIVEN PAST TIME

Therefore, about 2.5 billion years had passed on the earth when life originated.
Past perfect tense: had passed
Sentence Patterns

REPORTING A COMPLETED ACTION (SIMPLE PAST TENSE)

Darwin	{ published / announced / proposed }	his theory of evolution in 1859.	

REPORTING AN UNCOMPLETED OR RECENT ACTION
(PRESENT PERFECT TENSE)

Biologists / He/She	have / has	{ often / already / just / seldom / sometimes / not yet / recently / still not / usually } made	new discoveries.

REPORTING AN ACTION COMPLETED BEFORE A GIVEN TIME
(PAST PERFECT TENSE)

REPORTING A CONTINUOUS ACTION (PAST CONTINUOUS, PRESENT PERFECT CONTINUOUS. AND PAST PERFECT CONTINUOUS TENSES)
NOTES: When reporting, remember the following:
1. Adverbs of time and frequency (such as often, already, and usually) are usually used with the present perfect tense.
2. The continuous past tenses are included above for reference. However, they are not discussed in the chapter because they do not occur frequently in scientific writing.

An important way of organizing ideas, described by Michael Hoey in On the surface of discourse (1983), is as follow:

Situation
Problem
Response
Evaluation / Result

With variations, this organisation forms the basis of much discursive and academic writing, and a set of questions derived from this sequence makes a useful prompt for writers:

Situation	What is the present situation?
	How did it come about?

	What are its characteristics?
Problem	Is there a problem?
	What is it?
Response	How can the problem be dealt with?
	What alternative solutions are there?
	What constraints are there on each possible solution?
Evaluation	Which of the solutions is likely to be the best?
	What would be the result of applying any of the solutions?

If the writer is reporting on past problems and solutions, the question will be modified accordingly, for example:

What was the situation?

What were its characteristics?

Was there a problem? and so on.

Such an ordered set of questions defines the basic organisation of ideas, thus providing a framework of structuring the actual writing. The questions can give rise to text ranging in length from a paragraph to a complete book.

Another way of examining the topic is to use some categories and sets of questions, following the principles of classical invention derived from Aristotle.

1. Definition

What are X-s? Classify and divide them into types.

What are X-s related to?

2. Comparison

To what extent are X-s like or different from what they are being compared with?

3. Relationship

What caused X-s? What effect do X-s have on people?

What comes before X-s? What follows X-s?

What is against X-s?

4. Circumstances

What kinds of X-s are possible? What things in X-s are possible?

What is not possible?

What are past facts about X-s? What can we predict about X-s for the future?

5. Testimony

Where did X-s originate? Who says so?

What statistics are available? What time-tested theories or laws support X-s? What personal experiences of X-s do you have?

An even more extensive selection of questions can be used, covering a large range of functions, not all of which may be appropriate to the topic concerned. The questions are not, of course, in any kind of order and answers will need organizing and grouping in subsequent stages.

Questions	Function
1. What does X mean?	Definition
2. How can X be described?	Description
3. What are the component parts of X?	Analysis
4. How is X made or done?	Analysis of process

5. How should X be made or done?	Recommendation
6. What is the essential function of X?	Analysis of function
7. What are the causes of X?	Analysis of origins
8. What are the consequences of X?	Analysis of outcomes
9. What are the types of X?	Classification
10. How does X compare with Y?	Comparison
11. What is the present status of X?	Evaluation
12. How can X be interpreted?	Interpretation
13. What are the facts about X?	Reporting
14. How did X happen?	Narration
15. What kind of person is X?	Characterisation
16. What is my personal response to X?	Reflection
17. What is my memory of X?	Reminiscence
18. What is the value of X?	Evaluation
19. How can X be summarized?	Summary
20. What case can be made for or against X?	Argument

COMPARING

Scientists try to organize information by seeking relationships. Classification is one way of arranging information. Comparing is another.

Comparisons not only arrange information but also expand it. When prehistoric human beings noticed that wood burns and stone does not, they were making an important step toward advancing scientific knowledge. Often comparisons enable us to solve problems. For example, to determine which substance to use for electrical wiring, various metals are compared for electrical conductivity, cost, availability, and the like.

Comparisons provide a new perspective on information. For example, the fact that an ant can carry a crumb of bread only becomes impressive when the crumb is discovered to be three times the weight of the ant. The fact that water expands when it becomes solid is more interesting when comparisons show that all other liquids contract, or lake up less space, as they solidify. It was a comparison of the habits of lung cancer victims with those of the general population that led to the discovery of a link between smoking and lung cancer. Comparisons arc thus a pan of every aspect of science.

USING ENGLISH TO COMPARE

Comparing is examining two or more items to discover their similarities and differences. Comparing may but does not always concentrate on similarities. Contrasting concentrates on differences.

COMPARING SIMILARITIES

Magnetismus is { like / similar to / comparable to / as important as } aluminum.

Magnesium { resembles / parallels } aluminum in many ways.

CONTRASTING DIFFERENCES

Iron { is unlike / is different from / differs from } aluminum.

Unlike iron,
In contrast to iron,
Compared to iron,
In comparison to iron, } aluminum is light.

Iron is { heavier than / less abundant than / not as soft as } aluminum.

Iron is a { relatively / comparatively } soft metal.

EXEMPLIFYING

After giving a definition or making any general statement, the best way to clarify a point is to give an example of it. A Chinese proverb says that a picture is worth a thousand words. It might also be said that one example is worth a thousand explanations. An example brings the general or abstract statement down to a specific or concrete image. For example, it is one thing to say that smoking is bad for your health and another to say that a regular smoker loses about five and a half minutes of life expectancy for each cigarette smoked. The example adds impact, making the statement more memorable, more interesting, and more persuasive, as well as providing evidence for it.

Scientists use examples to explain or clarify a concept and to give evidence to support it. Examples can sometimes serve to test the validity of a point. If no example can be found to illustrate a point, (here may not be a point.

USING ENGUSH TO EXEMPLIFY

The above passage makes several claims about how temperature affects mailer. Each statement is followed by specific examples that serve to illustrate the point.

(Examples nuke a point clearer and at the same time. give evidence to support it.)

For example, at a temperature of 0^{o} C or below, water is a solid....

Temperature alters the colour of matter.

(An example may comprise a few words, a sentence, a paragraph or more).

Iron, for example, turns red, then orange, and then white at increasingly higher temperatures.

The size of an object is affected by temperature.
(Examples are not always marked with due words such as *for example, for instance*, and *to illustrate*, and often can only be identified by the context of the paragraph).
A glass may break when boiling water is poured onto it …
Temperature also affects the pressure of a gas.
If a closed glass tube is heated, the increased pressure inside will cause it to break.
The ability of a metal to resist electricity varies with its temperature.
Heated wires cause excess electrical movement, which can damage machines.
Living things are very sensitive to comparatively small temperature changes.
(Sometimes more than one example is used to explain the various aspects of a concept).
This is exemplified when we touch something very hot or cold and feel pain.
…We pasteurize milk and cook meat to kill harmful bacteria and other organisms that tolerate heat.

Exemplifying

For example,
For instance,
To be specific,
To illustrate,
} iron turns red when it is heated.

Iron is { for example, / for instance, } turns red when heated.

Iron is { an example / a case / an instance / an illustration } of a substance that turns red when heated.

Iron { exemplifies / illustrates } the concept of heat affecting color.

The concept of heat affecting color is { exemplified / illustrates } by iron.

Solids { such as / like } iron and copper turn red when heated.

Note: When writing examples, remember the following:
1. Examples in science are usually written in the present simple tense.
2. Examples are also used to illustrate terms, and these examples are similar to classification. For instance, the sentence "Copper is an example of a metal" is both an example and classification. If all possible examples of a term are given, it is more classification than example.

3. Examples are not always marked with due words and often can only be identified by the context of the paragraph.

DESCRIBING

A description serves to introduce a scientist's view of the world. It may describe conditions, results of an experiment, chemical changes, physical movements, or what is seen through a telescope or microscope. A description may also tell the characteristics or distinctive features of an object – how it looks, sounds, tastes, smells, works, or is produced.

The nature of something can be explained by describing it. For example, the concept of an atom is difficult to grasp from a definition alone, but a description of its appearance, detailing its structure and function, makes it easier to visualize.

USING ENGLISH TO DESCRIBE

Scientific writing includes descriptions of processes, substances, concepts, conditions, and events. The above passage describes some of the physical, functional and chemical properties of the sun.

PHYSICAL DESCRIPTION

It is a flaming ball of extremely hot gases.
Shape: bail. Physical composition: hot, flaming gases
The surface temperature is about 11.000^{o} F, hot enough 10 turn every solid to vapor, but relatively coot compared to the interns heat at the center.
Located about 93 million miles from the earth…
Position of location: 93 million miles from the earth
…the sun has a diameter that is approximately equal to 109 of our earths lined up like a row of beach balls, and a mass that is about 330.000 times the mass of the earth.
Diameter: 109 x earth's diameter. Mass: 330.000 x earth's mass
Functional description: The sun is the original source of nearly all our energy.
Importance: source of our energy
Chemical description
It is mostly made of hydrogen, although it also contains nearly every other kind of atom that exists on the earth.
Chemical composition: mostly hydrogen + nearly all other known atoms

Describing characteristics

The Nile River Mount Everest	is	4.145 miles 8.848 meters	long. high.	
The Nile The sun	has a	length surface temperature	of	4.145 miles. 11.000^{o} F.

The length of the Nile is 4.145 miles.

Pluto Glass Blue stars	is/are	relatively somewhat extremely	small. brittle and transparent. hot.

Note: The present simple tense is used frequently when describing, because descriptions in science are usually universals. The most commonly used verbs are “to be” and “to have”.

Using Precise Descriptions. Science demands objectivity and precision in its descriptions. To describe a comet as fantastic or long and beautiful tells very little. The word “fantastic” describes how you feel about something, but it does not bring an image to mind. “Long” is a relative term. Scientists need to be specific. Is it a mile long? 50 miles? 1.000 miles? 100.000 miles? The word “beautiful” is subjective. Is it luminous or dull? bright or dim? transparent or opaque? Adjectives must be objective and concrete. Dimensions should be quantitative.

CLASSIFYING

The early stages of scientific research involve making observations and gathering information. However, merely collecting facts is not enough. The scientific needs to arrange and classify the facts and to find relationships among them.

The word “classification” comes from the word “class” – meaning a group of things that all have one important element in common. Scientists group related information into an array. Chemists, for example, cannot study every element, but can make generalizations by arranging all the elements into groups with related properties. Thus, if iodine is identified as belonging to the same group as chlorine and bromine, its properties can be predicted. Similarly, since there are several million kinds of plants and animals on earth. It is clearly impossible to study each one. However, by classifying an animal as a member of a particular group, or species, a biologist can predict its characteristics. Classification is thus very basic to scientific thought and expression.

USING ENGLISH TO CLASSIFY

A classification includes:

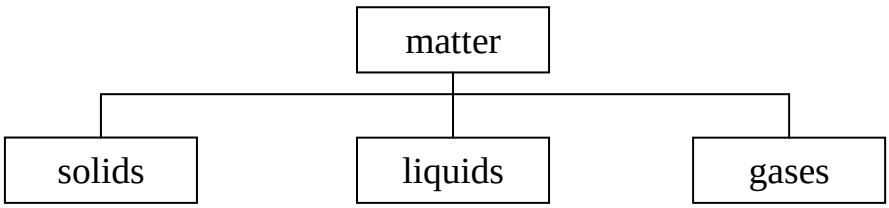
1) a general class; 2) a specific item or items; 3) a basis for classification, which is frequently not started because it is understood or explained elsewhere.

Consider this sample sentence:

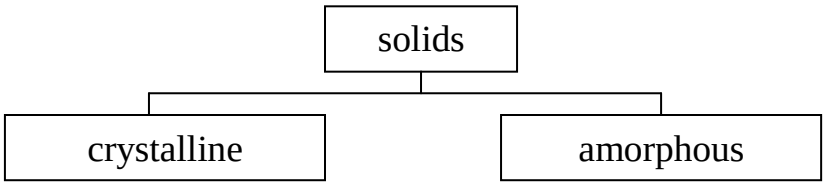
All matter may be classified as either solid, liquid or gas.

The general class is “matter”. The specific items are solid, liquid and gas. The basis for classification is the physical state of matter, which is not mentioned in the sentence. But there is more than one way matter may be classified. For example, it may be classified on the basis of its chemical composition as either living or nonliving. For this reason, classification sentences frequently contain modals of possibility, such as “can”, “could”, or “may”.

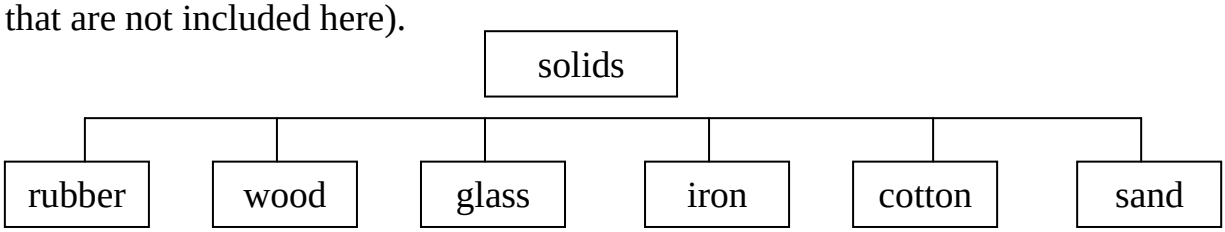
Classifying from general to specific



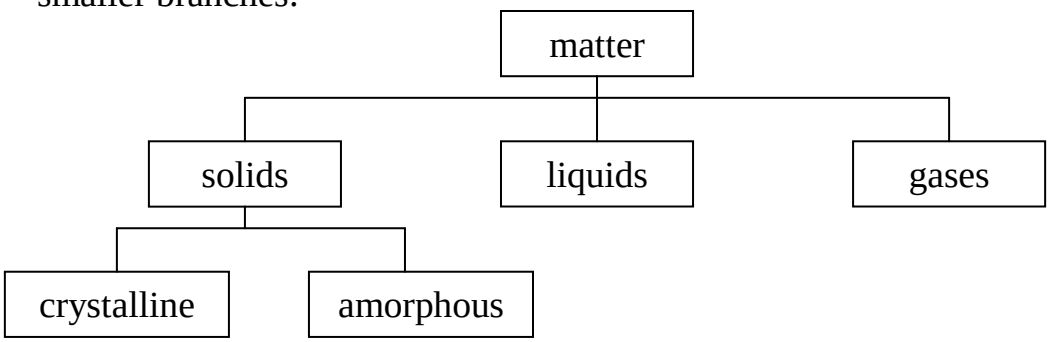
Solids may be further divided into two classes: crystalline and amorphous.



Classifying from specific to general
Rubber, wood, glass, iron, cotton and sand are all classified as solid.
(When classifying from specific to general, the specific items do not necessarily cover all the subdivisions of the general category: that is, there are obviously other solids that are not included here).



Note: The trunk of each classification may be divided into large branches, each branch is subdivided into smaller branches, and smaller branches may subdivide again into smaller branches:



1. The passive form is used frequently in sentences of classification and in all scientific writing because the emphasis in science is usually on the action, not on the person performing the action.
2. The present simple tense is the most commonly used tense in scientific writing because it expresses universals. For example, water freezes at 0^{o} C.
3. In a sentence like "Oxygen is a gas" only the meanings of the words "oxygen" and "gas" will reveal which is the general category and which is the specific item.

Classifying from general to specific

Matter { is/are / may/ can/ could be } { classified / grouped / divided / arranged } into { divisions. / groups. / types / categories }

There are three { types / kinds / classes / categories } of matter.

Classifying from specific to general

Oxygen { may be / can be / is/are } { classified / classed / categorized } as a gas.

Oxygen is { an example of a / a type of / a kind of / a form / a } gas.

CAUSE AND EFFECT

The process of seeking relationships among scientific facts includes looking for cause and effect. The fifth-century Greek philosopher Leucippus suggested that there is causality in nature, that is, that every natural event has a natural cause. All science is based on this assumption. For example, something causes apples to fall, planets to stay in their orbits, the sun to emit energy, and a baby to be born with a defect.

Scientists must be careful, however, not to assume that one event caused another just because they happened in sequence. If there is an earthquake the day a comet passes near the earth. It cannot be assumed that the two events are related.

Sometimes the effect of one occurrence becomes the cause of a second event, and the effect of the second becomes the cause of a third. A nuclear reaction is an example of this kind of causal link. As one uranium atom is split, it releases neutrons that in turn split other uranium atoms. The result is a continuous chain reaction of causes and effects. It is the job of science to connect situations and events and thereby discover the how's and why's of our world.

USING ENGLISH TO SHOW CAUSE AND EFFECT

Causes and effects connect events or situations. Causes explain why something happens. Effects describe outcomes.

… a wavelength of 4000 nanometers (nm) causes us to see violet.

CAUSE		EFFECT
wavelength of 4000	⟶	we see violet

The colour browns is inducted by the mixing of wavelength.

(Sometimes the effect precedes the cause in the sentence. By definition, however, causes always precede effects).

CAUSE		EFFECT
the colour brown	→	a mixing of wavelength

Yellow can be produced by either its own wavelength or a mixture of the wavelengths for red and green.
(Causes and effects are often complex. One effect may be produced by many causes, and one cause may produce many effects).

CAUSE		EFFECT
yellow	←	its own wavelength
		or
	←	a mixture of the wavelengths for red and green

Wavelengths sorter than that of violet produce ultraviolet light that can damage skin cells.
(An effect can become a cause. Sometimes there is a cycle of causes and effects).

CAUSE		CAUSE / EFFECT		EFFECT
wavelengths than that of violet	→	ultraviolet light	→	damaged skin cells

A mixing of all wavelengths { causes / results in / produces / induces } a white light.

White light is { caused by / due to / induced by / a result of / produced by } a mixing of wavelengths.

{ If / When / As } all the wavelengths are mixed, a white light is produced.

A white light is produced { if / when / as } all the wavelengths are mixed.

Note: Some of the above are also predictions and can be expressed with the future tense. For example: “If all the wavelengths are mixed, a white light will be produced”.

DEFINING

When making a hypothesis or other statement, scientists must make sure they are understood by other researchers. Misunderstandings occur when there are different concepts of what is being discussed.

USING ENGLISH TO DEFINE

Aristotle suggested that a good definition should include the general classification of a term plus the specific characteristics that differentiate the term from other members of its class. For example, a definition of a giraffe should include a classification, such as, "A giraffe is an animal", and a specific characteristics, such as, "A giraffe is a tall, African animal with a very long neck".

Definition formula: Term = Class + Characteristics

Chemical energy is potential energy that is stored in gasoline, food, and oil.
(Frequently, the characteristics appear as a relative clause beginning with *which, that, who,* or *where).*

Term		Class		Characteristics
chemical energy	=	potential energy	+	that is stored in gasoline, food, and oil

Mechanical energy is energy related to the movement of objects.

Term		Class		Characteristics
mechanical energy	=	energy	+	(that is) related to the movement of objects

Energy is the ability to do work… Kinetic energy is the energy of motion.
(Sometimes the characteristics take the form of an infinitive phrase or prepositional phrase).

Term		Class		Characteristics	
energy	=	ability	+	to do work	(infinitive phrase)

NOTE: When defining, remember the following:
1. Definitions require the present simple tense and the verb 'to be'.
2. The definite article 'the' is usually not used with the term being defined because definitions are general statements. For example, we would define *a* giraffe (in general), not *the* giraffe (a specific giraffe).

DEFINING - GENERAL

TERM = CLASS WORD + SPECIFIC CHARACTERISTICS

An astronomer	is	a scientist	who	studies the universe.
A barometer		an instrument	that	measures air pressure.
Conduction		a process	by which	heat is transferred.
A laboratory		a place	where	experiments are performed.

Physics	is	the study	of matter and energy.
A volt		a unit	for measuring electrical pressure.

TERM = SPECIFIC CHARACTERISTICS + GENERAL CLASS WORD

Mercury	is a	a liquid	metal.
A triangle		three-sided	plane figure.
Asbestos		fire-resistant	mineral.
A dinosaur		prehistoric	reptile.