The Intergration Of Content And Study
In An EST Programme

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1 Introduction

The University of Malaya Regulations, Act IV, Part I (Amended) states that for the second year course of study,

> "All students who are admitted on the basis of qualifications obtained through the medium of Bahasa Malaysia at STP level must take the course SF205 English I ...."

(University of Malaya Calendar 1984/85, pp. 268)

The second-year students in the 1984/85 session were the first group to have obtained their Higher School Certificate through the medium of Bahasa Malaysia and as such were required to take the course SF205 English I This paper is an attempt at describing the rationale for course design, materials development and teaching procedures used in the programme.

The programme needed to take into account the fact that undergraduates would be taking a variety of courses from the following departments:

Biochemistry	Geography
Botany	Geology
Chemistry	Mathematics
Educational Studies	Physics
Genetics and Cellular Biology	Zoology

Another factor that had to be kept in mind was the varying levels of proficiency in English amongst undergraduates. Most of them would have received instruction in the language for eleven years and a smaller number - those who had their early education in Chinese and Tamil primary schools - would have been taught the language for nine years. For both groups, in the fourth and fifth forms of the secondary school, instruction would have been in the 'communicational' use of the language. These undergraduates would not have received any instruction in the English language in the sixth form. There is a broad spectrum in terms of proficiency levels. At one end there is a small group with a high level of proficiency and at the other an equal number who do not seem to have benefitted from instruction and the

larger middle group shows a varying range of ability. The course had to be designed against this background of differing subject disciplines and proficiency levels.

The University of Malaya's policy on the teaching of English for reading comprehension (Asmah Hj. Omar 1979) is well reflected in the course aims (SF205) which are as follows:

1)   To raise the level of the students' reading proficiency in English so that they will be able to read textbooks, journals and other reference materials in English, with special reference to Science Texts.

2)   The course will also attempt to equip students with the skills they need to locate, select, store, retrieve and use written knowledge for academic purposes, and to perform these tasks with the necessary speed and flexibility

3)   To raise the students' level of spoken English so that they will be able to participate in tutorials, seminars and social situations.

The weightage given to these components in the examination for this course shows the importance accorded to each. Reading comprehension and study skills carry 80% of the marks and the oral test - an interview - carries 20%. The time allocation for the course is 3 contact hours per week spread over a minimum of twenty weeks. Students would spend two hours a week on reading comprehension and study skills while the remaining hour would be spent in the language laboratory on listening comprehension and oral interaction activities. Thus, the course had to be designed with all these factors in mind.

2.0 Towards A Model of Reading Comprehension

It is obvious that the University's policy on the teaching of English lays stress on the current real needs of undergraduates as opposed to their future real needs or future hypothetical needs (Mackay, R. 1980). The purpose is to provide undergraduates with the kind of English to language and study skills that would be most useful to them in the pursuit of their academic studies. In this context the reading skills emerge as the most relevant. The rationale behind this is evident in the following statement that the more closely a second-language teaching programme is based on the identified uses to which a specific group of students will put the language, the more successful and effective the course will be (Selinker, Trimble, and Vroman, 1972).

A logical first step seemed to be a need to identify the processes involved in reading comprehension related to the field of EST It was hoped that a search of the literature would provide the answer to this

and other questions related to course design and materials development.

What is most striking in the literature of EST is the tentativeness of long established practitioners in the field. The two examples provided below are a reflection of this. The first of these is:

> "What then are the features of language organization that need mastering before the information coded in English can be unlocked? What kind of objectives
> reading success? These are problems for which we have only the crudest answers, but clearly they involve specifying the crucial features of

> 1. the conceptual competence
> 2. the rhetorical competence
> 3. the grammatical competence

> that should reside in the knowledge store of the individual student.
> (Jones and Roe, 1976).

The second reads as follows:

> "We have yet to determine precisely what learners of different ages in different educational environments, studying for different technical purposes, need to be told in their instruction, as well as what they might have practice in, in order to gain access to full meaning. Thus it is our contention that researchers must begin to gain information about the reading strategies that learners use when attempting to learn to read in a second language for professional needs, including the ways in which readers change intended messages at moments of 'frustration'.

> (Selinker, Trimble and Trimble 1976).

Faced with this situation of uncertainty the novice is tempted to look for ready-made solutions in the form of published materials. One is faced with a variety of "approaches" and claims. Although the textbooks examined claim unreservedly to teach the language of science and technology, there is little evidence that their authors have made the necessary efforts
in the first place, and the lack of agreement between textbooks as regards their valid teaching of content only emphasises the hapzard nature of the linguistic criteria applied. (Ewer, J.R. and Boys, O. 1981). In the face of Ewer's evaluation and criticism of these, the search has to be started anew.

The psycholinguistic model of reading proposed by Goodman seems to hold promise for the task at hand. Reading is viewed as an active process of prediction, selection, and confirmation in which the reader brings to bear not only knowledge of the language but also internal concepts of the processing of language information encoded in graphic

symbols, past experiential background, and general conceptual back-
ground. (Goodman, 1971). The next step is to consider the relevance
of schema theory to the processing of EST texts. Hudson's view is
that

> the reading problems of the L reader are not due to an absence of
> attempts at fitting and providing specific schemata ... Rather, the
> problem lies in projecting appropriate schemata (Hudson 1982:9)

Carrell believes that second language readers are persistent in their
attempts to provide schemata to make sense of texts. The effort fails
if the reader cannot access the appropriate existing schemata necessary
to understand a text. The explanation given is that:

> Most commonly, acessing appropriate content schemata depends on
> textual cues; the graphic display must be somehow reconstructed by the
> reader as meaningful language. At this point, general language processing
> skills are most important. For second language readers, then, obviously
> some language proficiency is required to activate relevant schemata,
> and it is not surprising that failures to access appropriate schemata (i.e.
> comprehend) are often interpreted solely as deficiencies in language
> processing skills. (Carrell 1983).

In this context Ciiko (1978) posits that syntactic, semantic, and
discourse constraints serve as important sources of information for
the fluent L reader and that much of the difficulty in L reading may
be due to an inability to make full use of those contraints because of
low language proficiency The conclusion that Hudson (1982) draws
from this is that

> in then of L reading then, there is renewed emphasis on the traditional
> or decoding view of reading as parasitic on language. Here then was a
> model, however tentative, on which the curriculum design could be
> based. The model was seen as a fundamental basis for specifying the
> content of the materials.

3.0 Syllabus Design

Implicit in the design of language teaching material is a view of
language and learning which are identified with a particular approach
(Richards and Rogers, 1982). The theory of language as seen in these
materials is

> a view of language as communication, characterised by variable relation-
> ships between form and function: a view which sees language in terms
> of a dynamic process of the sharing and negotiating of meanings
> through the shared and recreated conventions governing particular
> communicative performances. (Candlin 1979).

Although language is seen as a means for communication, no claim is made that the materials discussed here are entirely communicative in approach. Neither can it be said that learning is viewed as entirely linear, synthetic or incremental. It is hoped that the materials reflect a kind of enriched eclectism which grows in an awareness of new insights into skills and processes and the recent emphasis on rule-governed creativity. (Tickoo, 1976).

"Before the specification of course content there is a need to see the link between content and process. Candlin (1979) believes that content in methodology is the link between the content of the target language and the content which the learner brings to the learning. Further, content is seen as that which the teaching-learning process works upon. Content is thus viewed as the servant of the process within methodology Process is seen as what teachers and learners undertake during language learning and it is said to represent the language teaching curriculum in action in the classroom.

4.0 Content Choice and Organization

Certain decisions concerning the selection of content had to be made. These involved both the subject matter and linguistic content of the materials. The discussion on the subject matter revolved around the content of the texts to be selected for reading comprehension. The ideal form of integration would have been the choice of an equal number of texts in the different subject areas ranging from Biochemistry, Botany, Chemistry, Genetic and Cellular Biology, Education, Geography, Geology, Mathematics, Physics to Zoology Would the inclusion of two texts from each subject area ensure the kind of content validity that was being hoped for the materials. A related issue was the capacity of Arts-biased teachers to deal with texts in Chemistry, Mathematics and Physics. One would have to admit that the Teacher/ Student "Gulf" does exist in Narrow-Angle EST Should one then follow the advice to track back into the calmer waters of science and technology in general and operate in the "frontier" and "regional" technology suggested by Williams (1978). This seemed a reasonable proposition but there were other factors that needed to be taken into account in the selection of texts. Within the confines of the selected subject areas and the related "frontier" technology the choice of a text would depend on whether it would lend itself to the teaching of the linguistic, study-skill or rhetorical component specified in the unit. A decision was taken that texts selected should come from books in the reading lists provided for the various courses. It was argued that this would provide authenticity for the materials as well as the tasks set.

4.1 The acceptance of the decoding view of reading as parasitic on language (Hudson, op.cit) pointed to the linguistic and conceptual aspects of competence as forming the main story of the curriculum with study-skills and rhetorical functions supplementing it. A search of the literature did not yield an accepted specification of the language/communication skills involved in the reading process. The language/communication skills prepared by Roger Hawkey and adapted by Carroll (1980) seemed to offer possibilities in this direction. Working on intuitive grounds the materials writing team extracted those skills which were felt to be relevant to the process of reading comprehension in the light of the view of reading posited earlier. These are as follows:

Skill:

Number

16.   Deducing the meaning and use of unfamiliar lexical items through:
      I   Understanding word formation:

             stem/roots;
             affixation,
             derivation,
             compounding.

             .... Contextual clues.

20.   Understanding explicitly stated information.

22.   Understanding information in the text, not explicitly stated, through:
      Making inferences

24.   Understanding conceptual meaning, especially:
      1.   Quantity and amount.
      2.   Definiteness and indefiniteness.
      3.   Comparison; degree
      4.   Time (especially aspect)
      5.   Location, direction
      6.   Means; instrument
      7   Cause; result; purpose; reason; condition; contrast

28.   Understanding relations within the sentence, especially:

      long premodification, and postmodification, especially postmodification by prepositional phrase.

41.   Selective extraction of relevant points from a text, involving:

      The co-ordination of related information;

      The ordered rearrangement of contrasting items;
      The tabulation of information for comparison and contrast.

4.2 The following is a list of the basic reference or study- skills extracted from the same source for inclusion in the materials.

Skill:
Number

44.   Basic reference skills: understanding and use of:

      Graphic presentaton, viz. headings, sub-headings, numbering;
      Cross-referencing; Card catalogue.

45.   Skimming to obtain:

      The gist of the text; A general impression of the text.

46.   Scanning to locate specifically required information on:

      A single point, involving a complex search;
      More than one point, involving a complex search;
      A whole topic.

51   Transcoding information presented in diagrammatic display, involving:

      Conversion of diagram/table/graph into speech/writing.

52.   Transcoding information in speech/writing to diagrammatic display, through:

      Completing a diagram/table/graph, Constructing one or more diagrams/tables/graphs.

      (Carroll, B.J 1980).

      4.3 The next task in the specification of content involved the inclusion of the "Specific Rhetorical Functions Employed to Develop the General Functions of Level B" in the Rhetorical

30.   Understanding relations between parts of a text through lexical cohesion devices, especially:

        Lexical set/collocation

31.   Understanding relations between part of a text through grammatical cohesion devices, especially·

        Reference
        Substitution
        Ellipsis
        Logical connectors.

34.   Interpreting text by going outside it:

        Using exophonic reference;
        'Reading between the lines';
        Integrating data in the text with own experience or knowledge of the world.

35.   Recognizing indicators in discourse for·

        Transition to a new idea; Anticipating an objection or contrary view.

37.   Identifying the main point or important information in a piece of discourse, through:

        Vocal underlining;
        Verbal cues;
        Topic sentences, in paragraphs of inductive and deductive organization.

38.   Distinguishing the main idea from supporting details by differentiating:

        The whole from its parts;
        Fact from opinion;
        A proposition from its argument.

40.   Extracting salient points to summarize:

        The whole text;
        A specific idea/topic in the text;
        The underlying ideas or point of the text.

Process Chart (Selinker, L., Todd Trimble, R.M. and Louis Trimble, 1976). The examples provided are as follows:

1. Definition
2. Classification
3. Description: Physical and Function
4. Description. Process.

The reasoning behind the decision to focus on these was that students would need to know the formal realisations of these specific rhetorical functions in order to derive the explicit and implied meanings in the reading texts and to carry out the tasks set in the study-skills component of the course. It was felt that the General Rhetorical Functions employed at Level B and the Rhetorical Techniques of Level D would emerge as a result of the guidelines set for text selection.

4.4 The explicit guiding principle in text selection was that there ought to be integration of subject content from the different courses the students were taking. Each unit of the course was allocated a specific subject area from which the reading text was to be selected. The choice of a particular text within the specified content area would depend on whether it lent itself to exploitation of the implied focus of the unit. This would be in terms of the reading skill, notion or function which formed the teaching point of the unit. For the units which dealt with the understanding of conceptual meaning e.g. Quantity and Amount, reference was made to the Council of Europe's "functions" and notions (Van EK. 1976: 37-42) to specify these. The reading text selected for this unit had to deal with some of the following notions: weight, size, length, pressure, volume, temperature, number, age, degree. Based on the above specification of content it was decided that 18 units of materials would be written. This would form the first year course for the two year programme. The team had a two-week workshop and together produced two units of the course materials to map out the common grounds and strategies on which the materials were to be developed. This necessitated a common understanding among the materials writers as to the final outcome of the process in terms of the individual units and the whole course. There was a real need to see a relationship between the different activities planned for each unit and how these contributed to the final outcome of the unit. However crude it may be, Ramsden's (1980) discourse theory was adopted as a model to explain the relationship between the different parts of the unit in terms of its outcome. This was as follows.

ACTIVITY Reading intensively for all the information

INFORMATION   ENABLING SKILLS
PROCESSING SKILLS

----
26. Understand communicative
    value of sentence

----
39. Distinguishing
main ideas from   --------------------------------
supporting   30, 32. Understanding
details   detail relations
---------------------------   between text thru'   -----------------------------
                         lexical/grammatical   29 Understand
                         cohesion   relations within
                         --------------------------------   the sentence
                                                       ----

---------------------------   --------------------------------
51 Understand   24. Understand
info. presented   conceptual meaning
in diagram display   --------------------------------

                                        (Ramsden, C. 1980)

Thus, one is able to see the link between the different activities
carried out within the unit and the different units within the framework
of the course. The lexical and functional/notional inputs in the unit
are seen as providing the enabling skills needed for information
processing. Using the model one is able to discern an implicit link
between the units dealing with the understanding of conceptual meaning
and the study-skills component of the course, which deal with inform-
ation processing. The units dealing with the understanding of relations
within the sentence and those that relate to understanding relations
between parts of a text through lexical/grammatical cohesion are seen
to be hierarchically linked to those which deal with information
processing at a higher level e.g. distinguishing main ideas from
supporting details. With these thoughts in mind it was now possible
to work out the format for unit organisation.

5.0 Unit Organisation

A unit of the course was seen as having the following parts:
Section A: Presentation, Section B: Practice, Section C: Consolidation.

Section A. Presentation

Part 1: Lexis - related to reading passage.
Part 2: Reading/Reference Skill.

Section B: Practice

Reading Comprehension
Pre-reading questions
Reading passage
Comprehension check

Section C: Consolidation

Part 1: Lexis
Part 2: Functions/Notions and Forms
Part 3: Reading/Reference Skill

6.0 Exercise Types and the Underlying Assumptions.

6.1 *The lexical exercises*

These exercises were based on the lexis selected from the reading
text and are seen as providing support for the student to arrive at the
meaning of the text, thereby freeing him to concentrate on the content
of the message. These included exercises on rephrasing, word-building,
the use of contextual clues, and the use of lexical relationships to
relate one part of the discourse to another (Berman 1975). The
exercises in Section C are seen as a recycling of the lexical skills dealt
with in Section A of the unit. Examples of these are provided in the
Appendix - Section A.

6.2 *The study/reference skill exercises*

These are armed at providing the student with practice in learning
to extract and reorder phenomena such as implicit definition, implicit
classification in EST discourse (Selinker, L, et al, op.cit.). Further,
they seek
   i. to emphasize the essential features of organization and lay out
       of various reader aids so that the students can use this under-
       standing to structure the information he gets through reading.
   ii. to give students practice in using their understanding of the
       non-linear reader aids as a tool in decoding language characteris-
       tically associated with it.

   (*Skills For Learning*, Nelson - UMP 1981. pp. vi)

The study/reference skills which are practised in Section A are recycled in Section C of each unit. Examples of exercises dealing with this component of the course are provided in the Appendix - Section B.

6.3 *The comprehension exercises*

The pre-reading questions are viewed as helping the student to focus his attention on important aspects of the text while at the same time activating his schema or background knowledge of the content. (Carrell, op.cit.)

The exercises used for checking comprehension take a variety of forms. The true/false questions are seen as serving their conventional evaluative purpose (Markee, 1984). The objective multiple choice questions can be thought of as providing the students practice in discrimination on the basis of evidence provided in the text. The open ended questions are more demanding in that they require the student to locate, order and evaluate information and take on a critical attitude towards the text. The information extraction exercises require that students take structured notes for filling in diagrams, tables and charts. Examples of these can be found in the Appendix - Section C.

6.4 *Exercises on form/function relationships*

These exercises concentrate on some of the form/function relationships as evidenced in the rhetoric of EST texts. The focus is on sentence level grammar and discourse grammar showing relationships between sentences as opposed to within sentences (Mackay, 1980). As pointed out, exercises in the use of logical connectors - provide the student with practice in identifying words that link information in a logical way and permit the reader to "follow the argument of the text" (Mackay, op.cit). Section D of the Appendix contains examples of exercises on the form/function relationship.

7 *Integration of Reading and Study Skills with Listening and Speaking*

Although reading comprehension and study skills were the focus of the materials prepared for two hours of class time there would be scope for listening and speaking in the different activities, especially in the discussion of answers and the provision of teacher feedback. This would be incidental to the subject matter and theme of the unit. A reading text which dealt with the importance and nature of "chemical kinetics" could not possibly encourage lively discussion in class. The availability of language laboratories and the constraint that one hour of class time be spent in these made it obligatory to design and produce listening and oral interaction materials which were in tandem with the reading and study-skills component. The fact that 20% of

the course marks are allocated for the oral exam - an interview -made it essential that students be provided with the opportunity to interact in class.

There was a need for the student to see a link between the reading and study-skills component and the speaking and listening activities carried out in the language laboratory A thematic link was seen as a viable solution. The undergraduate of today would be tomorrow's professional and citizen. As such, it would be worthwhile to sensitize him to some of the world's problems - more so the ones created by the progress of Science and the application of technology to human life. The development of the listening and oral interaction materials were guided by these considerations.

The listening input is seen as providing the factual basis for the intended oral interaction. It is in the form of a recorded mini -lecture, report of simulated discussion thematically linked to the reading text (not more than seven minutes of running time). Students listen to the taped input in individual booths and complete the worksheet provided for the lesson. Students work at their own pace and are given 30 minutes to complete the listening comprehension worksheet. The work sheet requires them to answer open-ended questions, fill in blanks, take structured notes to complete charts and tables, and make inferences on the basis of information provided. At the end of the 30 minute period the console is switched on the "conference" mode and students are asked to participate in the discussion on the issue provided at the end of the worksheet. The teacher plays the role of interlocutor and catalyst in the ensuing discussion. An example will make the procedure clearer The reading text in Unit 5 deals with the main industrial uses of the radiation from radioisotopes, sources of radioactivity and the effect of radiation on metals and living organisms. The listening input is a report on the source, dosage, consequences, genetic radiation damage by nuclear fallout, and comparative effects of radiation and other dangerous agents. The question set for discussion is as follows:

Is there enough attention being paid to the effects of radiation in our country? Suggest ways in which the problem can be tackled.

Discussion

The materials have been piloted for a year and certain observations need to be made in the light of this experience. Regular discussions amongst the materials writers have shown up some of the strengths and weakness of the materials. A few of the units have fallen below expectations in terms of quality This is to be expected because of the time constraint within which the materials had to be written and the fact the team had very little expertise in materials design and development. The whole process may be likened to an act of faith and hope

- that inspite of all the faults in design and development, the materials would do something for the students. It is gratifying that a larger number of units have worked well in class. Some of the units have been overloaded with too much material while others have been found to be lacking in quality and quantity. Student reaction to the materials has been mixed. Those at the higher end of the ability spectrum have voiced misgivings about the content of the materials. They wonder whether the course should not be geared towards giving them some insight into politics, economics, sociology - anything else except science. At the lower end students have complained that the materials are too demanding. This point has implications for a number of related issues.

The first of these is grading. The ordering of the language/communication skills seemed to point to some sort of grading - from simple to more complex skills and it was decided that this order be followed. In practice it turned out that the difficulty or ease of the unit depended very much on the reading text and the accompanying study-skill. Student feedback points to a new ordering of the units.

The sequencing of activities within the unit and among the units has been done on an intuitive basis. Variety has been infused into the exercise types used and it is hoped that a balance has been struck between the relatively simple and more complex skills practised.

The ease or complexity of the materials for students of differing ability levels calls for a discussion of the teacher's role. Implicit in the materials is the assumption that the teacher's role would be that of facilitator and provider of relevant feedback. The students are to work through the materials on their own with the teacher monitoring their progress and providing feedback in the form of answers. This procedure is not feasible with the weaker groups and the teacher's task becomes one of explaining not only the lexis but also the content - in a sense, providing the background knowledge or schema necessary for comprehension.

The above discussion has highlighted some of the problems faced in an attempt to intergrate content and skills and the possible lines along which revision should proceed. The summative and formative evaluation procedures used to gauge student performance point to some gains in this direction. At best these materials could be viewed as an attempt to provide comprehensible input - be it for acquisition or learning to take place.

Notes

1   I am grateful to my colleagues in the Science Team for the use of
    exercises, given as examples in the Appendix.

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Appendix - Section A

Unit 10

Part 1 Vocabulary

Exercise 1. Look at the words given in the list below Using your knowledge of prefixes roots and suffixes work out the meanings of the words.

audible   oscillator
piezoelectricity transmitter
ultrasonics   anatomical
microphone   displaced

Exercise 2. In each of the sets below, three of the words are related. Circle the word that is unrelated. Explain the relationship existing among the remaining three words.

1 pitch	feeble	slice	audible
2. signal	vibration	frequency	crystal
3. wave	sound	beam	materials
4. oscillator	bubble	transmitter	receiver
5. applied	reflected	bombarded	displaced
6. cavitation	compression	rarefaction	immersion

Exercise 3. In column B there are definitions for the words listed in Column A. Match each word and its definition.

Column A

1	detect	a.	the opposite of
2.	interference	b.	produce
3.	perpendicular	c.	existing in a high degree
4.	reverse	d.	limit line
5.	generate	e.	find out the presence of
6.	intense	f.	isturbance
7	boundary	g.	existing in a high degree
8.	flaw	h.	situated in the inside of a spine
9	internal	i.	single beat or vibration of source
10.	pulse	j.	succeed each other by turns
11.	alternate	k.	at right angles to
12.	components	l.	defective

Unit II. Section C   Part 1

Read the following passage and fill in the blanks with appropriate words selected from the list below.

energy	equipment	time
piezoelectric	conversion	ultrasonic
property	generate	frequency
voltage	vibrations	frictional

Discs of certain materials, when polarized will undergo a change of thickness each time a source of voltage is connected across their faces.

Ultrasonic vibration is employed to ----------- heat at the joint or interface between the material (s) to be united, by causing one of the surfaces to rub against the other at high ----------. The resulting localized production of ----------- heat will cause most thermoplastic materials to melt and adhere in an extremely short space of -----------, often less than one minute.
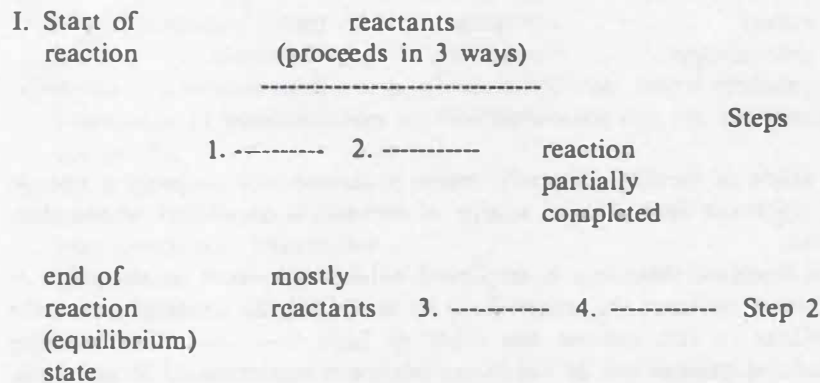
Equipment for ultrasonic welding consists of five basic units. The first of these is a generator which provides electrical power at an H frequency The second is a converter which changes the ----------- output from the generator into mechanical -----------. This unit is commonly based on a ----------- crystal, which changes its dimensions in response to a -----------. Quartz tourmaline, or manufactured poly-crystalline ceramics, are examples of materials having this -----------. The latter are used for industrial ultrasonic -----------, as they have a high energy ----------- efficiency

Unit 9

A. Below are sentences which refer to chemical reactions. Complete the sentences in Column A by choosing one of the alternatives in Column B.

	Column A		Column B
1	The rate of reaction and changes	a)	both reactants even products
2.	Usually the rate of reaction is maximum	b)	when the reaction starts
3.	A chemical reaction stops only	c)	if temperature and pressure do not
4.	A chemical reaction depends on	d)	homogenous and heterogenous groups
5.	Chemical reactions can be divided into	e)	when a state of equilibrium is reached

B. Complete the diagrams with information from the text. (In step 1 explain how the reaction has proceeded. In step 2 give the substances the remain at the end of the reaction).

I. Start of   reactants
   reaction   (proceeds in 3 ways)

                                                        Steps
                    1. ---------   2. ----------   reaction
                                                   partially
                                                   completed
   end of   mostly
   reaction   reactants   3. ----------   4. -----------   Step 2
   (equilibrium)
   state

II. There are 2 ways in which a reaction proceeds in terms of speed. All reactions begin with reactants and end in an equilibrium state. Fill in the blanks with the words provided below.

                                                    ---------- equilibrium
                                              ----
Most cases . reactants --------   ---------
                              1 --------- 2. ---------   3. ---------

Some cases   reactants ---------   ---------   ---------
                              1. ---------- 2. --------- 3. ---------
                      ---------   ---------
                      4. - - - - - - - - equilibrium

---
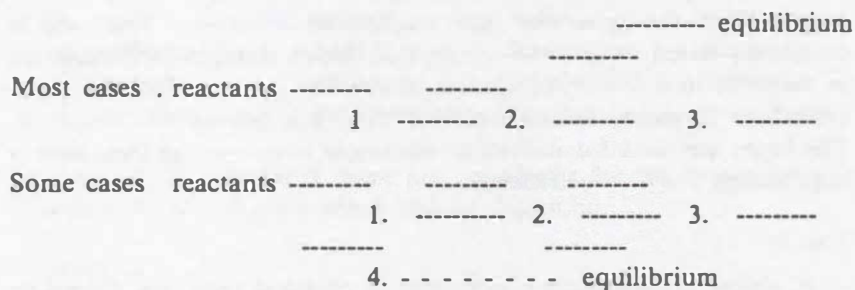
rate decreases gradually   rate is slow
rate increases to maximum   rate is zero

C. 1 Why is the study of chemical Kinetics necessary?
   2. Of what use are reaction rates to chemists?

Unit 12
Exercise 1   Read the following statements and state whether they are TRUE or FALSE, according to the passage.

          a.   Proteins do not provide protection against diseases

          b.   There is an absence of protein in hair and feathers.

    c.   There are some substances which do not react with protein molecules.

    d.   Most other biological materials have a more varied chemical composition than proteins.

    e.   In cells the most complex substances are those proteins which combine with nucleic acids.

*Exercise 2*   Complete the following statements by using material from the reading passage.

    (a)   Food proteins are dissassembled into their amino acid subunits with ....

    (b)   Grievous changes in the cell can be caused by ....

    (c)   Sickle cell anemia can be caused by ....

    (d)   The failure of an individual person's genetic code to specify the production of a single enzym can result in ....

Appendix - Section B

Unit 3

A. Read the text and study the flow diagram. Complete the flow diagram by filling in the missing blanks and boxes.

The fluid portion of the blood is called plasma. Among the constituents of plasma are calcium ions, and large protein molecules called prothrombin and fibrinogen. Small, rather fragile, blood cells called platelets contain the protein thromboplastin. When a blood vessel is damaged, the platelets rupture, releasing thromboplastin into the plasma. In the presence of calcium ions (Ca^{2+}) the thromboplastin causes the conversion of prothrombin to thrombin. Thrombin, in turn, changes fibrinogen into fibrin. If additional calcium ions are available, the fibrin molecules form tiny threads which are the framework of the clot. Blood can be kept from clotting by removing the calcium ions or taking them unavailable.

blood vessesl
damaged

|
↓

platelets → releases → [   ] ⟶✗⟶ [   ]

thrombin

[   ] ──── ↓ ──── fibrin

[   ]

↓

blood clot
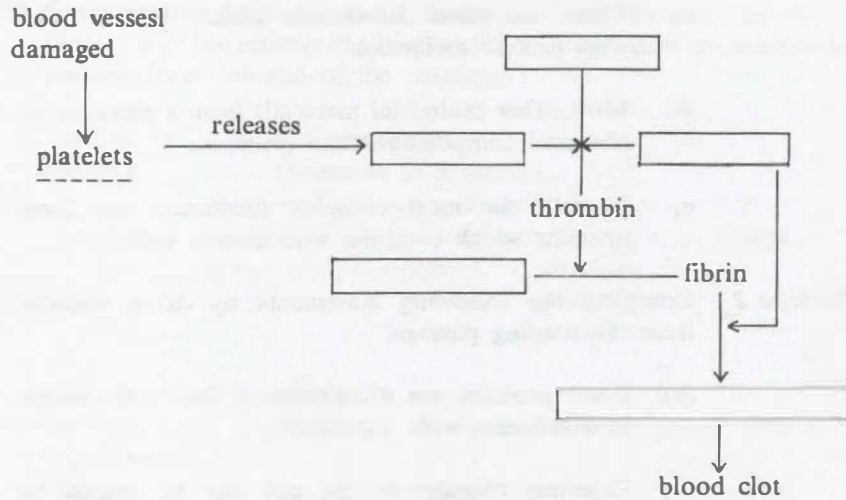
Exercise 3 Consolidation

Study the two diagrams below. Complete the descriptions of the diagrams by filling in the blanks with the words provided.
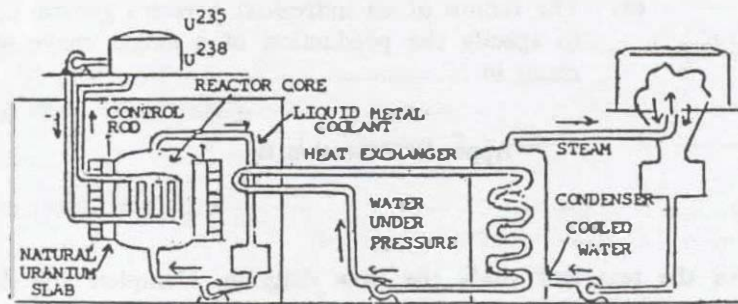
Breeding a nonfissionable material in a breeder reactor

The breeder reactor produces fissionable material. A nonfissionable material is used in the reactor After converting (breeding), a fissionable material such as plutonium is produced and can be recovered in the reactor for use elsewhere. The operation of this reactor consists of ----------- liquid fuel (U enrich with U or plutonium) into the ----------- of the reactor, figure 38-14. Within the core, the U acts on a natural uranium --------- (U) to breed it into fissionable plutonium.

The heat resulting from this process is transferred to a -----------. Eventually the heat energy produces ----------- which is then condensed, cooled, and ----------- as water

slab	liquid metal coolant
recirculated	pumping
steam	core