

Liverpool John Moores University

Title: PHYSICAL PHARMACEUTICS
Status: Definitive
Code: **4002DFPHAR** (113281)
Version Start Date: 01-08-2012

Owning School/Faculty: Pharmacy & Biomolecular Sciences
Teaching School/Faculty: Pharmacy & Biomolecular Sciences

| Team | Leader |
|-----------------|--------|
| Judith Madden | Y |
| Imran Saleem | |
| Robert Jones | |
| Linda Seton | |
| Raymond Fox | |
| Touraj Ehtezazi | |
| Matthew Roberts | |
| Shaqil Chaudary | |
| Mark Cronin | |
| Barry Nicholls | |
| Ian Bradshaw | |
| Philip Denton | |

Academic Level: FHEQ4 **Credit Value:** 24.00 **Total Delivered Hours:** 96.00
Total Learning Hours: 240 **Private Study:** 144

Delivery Options

Course typically offered: Standard Year Long

| Component | Contact Hours |
|-----------|---------------|
| Lecture | 56.000 |
| Practical | 24.000 |
| Seminar | 3.000 |
| Workshop | 10.000 |

Grading Basis: 40 %

Assessment Details

| Category | Short Description | Description | Weighting (%) | Exam Duration |
|----------|-------------------|-------------|---------------|---------------|
| Exam | AS1 | Examination | 70.0 | 3.00 |
| Report | AS2 | | 15.0 | |
| Test | AS3 | | 15.0 | |

Aims

The aim of this module is to introduce the basic principles of physical chemistry as they relate to the formulation of drug products. An understanding of the application of physical chemical concepts to pharmaceuticals will be developed during lectures supported by appropriate workshops and practical exercises.

The student should be able to demonstrate an understanding of the material by the production of scientifically written reports and presentation of a seminar on the subject. Overall this should improve the student's scientific verbal and written communication skills. Students should gain experience in production, retrieval, analysis and interpretation of scientific data and develop team working skills. In addition students should learn and develop key laboratory skills that they will utilise throughout their time at university.

Learning Outcomes

After completing the module the student should be able to:

- 1 Understand key concepts in physical chemistry and their application to pharmaceutical issues. Concepts include: the basic principles of thermodynamics; partitioning behaviour; properties of liquids, solids and gases; colligative properties; pH; pKa, buffer solutions; behaviour and measurement of ions in solution; Karl Fischer titration; solubility; melting point; polymorphism; surface phenomena, properties of surfactants, colloids, emulsions and suspensions.
- 2 Demonstrate knowledge of key properties of pharmaceutical products (solution viscosity, particle size etc) and how these properties can be measured and quality controlled.
- 3 Appreciate the various mechanisms by which drugs may degrade and the factors that affect drug stability. Applying knowledge of reaction kinetics to the prediction of rates of degradation of drugs.
- 4 Evaluate relevant physical parameters for pharmaceuticals (e.g. those described in the British Pharmacopoeia) and understand their role in determining an appropriate pharmaceutical formulation.
- 5 Demonstrate ability in key practical skills. Be able to obtain accurate, reliable results in the laboratory in addition to retrieving and evaluating scientific data from other sources.
- 6 Demonstrate the ability to work competently both as an individual and as a member of a team.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

EXAM 1 2 3 4 5

| | | | | | | |
|------|---|---|---|---|---|---|
| RPT | 1 | 2 | 3 | 4 | 5 | 6 |
| TEST | 1 | 2 | 3 | 4 | 5 | |

Outline Syllabus

Liquids, solutions, solids: Physical and chemical properties; phase rule; phase equilibria; gaseous phenomena; gas/liquid equilibria; solids in liquids; kinetics; reaction order; liquids in liquids; partitioning; eutectics; solubility curves; colligative properties; tonicity; osmolarity. Basic thermodynamics; enthalpy; entropy; Free energy; spontaneity Kirchoff's law; Van't Hoff isotherm
Electrolytes; pH, pKa, pKb, buffer solutions; Karl-Fischer titration.
Preformulation: solubility; pKa; purity; melting point; assay development.
Stability of drug products. Polymorphism. Crystallisation, milling, sieving, particle size analysis.
Viscosity and flow of liquids: Poiseuille equation; Stoke's Law; Reynold's number. Measurement of viscosity, laminar and turbulent flow. Capillary viscometers, the falling sphere viscometer, intrinsic viscosity.
Surface phenomena: Surface tension, contact angle, spreading of liquids.
Surfactants. Gibbs Adsorption Isotherm. Micelles, solubilisation, surface films, film pressure. Colloidal systems: Classification, properties. Flocculation, coagulation, zeta potential. Classes of pharmaceuticals: Oral liquids, topical preparations, emulsions, foams, suspensions, Microencapsulation.

Learning Activities

The module will use lectures, workshops, seminars and practicals to disseminate information. Students will also make use of directed reading, problem solving tasks, appropriate computer packages and internet resources to support their learning. Revision of material and preparation for examinations will be undertaken in a series of revision lectures. Learning will be assessed via formal laboratory reports, classroom tests, seminar presentation and formal examination.

References

| | |
|------------------------|--|
| Course Material | Book |
| Author | Florence, A. T. and Attwood, D. |
| Publishing Year | 2006 |
| Title | Physicochemical Principles of Pharmacy |
| Subtitle | |
| Edition | 4th Ed |
| Publisher | Macmillan Press Ltd |
| ISBN | |

| | |
|------------------------|----------------------|
| Course Material | Book |
| Author | Martin, A |
| Publishing Year | 1993 |
| Title | Physical Pharmacy |
| Subtitle | |
| Edition | 4th |
| Publisher | Williams and Wilkins |
| ISBN | 0812114388 |

| | |
|------------------------|--------------------------------|
| Course Material | Book |
| Author | Atkins, PW |
| Publishing Year | 2005 |
| Title | Elements of Physical Chemistry |
| Subtitle | |
| Edition | 4th Ed |
| Publisher | Oxford University Press |
| ISBN | |

| | |
|------------------------|--|
| Course Material | Book |
| Author | Aulton, M. E. |
| Publishing Year | 2007 |
| Title | Pharmaceutics: The Science of Dosage Form Design |
| Subtitle | |
| Edition | 3rd |
| Publisher | Churchill-Livingstone |
| ISBN | |

| | |
|------------------------|--|
| Course Material | Book |
| Author | Cairns, D |
| Publishing Year | 2008 |
| Title | Essentials of Pharmaceutical Chemistry |
| Subtitle | |
| Edition | 3rd |
| Publisher | Pharmaceutical Press |
| ISBN | |

| | |
|------------------------|--------------------------------------|
| Course Material | Book |
| Author | Price, G |
| Publishing Year | 1998 |
| Title | Thermodynamics of Chemical Processes |
| Subtitle | |
| Edition | |
| Publisher | Oxford University Press |
| ISBN | |

| | |
|------------------------|------------|
| Course Material | Book |
| Author | Watson, DG |

| | |
|------------------------|--|
| Publishing Year | 2005 |
| Title | Pharmaceutical Analysis |
| Subtitle | A Textbook for Pharmacy Students and Pharmaceutical Chemists |
| Edition | 2nd |
| Publisher | Churchill Livingstone |
| ISBN | |

| | |
|------------------------|--------------------------|
| Course Material | Book |
| Author | Various |
| Publishing Year | 2009 |
| Title | Catch Up Compendium |
| Subtitle | |
| Edition | |
| Publisher | LJMU, Faculty of Science |
| ISBN | |

| | |
|------------------------|---|
| Course Material | Book |
| Author | Chang, R |
| Publishing Year | 2000 |
| Title | Physical Chemistry for the Chemical and Biological Sciences |
| Subtitle | |
| Edition | 3rd |
| Publisher | Macmillan Press |
| ISBN | |

| | |
|------------------------|--|
| Course Material | Book |
| Author | Moynihan, H and Crean, A |
| Publishing Year | 2009 |
| Title | The Physicochemical Basis of Pharmaceuticals |
| Subtitle | |
| Edition | |
| Publisher | Oxford University Press |
| ISBN | 9780199232840 |

Notes

Further details about this module can be found in the appropriate module handbook.