1. **Title of the module**

LABS410 Physical Chemistry

1. **Division or partner institution which will be responsible for management of the module**

Digital and Lifelong Learning

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 4

1. **The number of credits and the ECTS value which the module represents**

15 Credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Flexible delivery model

Autumn and/or Spring and/or Summer

1. **Prerequisite and co-requisite modules**

N/A

1. **The programmes of study to which the module contributes**

FdSc and BSc (Hons) in Applied Chemical Sciences

1. **The intended subject specific learning outcomes.  
   On successfully completing the module students will be able to:**

8.1 Describe the basic chemical concepts in the area of physical chemistry.

8.2 Demonstrate knowledge of the definitions and properties of acids and bases and be able to relate these to appropriate equations.

8.3 Display an understanding of solution equilibria, the rates of chemical reactions and the factors that affect them.

8.4 Explain the key concepts of the first and second laws of thermodynamics and their application in a chemical context.

1. **The intended generic learning outcomes.  
   On successfully completing the module students will be able to:**

9.1 Demonstrate the development of practical/technical skills

9.2 Analyse, evaluate and correctly interpret data

9.3 Communicate and present data effectively

9.4 Obtain and use information from a variety of sources as part of self-directed learning.

9.5 Manage the time and use organisation skills within the context of self-directed learning.

1. **A synopsis of the curriculum**
2. Introduction to Acids and Bases

* Define acids and bases, understand their properties, identify their structural features, and relate them to acidity and pKa values.
* Understand Arrhenius and Bronsted acids and bases and the relationship of conjugate acid-base pairs; acid/base strength and the pH Scale; the autoprotolysis of water.
* Define the ionic product of water (Kw) and pX where X can be, H, OH, Ka, Kb, Kw.
* Calculate pH of aqueous solutions of strong acids/bases and calculate [H3O+] and [OH-] at a given pH or pOH.

2. Basic Kinetics

* Understand the parameters that can affect the rate of a chemical reaction and explain the terms: rate of reaction, rate law, order of reaction, and rate constant.
* Have a basic understanding of equilibrium and collision theories.
* Explain concentration/time profile for zero, first, pseudo-first, and second-order reactions and state rate laws for zero, first, and second-order reactions.
* Determine rate constants and orders of reaction and calculate half-life.

3. Basic Thermodynamics

* Define and understand energy, pressure, temperature, systems, and internal energy.
* State the first and second laws of thermodynamics.
* Define enthalpy, discuss what endothermic/exothermic chemical reactions are, and calculate enthalpies.
* Define entropy and free energy, discuss spontaneous/non-spontaneous chemical reactions, and calculate entropies and free energies.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**

Ebbing, D.D. and Gammon, S.D. (2013) *General chemistry*. Australia: Brooks/Cole Cengage Learning.

Atkins, P.W. (2014) *Physical chemistry: A very short introduction*. Oxford, Oxford University Press.

Hammes, G.G. and Hammes-Schiffer, S. (2015) *Physical chemistry for the biological sciences.* Hoboken, New Jersey: Wiley.

Elliott, J. and Page, E. (2017) *Physical chemistry*. (Workbooks in chemistry). Oxford: Oxford University Press.

Stoker (2015) *General, Organic, and Biological Chemistry*. 7th edn.: Cengage Learning.

Kotz, J.C. *et al.* (2019) *Chemistry & chemical reactivity*. 10th edn. Boston, MA: Cengage Learning.

Burrows, A. (2017) *Chemistry³: Introducing inorganic, organic and physical chemistry*. Oxford, Oxford University Press.

1. **Learning and teaching methods**

Blended Distance learning:

Contact Hours: 120

Private Study Hours: 30

Total Study Hours: 150

1. **Assessment methods**
   1. Main assessment methods

Essay assignment/s (70%) - 1600 words.

Moodle Quiz (30%) .

The pass mark for this module is 40%. The aim of the assessment is that there should be an equal balance between ‘application’ (i.e. reflection related to practical/work experience) and ‘theory’ (i.e. examination), but that neither should enable the student to obtain a pass grade independently and in its entirety.

13.2 Reassessment methods

Like for Like

1. ***Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 9.1 | 9.2 | 9.3 | 9.4 | 9.5 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |
| **Teaching** | **x** | **x** | **x** | **x** |  | **x** | **x** | **x** | **x** |
| Private Study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Work-based experience |  |  |  |  | **x** | **x** | **x** | **x** | **x** |
| **Assessment method** |  |  |  |  |  |  |  |  |  |
| Assignment/s | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Moodle Quiz | **x** | **x** | **x** | **x** |  |  |  |  | **x** |

1. **Inclusive module design**

The *Division* recognises and has embedded the expectations of current equality legislation by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where the module will be delivered**

Blended distance learning – delivered from Medway and Canterbury campus

1. **Internationalisation**

International vocation is an important part of Applied Chemical Science. The intended learning outcomes 8.1, 8.2, 8.3, and 8.4, for this module cover key universal principles and concepts of physical chemistry and therefore are core components of Applied Chemical Science worldwide. Furthermore, Physical Chemistry is a core component of the Pharmaceutic R & D industry and this module reflects international aspects.

**Divisional USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
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