MRes in Catalysis at Imperial College
2014-15

Course Handbook
Key dates for 2014-15

College Term Dates:
Autumn Term: Saturday 4th October to Friday 19th December 2014
Spring Term: Saturday 10th January to Friday 27th March 2015
Summer Term: Saturday 25th April to Friday 26th June 2015
The MRes Catalysis course runs until the end of September 2015

Saturday 4th October 2014
18.00 – 19.00 Welcome event for new postgraduate students, Vice-Provost (Education), Director of the Graduate School, Director of Student Affairs, ICU President and ICU Deputy President (Welfare) (G16, Sir Alexander Fleming Building). Followed by postgraduate drink reception (SCR, Level 2, Sherfield Building).

Sunday 5th October 2014
11.00 – 13.00 Provost’s welcome event for international postgraduate students, mini fair and buffet lunch (Great Hall for talks, Senior Common Room and Queens Tower Rooms for food and mini fair).

Monday 6th October 2014
09.00 onwards MRes postgraduate welcome pack can be collected from Dr Mike Ray at the Student Services Centre, (Room 258, Level 2, Chemistry building)
14.00 – 14.45 Welcome Talk by Rector, Director of Graduate School and GSA Chair (Great Hall, Level 2, Sherfield Building)
14.45 – 16.00 Meeting with Course Directors. Research Project titles discussed (Room G47A, Flowers Building)

Tuesday 7th October 2014
11.00 – 16.00 Freshers’ Fair (Student Union, South Kensington campus)

Wednesday 8th October 2014
09.00 – 17.00 Sports Team Trials (Student Union, South Kensington campus)

Thursday 9th October 2014
11.30 – 12.00 Explosion Hazards Lecture (Lecture Theatre C, RCS1 Building)
Attendance Compulsory
12.00 – 13.00 Safety Talks - Primary Induction (Lecture Theatre C, RCS1 Building)
Attendance Compulsory
14.00 – 16.30 Safety Talks – Basic Laboratory Safety (Lecture Theatre C, RCS1 Building)
Attendance Compulsory

Friday 10th October 2014
14.00 – 17.00 Department of Chemistry Welcome Induction for all new Postgraduates (Room 231, Level 2, Chemistry)

Saturday 11th October 2014
19.00 – 02.00 Postgraduate Mingle (Student Union, South Kensington campus)

Friday 31st October 2014
DEADLINE 14.00 Submission of 5 project choices in order of preference to the MRes programme coordinator Dr Mike Ray by email (michael.ray@imperial.ac.uk).
Wed 17th December 2014

**DEADLINE 14.00** Research Proposal. Submit:
• one electronic copy of Research Proposal by email to Dr Mike Ray by email (michael.ray@imperial.ac.uk)
• one electronic copy of your Research Proposal (as word or pdf format) on **Blackboard Learn (Virtual Learning Environment)**

Week beginning Monday 12th January 2015
Exams week

February - March 2015
Journal club – Date and venues to be confirmed.

Week beginning Tuesday 5th May 2015
Exams week

Monday 31st August 2015

**DEADLINE: 14.00** Dissertation. Submit:
• one electronic copy of Dissertation by email to Dr Mike Ray by email (michael.ray@imperial.ac.uk)
• one electronic copy of your Dissertation (as word or pdf format) on **Blackboard Learn (Virtual Learning Environment)**

September 2015
Two days Oral Presentation Days (date and venue to be announced)
**Attendance Compulsory**

September 2015
All day External Examiners meeting (date and location to be confirmed) – You may be called to a viva by the external examiners so you must be present in college for the whole day.
**Attendance Compulsory**

Wed 4th May 2016 Graduation Ceremony, Royal Albert Hall

**Important note:** All dates and times can be subject to change at short notice and you are thus well advised to check your college email account regularly (daily), as we will use this to notify you of any changes to the above arrangements.
MRes in Catalysis at Imperial College

The MRes course in Catalysis at Imperial College is a multidisciplinary one-year course featuring the involvement of several world-class departments. Taught modules cover topics as diverse as Green Chemistry, Palladium catalysis, Catalysis in Chemical Engineering, environmental chemistry, Green solvents, Applications of inorganic chemistry in industry, water treatment and Inorganic mechanisms & catalysis. In addition to lectures, you will spend nine months working on a cutting edge research project, typically with supervisors from at least two different departments.

Graduates of this course can expect to have all the necessary skills and experience to apply Catalytic techniques and technologies in either commercial or academic laboratories, the research project in particular equipping them admirably for PhD studies.

If you have any queries not covered here, please contact the MRes Programme Coordinator Dr Mike Ray (michael.ray@imperial.ac.uk) in the first instance. If further advice is necessary, please contact the Course Directors, Dr George Britovsek (g.britovsek@imperial.ac.uk) & Dr James Wilton-Ely (j.wilton-ely@imperial.ac.uk). The links below contain useful information:

- The MRes Catalysis Website: [http://www3.imperial.ac.uk/chemistry/postgraduate/mres/catalysis](http://www3.imperial.ac.uk/chemistry/postgraduate/mres/catalysis)
- Health and safety information (Occupational Health requirements, vaccinations, use of equipment, training etc): [http://www3.imperial.ac.uk/estatesfacilities/about/healthandsafety](http://www3.imperial.ac.uk/estatesfacilities/about/healthandsafety)
- Imperial Study Guide / Imperial Study Guide for Master's Students: [http://www3.imperial.ac.uk/students/studyguide](http://www3.imperial.ac.uk/students/studyguide)
- Link to ‘Our Principles’ (the College’s Student Charter): [http://www3.imperial.ac.uk/students/ourprinciples](http://www3.imperial.ac.uk/students/ourprinciples)
- MRes Code of Practice: [http://www3.imperial.ac.uk/registry/proceduresandregulations/qualityassurance/codesofpractice/codeofpracticeformresprogrammes](http://www3.imperial.ac.uk/registry/proceduresandregulations/qualityassurance/codesofpractice/codeofpracticeformresprogrammes)
- Information about the Graduate School: [http://www3.imperial.ac.uk/graduateschools](http://www3.imperial.ac.uk/graduateschools)
- Transferable Skills Training: [http://www3.imperial.ac.uk/graduateschool/currentstudents/professionalskillsmasters](http://www3.imperial.ac.uk/graduateschool/currentstudents/professionalskillsmasters)

For other useful links, see page 32 of this Handbook.

Contacts
MRes Programme Coordinator: **Dr Mike Ray** (michael.ray@imperial.ac.uk). First point of contact for queries (or you may prefer to talk to the Director of MRes Studies).
Course Co-Director: **Dr George Britovsek** (g.britovsek@imperial.ac.uk)
Course Co-Director: **Dr James Wilton-Ely** (j.wilton-ely@imperial.ac.uk)
Director of MRes Studies: **Dr Laura Barter** (l.barter@imperial.ac.uk).
Welcome to Imperial College

The welcome talks for new Master’s students will take place on Monday 6th October at 14.45 in the Great Hall, Sherfield Building. The welcome talks will be led by the Provost and will last approximately 45 minutes and include welcomes from the Director of the Graduate School and Imperial College Union (ICU) and the Graduate Students’ Association (GSA).

Open Day for those interested in further study at Imperial which will take place on Wednesday 3rd December 2014 from midday in the Great Hall, Sherfield Building.

The Student Union
You are reminded that all new students should have the opportunity to attend the following events:

- Tuesday 7th October: Freshers’ Fair – 11.00hrs – 16.00hrs
- Saturday 11th October: Postgraduate Mingle – from 19.00

New Students Website
You are reminded of the following website that contains relevant information for all new students: www.imperial.ac.uk/newstudents

See the Welcome Week Timetable for more information: http://www3.imperial.ac.uk/students/newstudents/yourfirstweek/welcomeweekpg2014

MRes in Catalysis: Energy and the Environment – Timetable

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Overview of the course

How the course is constructed:
70% research and 30% taught. Actual breakdown:
Research: Research Proposal (10%), Dissertation (50%), Viva (5%), Oral Presentation (5%)
Taught: Exams (20%), Journal Club (10%)

On arrival in October, a list of projects (with abstracts) will be provided for the students to look through. They should then contact the relevant supervisors to discuss their favourite potential projects. The students submit their top 5 projects in order and the Course Directors will aim to assign the projects according to these wishes. Once the research projects have been assigned a list of literature projects will be distributed and the topics chosen in the same manner.

Research proposal
This will be on the research project topic chosen by the student and is based on the EPSRC proposal format. The deadline is at the end of the 1st term. These will be marked and second marked by supervisors of Catalysis students.

Dissertation
Students start their projects in December or January and are embedded in their respective groups. The Dissertation is 60-80 pages in length and must be handed in by the deadline of first week of September. These are marked and second marked by supervisors of Catalysis Students.

Viva
This is an oral exam on the topic of your research and will be conducted with a member of staff and an external assessor.

Oral Presentation
This is an oral presentation base on your dissertation and research work. You will present your work as part of a symposium where all MRes in Catalysis students will present their research work.

Journal Club
This is an assessed transferable skills course, which aims to develop presentation skills, whilst encouraging scientific debate, and providing the opportunity to broaden scientific knowledge.

Exams
MRes students must attend the 4 core lecture courses from the UG 4th year and 2 optional courses,* which they can choose. If they answer more than two optional questions, then the best marks are taken and the worst discarded.

Core:
I-18 Palladium catalysis in organic synthesis – 8 lectures
O-10 Catalytic asymmetric synthesis – 8 lectures
O-24 The kinetics of catalysis – 8 lectures
Catalysis reaction engineering – 24 lectures (counts as double credit)

Optional:
I-1 Inorganic mechanisms and catalysis – 9 lectures (this is compulsory but not examined)
I-5 Modern applications of inorganic chemistry in industry – 8 lectures, chemical industry staff
I-11 Green solvents – 4 lectures (2 hrs each)
I-10 Green chemistry – 10 lectures
O-7 Pharmaceuticals – 6 lectures, GSK staff
Dynamic behaviour of process systems – 20 lectures (counts as double credit)
Last year’s exam papers and guide answers will be provided during the first term. Guide answers are NOT written for students, but are written for the External Examiner who reviews our questions and for the second markers to provide a guideline for marking. As such, they are sometimes lacking in detail, they occasionally have issues which only come to light when the marking starts, and there may be more than one way to answer a question. You should not treat them as anything other than a guide as to how a question should be answered.

Students must attain 50% overall for the taught component of the course. If they need to retake a failed exam, retakes happen the next academic year.

The students can have a provisional letter grade for their exams, which will be ready in late February/early March and June.

The students can answer 3 questions in the 3 hrs or 4 questions if they wish.

The I-11 Green Solvents course is examined by essay and the students choose their topic. This must be distinct from the topic chosen for the Literature Report.

**Oral presentation**

A symposium of short presentations by the whole cohort will be held in late September. This is given in front of peers and marked by the supervisors and the External Examiner.

The Presentations Day gives the students a chance to present to fellow students and their supervisors.

**Fortnightly meetings**

One hour meetings will be held every fortnight (from January) in which students present their research. Organisation of these meetings are taken over by the students as the course progresses. Tea, coffee and biscuits are provided.

Fortnightly meeting will provide a chance to meet and hear about the research members of the group are doing.
Additional seminars
Links will be provided so that MRes Catalysis students can attend non-compulsory seminars and lectures in other departments such as the Chemical Engineering Department and the Manufacturing Futures Lab.

Site visits
In order for the students to play a full part in the programme, they are encouraged to suggest and plan site visits to Industrial sites etc. Financial support will be provided.

Overall Mark for MRes
The MRes degree has the following classifications: 50% Pass, 60% Merit, 70% Distinction.

As explained above, the course is divided into research (70%) and taught (30%) components. The actual breakdown is:

**Research:** Research Proposal (10%), Dissertation (50%), Viva (5%), Oral Presentation (5%)  
**Taught:** Exams (20%), Journal Club (10%)

In order to obtain a Distinction, both taught and research components of the course must be passed at the 70% level or higher. For a Merit, taught and research components must both be awarded overall marks between 60-69%. If both taught and research components are in the range 50-59%, a pass will be awarded.

If a student scores 72% on the research component but only 65% on the taught component, a Merit will be awarded. Similarly, if a student achieves 56% on the research component and 65% on the taught component, they will receive a Pass. Some latitude may be shown at the discretion of the External Examiner if students are close to a borderline, e.g., 69% in the taught component and 72% in the research component. In these cases, the External Examiners may wish to interview the student to determine whether they should be promoted to the higher classification.

Centre for Academic English
The Centre for Academic English (CAE) provides free, dedicated support to international MRes students in science, engineering and medicine. Their aim is to help you communicate your research during the different stages of your degree as accurately and as professionally as possible. Through collaborating with the course directors and supervisors, they will help you to better understand their expectations in terms of the content, format, and style of your assignments. They then provide you with the relevant language skills to present your research effectively. The core component is a weekly Academic Writing class with a dedicated writing tutor who will offer sessions specifically designed to meet the needs of your research degree.

You will need to register at the link below:  
http://www3.imperial.ac.uk/academic-english/mres

Feedback
Meetings are held every week and the Course Directors will often be present. In addition to the chance to hold presentations in front of the whole group, this is an opportunity to ask questions and receive general feedback for the whole group. Marks will be communicated privately by the MRes programme coordinator and discussion of them can be arranged with the course directors as desired. Since the student’s supervisors are first markers for all project assessments, they should be approached initially. A summary of comments by the independent marker can be obtained from the Course Directors. A meeting can be arranged with the Course Directors if the student wishes to
discuss a mark further. Outline answers are released soon after the exams have been taken and this provides feedback to students to see where they may have lost marks.

**Student Surveys**
Your feedback is important to your department, the College and Imperial College Union. Whilst, there are a variety of means to give your feedback on your Imperial experience, the following College-wide surveys give you regular opportunities to make your voice heard:

- **PG SOLE lecturer/module**
- **Student Experience Survey (SES)**
- **Postgraduate Taught Student Experience (PTES)**

The **PG SOLE lecturer/module survey** runs at the end of the Autumn and Spring Terms. This survey is your chance to tell us about the modules you have attended and the lecturers who taught them. Run at the same time as the Autumn Term PG SOLE is the Union’s **Student Experience Survey (SES)**. This survey will cover your induction, welfare, pastoral and support services experience. During December you will receive an email in your Imperial College account with a link to the survey.

The **Postgraduate Taught Experience Survey (PTES)** is the only national survey of Master’s level (MSc, MRes, MBA and MPH) students we do and so the only way for us to compare how we are doing against the national average and to make changes that will improve our Master’s students’ experience in future. PTES covers topics such as motivations for taking the programme, depth of learning, organisation, dissertation and professional development. During the spring term you will receive an email in your Imperial College account with a link to the survey.

All these surveys are anonymous and the more students that take part the more representative the results so please take a few minutes to give your views. As a result of feedback to previous surveys, for example, we have removed some lecture courses from the programme and added others. If you would like to know more about any of these surveys or see the results from previous surveys, please visit: [http://www3.imperial.ac.uk/registry/proceduresandregulations/surveys](http://www3.imperial.ac.uk/registry/proceduresandregulations/surveys)

For further information on surveys please contact the Registry’s Surveys Team on surveys.registrysupport@imperial.ac.uk

**Safety**
The department, in conjunction with the Graduate School runs induction activities for all new MRes students in October each year. These include the mandatory Primary Induction session and the Basic Lab Safety Lecture (which details the department’s requirements for safe practice in your research). Details of this induction programme will be given to you by the MRes Programme Coordinator, Dr Mike Ray. Further details of departmental safety procedures and waste disposal can be found on our website at [http://www3.imperial.ac.uk/chemistry/safety](http://www3.imperial.ac.uk/chemistry/safety) or by contacting the faculty safety manager, Stefan Hoyle (s.hoyle@imperial.ac.uk). There are two other courses that are mandatory for all new PG students;

1. **Risk Assessment Foundation Training (RAFT)** - This is run as a Blackboard course and test for PG students. RAFT is a realistic and practical way to learn about the College’s risk assessment process via video scenarios based on one’s own work environment. After an introduction on why risk assessments are required, the learner is taken through the process of risk assessment before engaging with a series of video scenarios representative of their own work environments.

2. **Fire Prevention and Fire Safety at Work** – This course will be organised for you and should be completed in the first term prior to you starting in the lab for your research projects. The course is aimed at reducing the likelihood of fires starting and what action to
take in the event of a fire. The course covers: How fires start and spread, Steps to take to prevent fires, Methods of extinguishing fires, Types of fire fighting equipment and their uses, Smoke and gas hazards produced by fires, What to do in the event of discovering a fire and When not to tackle a fire.

You must undertake your research in accordance with safety regulations and procedures, as agreed with your supervisor (who is responsible for your health and safety). If you have any doubts about any safety aspects of your work or work environment, you should discuss these with your supervisor.

**Disclosure of vulnerability**

If you have any health condition or are taking treatment that could cause you to lose consciousness, affect your alertness or for which you might require emergency assistance, you should let your senior tutor or your supervisor know so that they can be in a position to organise help for you if ever needed and ensure appropriate precautions are put in place if necessary to ensure your safety. For health conditions for which you might require emergency help it is also worth letting a couple of friends know as well, so they can know what to do if you needed help away from the Department. All students should register with a doctor in London as soon as possible. This is particularly important if you have any health problems that require regular treatment. All students living in central London Halls can and should register with the College Health Centre. Students living outside halls may also be able to register. Check the Health Centre website for information [www.imperialcollegehealthcentre.co.uk](http://www.imperialcollegehealthcentre.co.uk)

**PLAGIARISM**

The Department and College take plagiarism very seriously. Do not plagiarise. Plagiarism is defined as the theft of another's thoughts or writings and presenting them as the plagiarist's own. Plagiarism also encompasses submitting the same piece of work for more than one unit as assessment. Plagiarism will not be tolerated in the Department and if it is detected in a student's work presented for assessment, it will be reported, together with the evidence, to the course supervisor, Head of Teaching Section and the Director of Undergraduate Studies who will take appropriate action. The penalty for proven cases can vary from loss of marks to expulsion by the University. Always cite your sources. For details of the College policy re-plagiarism see: [http://www3.imperial.ac.uk/portal/pls/portallive/docs/1/7289138.pdf](http://www3.imperial.ac.uk/portal/pls/portallive/docs/1/7289138.pdf)

All MRes students must complete the online postgraduate plagiarism awareness course by following the link below. [http://www3.imperial.ac.uk/graduateschool/plagiarismawarenesscourse](http://www3.imperial.ac.uk/graduateschool/plagiarismawarenesscourse)
**MRes Catalysis Lecture Courses**

**CORE**

**I-18 Palladium catalysis/chemistry in organic synthesis**  
(8 lectures: Dr Hii)  
Aims: Role of palladium reagents in modern synthetic methodology. Objectives: By the end of the course students should: Appreciate the versatility of palladium catalysis; be able to identify key catalytic precursors and intermediates involved in palladium-catalysed processes and to construct basic catalytic cycles from a given set of substrates and precursors; and be able to explain the origins of stereoselectivity in each of the processes.

**O-10 Catalytic asymmetric synthesis**  
(8 lectures, Dr Jordi Bures and Dr Christopher Cordier)  
Aims: To give you an understanding of the basic principles of asymmetric catalysis, and to demonstrate these in the context of state-of-the-art catalytic asymmetric processes for C-C bond formation and redox processes. Course Content: Introduction and general principles of asymmetric catalysis. Organozinc additions to aldehydes; a non-linear effect; copper catalysed 1,4-addition to α, β-unsaturated carboxyls (organozinc, Grignard); development of DNA-based asymmetric catalysis (SEG) Catalytic enantioselective Strecker reactions, the asymmetric Heck reaction (SEG) Proline and related catalysts: enamine catalysis; iminium catalysis, combination of enamine catalysis, iminium catalysis and cross metathesis (SEG) Oxidation of functionalised olefins: asymmetric epoxidation of allylic alcohols and enones (AA) Oxidation of unfunctionalised olefins: epoxidation, dihydroxylation and aminohydroxylation (AA) Reduction of olefins: asymmetric hydrogenation (AA) Reduction of ketones and imines (AA). At the end of this course you should be able to (learning outcomes) recognise the types of functional groups which can be prepared by catalytic asymmetric methods discussed in the course; Use this knowledge in planning the synthesis of enantiomerically enriched compounds from given prochiral starting materials; Outline the scope and limitations of any methods you propose, with respect to parameters such as turnover, substrate and functional group tolerance, availability of catalysts and/or ligands etc.

**O-24 The kinetics of catalysis**  
(8 lectures, Dr Jordi Bures)  
MR – fill in from UG summaries - Sunitha  
Aims: Be able of understand the kinetics and extract mechanistic information of catalytic reactions. Learn modern protocols for the kinetic analysis of catalytic reactions. Use kinetic simulation software to visualize the effects that different parameters have in complex catalytic systems. Course content: Reminder of basic chemical kinetics concepts. Microscopic reversibility principle applied to catalytic cycles. Building rate laws of catalytic cycles with the Quasi-Equilibrium assumption and the Steady-State approximation. Reaction Progress Kinetic Analysis (invited lecture from Syngenta). Kinetic Isotopic Effect in catalytic reactions. Kinetic simulation software. Learning Outcomes: Analyse the kinetic consequences of different mechanistic proposals for a catalytic reaction. Design experiments to get kinetic and mechanistic information of catalytic reactions. Use kinetic modelling and simulation software.

**Catalysis reaction engineering**  
(24 lectures - counts as double credit, Dr Andreas Kogelbauer, Dr Clemens Brechtelsbauer, Dr Frantisek Stepanek, Mr Richard Escott)  
Overview of some fundamentals of engineering, covering mass transfer, heat transfer, basic reactor design equations, material balances, certain physical laws and an introduction to ideal reactor models. The course will provide training in solving simple material/energy balances for a batch reactor, plug flow reactor (PFR), differential reactor, continuous stirred tank reactor (CSTR) and an understanding of rate, stoichiometry and how it is influenced by temperature. An
introduction will be given to heterogeneous reactions, encompassing transport processes in heterogeneous catalysis, including film factor, effectiveness factor, porous diffusion, Thiele modulus and fixed bed catalytic reactor design.

**OPTIONAL**

**I-1 Inorganic mechanisms and catalysis – 9 lectures**
This course covers key advanced topics in inorganic reaction mechanisms and their application in homogeneous catalysis. The course starts by giving an overview of the definitions important in catalysis including activity and selectivity and introduces the language commonly used in catalysis science. Lectures 2 & 3 are devoted to an in depth analysis and discussion of the various reaction mechanisms that can take place at a transition metal centre. Lectures 4-8 give an overview of catalytic reactions that are carried out in a homogeneous phase and that are of industrial importance. The various reaction processes are discussed in depth and the underlying mechanism of the catalytic reaction is analysed in detail.

**I-5 Modern applications of inorganic chemistry in industry**
(8 lectures, chemical industry staff)
An overview of how inorganic chemistry is used in industry, lectures by invited speakers from the chemical industry on their specialist areas. The areas covered vary from year to year although previous topics have included olefin dimerisation catalysts, ethylene polymerisation, the chemistry of light olefin production, fuel cell systems, silicones - their chemistry and applications, automotive pollution control and catalytic process design.

**I-11 Green solvents**
(4 x 2hr lectures, Dr Hallett)
This course investigates what makes a solvent ‘Green’. It surveys the literature of solvent types that are being advocated as Green replacements for currently used solvents. The first three lectures are formal presentations; the remainder of the course is taught by reading review papers, followed up by discussion classes. The examination is by essay.

**I-10 Green chemistry**
(10 lectures, Prof. Williams)
The course will focus on the design, development and evaluation processes of green chemistry and is particularly aimed at synthetic chemists or those interested in pursuing environmental chemistry. In the first lecture, there will be an introduction to the field and an evaluation of the twelve principles of green chemistry. In the following lectures these principles will be examined in more detail and contextualized with examples from the recent literature or from the chemical industry. The areas covered include use of renewable resources as chemical feedstocks, atom economy, green solvents, catalysis and biocatalysis, greener reagents or products and biodegradable materials.

**O-7 Pharmaceuticals**
(6 lectures, GSK research staff)
This six-lecture course provides an introduction to medicinal chemistry and related subjects in the pharmaceutical industry, and is presented by lectures from GlaxoSmithKline who are experts in their fields. The course begins with an introductory lecture on the overall processes of the pharmaceutical industry from a chemistry perspective, beginning at the identification of new disease targets, through to the final marketing of a drug, and focuses on the issues and hurdles that need to be overcome at each stage. Changes underway in the industry to address the falling output of new drugs being brought to the market are also described. Two case study lectures focus on recently developed drugs, illustrating their discovery and the medicinal chemistry challenges and hurdles that needed to be overcome. To support these lectures, a further lecture covers the importance of understanding the pharmacokinetics and metabolism of drug substances, and looks
at the effects of physical characteristics and chemical structure on these parameters. The fifth
dлежащего предложения:

The overall objective of this course is to teach students how to develop, in a systematic manner, correct, complete and mathematically well-behaved models of the transient behaviour of process equipment. The course focuses on first-principles mathematical models derived from an understanding of the fundamental process physics, and on the interactions between physics, mathematical formulations and mathematical/numerical solution methods. Ultimately, students should be able to apply these concepts to build and execute detailed models of process equipment using state-of-the-art modelling tools.
Educational aims of the course

1. Learning outcomes

The programme aims to:

- Produce science postgraduates equipped to pursue careers relating to sustainable technologies, in academia, industry, the public sector and non-governmental organisations;
- Develop the ability to undertake research in multidisciplinary teams;
- Develop knowledge of a range of basic and advanced concepts focused around catalysis;
- Develop research and analytical skills related to sustainable technology research
- Develop oral and written scientific presentation skills
- Attract the most motivated science and engineering graduates from both within the UK and from overseas;
- Develop new areas of teaching in response the advance of scholarship and the needs of vocational training.

Considering the above aims, the main outcome of the programme is to provide opportunities for postgraduate students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas:

a) Knowledge and understanding of:

- Core concepts in catalysis – introduction to the roles played by catalysis, key catalytic targets, the right catalyst for the process, the role engineering plays and how this translates to industry;
- Research techniques, including information retrieval, experimental design, chemical synthesis, process modelling, reactor design and laboratory safety;
- Detailed knowledge and understanding of the essential facts, concepts, principles and theories relevant to the student’s project; management and communication skills, including problem definition, project design, decision processes, teamwork, written and oral reports, scientific publications.

Teaching/learning methods and strategies

- Acquisition of the above knowledge and understanding (15.A-15.C) is through a combination of lectures, seminars, coursework and research.
- Throughout, the students are encouraged to undertake independent reading both to supplement and consolidate what is being taught / learnt and to broaden their individual knowledge and understanding of the subject.
- Assessment of the knowledge base is through assessed project work (15.A-15.C).

b) Intellectual skills. To be able to:

- Analyse and solve catalytic challenges using an integrated multidisciplinary approach
- Integrate and evaluate information
- Formulate and evaluate hypotheses using appropriate experimental design and statistical analysis
- Plan, conduct and write up a programme of original research

c) Practical skills

- Plan and execute safely a series of experiments
- Use laboratory–based methods to generate data
- Analyse experimental results and determine their strength and validity
- Prepare technical reports and give technical presentations
• Use the scientific literature effectively
• Use computational tools and packages

d) Transferable skills
• Communicate effectively through oral presentations, computer processing and presentations, written reports and scientific publications
• Management skills: decision processes, objective criteria, problem definition, project design and evaluation, risk management, teamwork and coordination
• Integrate and evaluate information from a variety of sources
• Transfer techniques and solutions from one discipline to another
• Use information and communications technology
• Manage resources and time
• Learn effectively for the purpose of continuing professional development
Student responsibilities

The MRes course is a postgraduate assignment and as such is not following undergraduate timing. There is no term-free time in this course. Students should be aware that their course is full-time employment up to the end of September. Any holidays or sick-leave will have to be taken at the discretion of the supervisors, but should under no circumstances be taken in the examination periods of January and May.

It is mandatory to attend all scheduled lectures, seminars, courses and exams. Missing an exam without any support from a doctor’s letter for the day of the exam will count as failure. It is the responsibility of the student to ensure that sufficient time is allocated for the exam and write-up preparation.

Students should contact the Course Directors for discussion of all matters concerning problems with the supervision of the projects or other pastoral difficulties.

Students are expected to organise, conduct and present their research project in an independent fashion. The supervisory role is to guide and advise the student intellectually as well as technically, but it is not the supervisor’s responsibility to do the thinking or the work for the student. All projects will have at least two supervisors. Both supervisors should be approached for guidance. It is the student’s responsibility to make an effort and seek contact with their supervisors on a regular basis.

In order to pass the course successfully students have to pass all assessed components of the course. This includes the written exams, the research proposal, journal club, the dissertation and the oral presentations.

At the end of the course an external examiner will assess the examination process. All students have to be available on this day unless instructed otherwise. Students that are either at boundaries between marks (i.e. pass/failure or merit/distinction) or have failed one or more components of the course may get an additional oral examination (viva) that will determine their final mark.

Students should seek guidance with respect to their write-up and Research Proposal from their corresponding supervisors, since they will be involved in the marking. After completion of the Research Proposal students should seek feedback from their corresponding supervisors to help improve the quality of their final Dissertation.

Students are required to submit an electronic version of the Dissertation to their supervisors. Additionally, they must hand over all notes, lab-books, results, computer programmes etc to their supervisors at the end of the course.
Professional Development for Master’s students

Introduction
An Imperial College Master’s degree provides students with high quality, discipline specific training. To complement this we wish to ensure that all Master’s students obtain generic skills training with a view to providing skills relevant both for their degree and for future employment. It is recognised that there is excellent practice with respect to professional development skills embedded within many Master’s courses. In addition, many Master’s courses make use of the current MasterClasses provided by the Graduate School while others benefit from the professional development skills courses developed for our doctoral students. However what is currently lacking is a formalised College-wide approach to the generic skills training for all our Master’s students. Following the recent College review of transferable skills it has been decided that all Master’s students at Imperial should receive professional development training with a view to particularly developing:

- Reflective independent learning
- Critical thinking
- Communication of complex ideas
- Interdisciplinary awareness
- Project and time management
- Flexibility and ability to manage complexity
- Networking skills

Professional development skills requirement
As mentioned above it will be Course Directors’ responsibility to ensure that the professional skills component is embedded into each Master’s course. It is also expected that all students are given the opportunity to further develop their generic skills within their Master’s course, for example by giving poster and oral presentations. It is important that students are receiving feedback on such existing professional development elements. Clear statements should be made in course handbooks so that the professional development content is evident to students. The professional development components of Master’s Programmes will be assessed by the Master’s Quality Committees through annual monitoring.

Embedding the professional development skills components
Course Directors will be responsible for ensuring that the different components are embedded within their respective courses. Support will be given in the provision of Master’s training by the Postgraduate Development Unit (Head: Elaine Walsh). Two new staff members, a teaching fellow and an e-learning technologist, with responsibility for development and delivery of Master’s training courses, have been appointed to start in August. The Postgraduate Development Unit (PDU) will support Course Directors for example by outlining the professional development skills requirement, providing course materials and providing guidance on ensuring adequate feedback on generic skills training. In addition we aim to disseminate examples of good practice and generate links between individual courses with a view to encouraging the sharing of existing training resources where possible.

Currently Master’s students may attend appropriate Graduate School professional skills courses and this will still be possible during the 2014-2015 academic year. Where there are Master’s Programmes which have a requirement for their students to attend specific Graduate School professional development course(s), we will be able to maintain existing arrangements for 2014-2015, but will move away from this model over the next few years and embed all required training
within the Master’s course itself. As described above, help and support will be provided to facilitate this transition.

**MasterClasses**
Currently the Graduate School runs a series of MasterClasses at the South Kensington, Hammersmith and Silwood Park Campuses. These are normally in the form of 90 minute lectures held over lunchtime. The current MasterClasses are:

- Note-taking and Efficient Reading
- Research Skills and Reference Management
- Preparing and Writing a Literature Review
- Stress Management
- Academic Writing
- Developing your Career through Networking
- Interview Skills
- Job Search with a Difference
- Informational Posters - Layout and Design.
- Interpersonal Skills
- Negotiating Skills

**E-learning tools**
The Graduate School is in the process of setting up a dedicated website for Master’s students. This will contain information on the courses available to Master’s students as well as links to information on the support and advice available for Course Directors. This site will also contain links to existing e-learning tools which are of relevance to at least some of our Master’s students. There is an excellent on-line maths and statistics tool which will be available on Blackboard and additional courses are being developed. In addition the Masters e-learning technologist will be developing specific tools on plagiarism. New e-learning tools may be developed in consultation with specific Course Directors. We also have two DVDs covering presentation skills and oral examination skills.

Although the PDU is able to help substantially in the development and delivery of generic skills course, it will be the responsibility of the Course Director to arrange training in skills specific to a particular Master’s programme.

**Careers Advisory Service (CAS)**
Each year in October and again in January, the CAS hold a lunchtime talk aimed mainly at incoming Master’s students on “Working in the UK”. In addition, there are some specific whole day workshops for Master’s students to provide last minute help and advice on job hunting. The CAS also provides bespoke careers advice sessions to individual Master’s courses which are delivered at different College campuses. If a Course Director feels their students could benefit from such a course then they can contact the CAS directly to arrange a session.

**Updates to the programme**
New developments and updates to the programme will be disseminated in the Graduate School’s newsletter to Course Organisers.
Frequently Asked Questions

1. Is the MRes in Catalysis a taught or a research masters programme?

The course consists principally of research (70%) with a mixture of core and optional lecture courses on relevant topics making up the remaining 30%. Lectures are not confined to the Chemistry Department but also include ones offered by the Centre for Environmental Policy and the Sustainable Energy Futures course. Research projects commence in January after a proposal has been devised between student and supervisor. The projects can be based in one department or jointly between supervisors in various departments across the University such as Chemistry, Chemical Engineering, Materials, Physics, Maths and Biochemistry.

2. When do I need to choose a supervisor for my research project?

Contact is made between students and supervisors once the course has started. A range of projects will be offered and you will have the chance to talk to those offering projects and your choices will be used to allocate projects in the first term.

3. What reading material related to the course would you recommend?

All students would do well to revise the topics of transition metal and organometallic chemistry. In addition, more specialised books on catalysis are available in University libraries. We do not expect you to buy the following books but they would be useful reading in advance and during the course:


4. How much are living costs in London?

It is recommended that you budget £14,000 per annum for living costs in London.

5. Is it possible to do a part-time job while attending the course?

The course is full time so we only suggest that, if you wish to work while attending the course, you only take a part-time job at weekends.

6. Can I get help with my English language skills?

Yes, the English Language Support Unit (ELSU) offers classes to students who are not native speakers of English. The majority of these courses are free of charge. Further information can be found at: http://www3.imperial.ac.uk/humanities/englishlanguagesupport
MRes GUIDANCE FOR WRITING A RESEARCH PROPOSAL

FORMAT OF PROPOSAL:
A research proposal should be clear, concise and not cluttered with technical jargon. Try to convey what it is that is exciting about the research. You need to convince the reader about the value of your project. Provide a convincing case for the originality of your proposal and describe your objectives clearly and succinctly.

Your research proposal should adhere to EPSRC guidelines as far as possible (see: http://www.epsrc.ac.uk/funding/apprev/preparing/Pages/documents.aspx). This means that the proposal should be composed of the main proposal (maximum 6 sides of A4) and a diagrammatic work plan (maximum 1 side of A4):

1. **Main proposal.** This should comprise:

   **Background:** Introduce the topic of research and explain its academic and industrial context. Demonstrate a knowledge and understanding of past and current work in the subject area in the UK and abroad.

   **Programme and Methodology:** Identify the overall aims of the project and the individual measurable objectives against which you would wish the outcome of the work to be assessed. Detail the methodology to be used in pursuit of the research and justify this choice. Explain why the proposed project is of timeliness and novelty. Describe the programme of work, indicating the research to be undertaken and the milestones that can be used to measure its progress.

   **Relevance to Beneficiaries:** Identify the potential impact of the proposed work. Show who is likely to benefit from the proposed research. If the benefits do not directly relate to wealth creation and/or to improving the quality of life, give details of other beneficiaries and explain their importance; other research workers are legitimate beneficiaries.

   **Dissemination and Exploitation:** Indicate the proposed dissemination and technology transfer routes and explain how the transfer of knowledge will take place to beneficiaries and the general public.

2. **Diagrammatic work plan.** This should be a diagrammatic indication of the project plan, for example, a PERT or Gantt chart.

PLAGIARISM
The Department and College take plagiarism very seriously. Do not plagiarise. You must read and comply with the Chemistry Department Policy on Plagiarism:

http://www3.imperial.ac.uk/chemistry/teaching/undergraduateteaching/materials/plagiarism

COVER PAGE FORMAT:
All research proposals must provide the following information on the cover:

- The title
- Your name, course and year (e.g. Tom Jones, MRes Catalysis)
- The type of report: e.g. Research Proposal.
- Your examination (candidate) number
- The name of your supervisor(s)
- The place where the work is to be carried out, if not at Imperial
- The date of submission (month and year)
**ASSESSMENT:**
The report will be assessed by your supervisor and an independent assessor (another member of staff) using the criteria shown in the attached guidelines. Where the independent assessor and supervisor disagree about the merit of the report, the report will be returned to the coordinator who will commission further independent assessors and/or arbitrate.

**SUBMISSION DEADLINE:**
Three hard copies of the Research Proposal must be handed in to Dr Mike Ray by the specified date and time (see page 2 of this Handbook). An identical electronic (pdf) version must be e-mailed to him and the same file must be uploaded onto the Blackboard site, both by the stated deadline. This file should be named as follows:

Surname[CIDnumber]prop.pdf  
e.g. jones00788951prop.pdf

This pdf electronic copy of your report will be scanned for evidence of plagiarism.

**Late submission will be penalised:** At the discretion of the Course Directors, 10% of the awarded mark will be deducted for submission up to 24 h late; an additional 5% will be deducted for each subsequent working day.

**FEEDBACK ON PROPOSAL:**
Once your proposal has been marked by your supervisor and an independent assessor you can ask your supervisor for verbal feedback on its content, structure, presentation etc. Please contact your supervisor directly for this. Bear in mind that he/she will not be able to do this until marking by both assessors is complete.
GUIDANCE FOR THE ASSESSMENT OF RESEARCH PROPOSALS

<table>
<thead>
<tr>
<th>No.</th>
<th>Criterion</th>
<th>Factors</th>
<th>Supervisor</th>
<th>Maximum Marks</th>
<th>Independent Assessor</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lit Survey</td>
<td>coverage context</td>
<td>√</td>
<td>25</td>
<td>√</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Understanding of background</td>
<td>Insight, critical analysis</td>
<td>√</td>
<td>25</td>
<td>√</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Planning and assessment of viability</td>
<td>Fallback options, appreciation of risk</td>
<td>√</td>
<td>25</td>
<td>√</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Presentation</td>
<td>Structure, clarity, written style, quality of English</td>
<td>√</td>
<td>25</td>
<td>√</td>
<td>25</td>
</tr>
</tbody>
</table>

Total 100 100

DETERMINATION OF FINAL MARKS

For MRes research project proposals:
Supervisors mark for proposal 50%
Independent Assessor’s mark for proposal 50%

CRITERIA FOR MARKING APPLIED TO MRes RESEARCH PROPOSALS
(with comparison to degree classification)

Clear Fail (40%):
1) Literature survey (coverage & context) - poor coverage of topic; little evidence of structure.
2) Understanding of background (insight, critical analysis) - very limited grasp of key scientific issues; little evidence of critical analysis.
3) Planning & assessment of viability (fallback options, appreciation of risk) - very limited concept of scope of project; no fallback options indicated.
4) Presentation (structure, clarity, written style, quality of English) - minimal organisation of material; difficult to follow; unclear; poor English.

Fail/Merit Borderline (50%):
1) Literature survey (coverage & context) - acceptable coverage; somewhat illogical composition.
2) Understanding of background (insight, critical analysis) - some comprehension of scientific issues; attempts to apply reason-based analysis.
3) Planning & assessment of viability (fallback options, appreciation of risk) - basic scope of project adumbrated; some indications of priority and fallback avenues.
4) Presentation (structure, clarity, written style, quality of English) - apparent structure into sections; English acceptable; some text to scheme links.

Pass/Merit Borderline (60%):
1) Literature survey (coverage & context) - good coverage; logical selection of literature citations.
2) Understanding of background (insight, critical analysis) - appreciation of key issue; some insight and analysis into key aspects.
3) Planning & assessment of viability (fallback options, appreciation of risk) - coherent picture of scope of project conveyed; priorities and fallbacks alluded to.
4) Presentation (structure, clarity, written style, quality of English) - English good; clear organisation of material into logical section; Good, clear style.
Merit/Distinction Borderline (70%):

1) Literature survey (coverage & context) - comprehensive coverage; carefully chosen & evaluated references.
2) Understanding of background (insight, critical analysis) - clear awareness of scientific background; logical and insightful analysis.
3) Planning & assessment of viability (fallback options, appreciation of risk) - clear description of project scope; objectives prioritised and fallbacks clearly identified.
4) Presentation (structure, clarity, written style, quality of English) - essentially error free; clear logical construction; balanced presentation of message.

Clear Distinction (~85%):

1) Literature survey (coverage & context) - highly accomplished précis of subject area; publishable quality.
2) Understanding of background (insight, critical analysis) - lucid presentation of complex ideas; mature, critical analysis.
3) Planning & assessment of viability (fallback options, appreciation of risk) - Research Council quality planning; clear, concise, reasoned and justified.
4) Presentation (structure, clarity, written style, quality of English) - flawless English; clear, logical structure; engaging style; clear developed message.
MRes GUIDANCE FOR JOURNAL CLUB

DESCRIPTION:
Journal club meetings take place in the spring term. This is an assessed transferable skills course that aims
a) to give experience in presenting research to a broad audience and working together in a group, b) encourage reading around your subject and the wider field of catalysis and c) provide an opportunity to discuss topical subjects in catalysis.

FORMAT:
At each session one group will present a paper whilst the others will read the same paper in depth and prepare questions to ask. Over the course of the Journal Club, each group will present twice and prepare questions twice (4 sessions).

Presentations are based on a paper that will be emailed to the students about 2 weeks before the day of the Journal Club session, and should last 20 minutes (typically 15 slides). There will then be questions from the ‘questioning’ group, followed by a general discussion.

The format of the presentation is entirely up to your group to decide, but each person is expected to contribute 5-6 minutes to the presentation itself. Areas to be covered are background to the paper, methodology, results and discussion of the implications of the study.

ASSESSMENT:
Each person presenting will be assessed (equal weighting) by the two members of staff present on presentation (e.g. slides, delivery, timekeeping), science (e.g. pitched at an appropriate level, awareness of context), integration (e.g. evidence of teamwork, organisation, even division of material between the group).

Late submission and absences will be penalised: This is an obligatory part of the course and attendance is expected.
MRes GUIDANCE FOR CARRYING OUT A RESEARCH PROJECT, WRITING A DISSERTATION & MAKING AN ORAL PRESENTATION

CARRYING OUT THE PROJECT:

The lab-based research project should be carried out in collaboration with your designated research supervisor. The laboratory work will be carried out in a lab designated by your supervisor. You are expected to work in your supervisor's lab during normal working hours (9 am – 5 pm) whenever you do not have lectures and allowing of course for a one hour lunch break. The project lasts from the first week of the Autumn term to mid-September in the Summer term. Holidays/revision breaks are arranged with your Supervisor.

Throughout the project, you should meet regularly with your supervisor to update him/her on what progress you are making. If you are having problems or difficulties with the work you should let your supervisor know as soon as possible. If for some reason you are unable or unhappy about doing this please contact the Directors of the MRes Catalysis programme or the Director of Postgraduate Studies.

Safety: You MUST attend a lab safety talk prior to starting laboratory work and abide by the Departmental safety procedures at all times. See: http://www3.imperial.ac.uk/chemistry/safety.

Lab book and primary data retention: During the course of your project you must keep a dated lab book in which details of all the experiments/investigations you carry out. This lab book is the property of the Department and must be retained by your supervisor once the project has finished. Additionally, you will generate primary spectroscopic and computational data from various instruments/systems that relate to your findings (e.g. spectroscopic data, computational output etc.). This primary data, in whatever form (electronic or paper etc.) is also the property of the Department and must be given to your supervisor once the project has finished. It is your responsibility to ensure that happens. This is of paramount importance as this will be required as evidence in the event that it is necessary to check the validity of the data reported.

FORMAT OF THE DISSERTATION:

Your Dissertation should be written in an accepted RSC style (i.e. Dalton, Faraday or Org. Biomol. Chem.). Start with Introduction and Aims and Objectives sections setting out why you are doing the work, i.e., why it is important, what you were expecting to achieve at the outset, and referring to any relevant publications. These are followed by Results and Discussion and Experimental sections - the order varies with the style. The References come at the end.

The length should be no more than 60-80 pages (A4 typed; 1.5 or double spaced) and may well be shorter than this as the scientific approach is to be concise.

The Results and Discussion chapter presents your experimental results, including the things that didn't work as well as those that did - this is important, as it allows the markers to judge how much you did during your time. Remember that much scientific research is unsuccessful! The discussion should explain the significance of your results and suggest avenues of future research. The Experimental chapter describes concisely the experimental techniques and procedures you used. It is not necessary to describe standard techniques in detail, but you should mention any special techniques, precautions or difficulties. When you have finished, write an Abstract of not more than one page - this goes at the front of your report.

Your research supervisor should be able to help you with the format of your report - it is important not to leave writing up too late so that he/she can see the first part in draft. Another reason for starting to write-up well before the deadline is that you may well think of a finishing touch that would round off your experimental work. It is the content rather than the number of pages that counts.

COVER PAGE FORMAT:

All Dissertations must provide the following information on the cover:

- The title
- Your name, course and year (e.g. Tom Jones, MRes Catalysis)
- The type of report: e.g. Dissertation
- Your examination (candidate) number
- The name of your supervisor
- The place where the work was carried out, if not at Imperial
- The date of submission (month and year)
**SUBMISSION DEADLINE:**

Three hard copies of the Dissertation must be handed in to Dr Mike Ray by the specified date and time (see page 2 of this Handbook). An identical electronic (pdf) version must be e-mailed to him and the same file must be uploaded onto the Blackboard site, both by the stated deadline. This file should be named as follows:

Surname[CIDnumber]res.pdf  
e.g. jones00788951res.pdf

This pdf electronic copy of your report will be scanned for evidence of plagiarism.

**Late submission will be penalised:** At the discretion of the Course Directors, 10% of the awarded mark will be deducted for submission up to 24 hrs late; an additional 5% will be deducted for each subsequent day.

The presentations must be prepared in time for the appropriate MRes Catalysis Presentation Day. Failure to show up will result in zero marks being assigned.

All MRes students making presentations MUST attend the ENTIRE Presentation Day.

A viva will also be conducted on the research work carried out. Failure to attend will result in zero marks.

**FORMAT OF THE ORAL PRESENTATION:**

Discuss the format of this with your supervisor and preferably have a number of practice sessions prior to the Departmental presentation. In all cases, your talk should:

- be a clear and concise summary of your research.
- provide a non-specialist audience with sufficient background information to place your research contribution in perspective.
- be prepared using power point or similar presentation software using a font that is easily readable in a lecture theatre (i.e. > 14 point, preferably sans-serif: e.g. Helvetica or Arial).
- start with a slide displaying clearly your project title, your name & your supervisor’s name as well as the College Logo.
- last no more than 15 min to allow 5 min for questions.

Be imaginative! There will be prizes for best presentations.

An identical electronic (pdf) version of the presentation must be uploaded onto Blackboard Learn by the stated deadline. This file should be named as follows:

surname(CID number)talk.pdf  
e.g. jones(00258951)talk.pdf

This pdf electronic copy of your report will be scanned for evidence of plagiarism.

**Late submission will be penalised:** At the discretion of the Course Directors, 20% of the awarded mark will be deducted for submission up to 24 hr late; an additional 5% will be deducted for each subsequent day.

**ASSESSMENT:**

Assessment of this assignment has four components:

1. Your performance in carrying out the research project – this is assessed by your research supervisor using the criteria shown in the attached guidelines.
2. Your Dissertation – this is assessed by your supervisor and an independent member of staff using the criteria shown in the attached guidelines. Where the independent assessor and supervisors disagree about the merit of the dissertation, it will be returned to the Course Directors who will commission further independent assessors and/or arbitrate.
3. Your research presentation – this is assessed by a panel of staff (excluding your supervisor) at the Catalysis Presentation Day.
4. Your performance in discussing your research work in the Viva.
For the division of marks between these categories, see the guidelines below.
GUIDANCE FOR THE ASSESSMENT OF RESEARCH PERFORMANCE

These criteria should be combined with the definitions of degree classification given overleaf in making an assessment of the students’ performance.

<table>
<thead>
<tr>
<th>No.</th>
<th>Criterion</th>
<th>Factors</th>
<th>Supervisor</th>
<th>Maximum Marks %</th>
</tr>
</thead>
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<tr>
<td>1</td>
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<td>35</td>
</tr>
<tr>
<td>2</td>
<td>originality</td>
<td>independence, initiative</td>
<td>√</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>productivity &amp; achievement</td>
<td>output, time management</td>
<td>√</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>commitment</td>
<td>diligence, motivation</td>
<td>√</td>
<td>10</td>
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<tr>
<td>5</td>
<td>record keeping</td>
<td>Clarity, accuracy</td>
<td>√</td>
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Total: Supervisor 100

GUIDANCE FOR THE ASSESSMENT OF DISSERTATION

These criteria should be combined with the definitions of degree classification given overleaf in making an assessment of the report.

<table>
<thead>
<tr>
<th>No.</th>
<th>Criterion</th>
<th>Factors</th>
<th>Supervisor</th>
<th>Maximum Marks %</th>
<th>Independent Assessor</th>
<th>Maximum Marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>background &amp; introduction</td>
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<td>√</td>
<td>20</td>
<td>√</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>understanding &amp; analysis</td>
<td>scientific awareness, justification</td>
<td>√</td>
<td>30</td>
<td>√</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>quality of experimental</td>
<td>volume &amp; accuracy</td>
<td>√</td>
<td>30</td>
<td>√</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>presentation</td>
<td>structure, clarity, written style, quality of English</td>
<td>√</td>
<td>20</td>
<td>√</td>
<td>20</td>
</tr>
</tbody>
</table>

Total: Supervisor 100

GUIDANCE FOR THE ASSESSMENT OF ORAL PRESENTATION AND VIVA

The criteria for these are based on the same aspects above, however, at the Presentations Day it will be the delivery and presentation of the research rather than the content which will be marked. The Viva seeks to reveal the student’s fundamental understanding of the project, background knowledge and context.
CRITERIA FOR MARKING APPLIED TO FINAL YEAR RESEARCH PROJECTS
(degree classifications provided for comparison)

Clear Fail (40%):

Research Performance:
1) **Skill (technical competence)** - a just passable level of skill; implemented some ideas but misunderstood some.
2) **Originality (independence, initiative)** - did have some ideas but mainly irrelevant and impractical.
3) **Productivity and achievement (output, time management)** - poor attendance; poor time management, minimal progress achieved.
4) **Commitment (diligence, motivation)** - expended minimal effort to progress the project.
5) **Record keeping (clarity, accuracy)** - very poor record of experiments; many critical details not recorded.

Dissertation:
1) **Background and introduction (quality of coverage & context)** - scientific aims and background poorly conveyed; absent key references/concepts.
2) **Understanding and analysis (scientific awareness, justification)** - very limited grasp of key scientific issues; little evidence of critical analysis.
3) **Quality of experimental (volume and accuracy)** - few meaningful results obtained; presentation of data imprecise/inaccurate.
4) **Presentation (structure, clarity, written style, quality of English)** - minimal organisation of material; difficult to follow; unclear; poor English.

Fail/Pass Borderline (50%):

Research Performance:
1) **Skill (technical competence)** - competent but required significant help with complex tasks/experiments.
2) **Originality (independence, initiative)** - some ideas which contributed to advancement of the project.
3) **Productivity and achievement (output, time management)** - lacking in commitment; most experiments conducted in a satisfactory fashion.
4) **Commitment (diligence, motivation)** - showed some interest in progressing the project but easily distracted.
5) **Record keeping (clarity, accuracy)** - most necessary experimental details recorded; some ambiguity apparent.

Dissertation:
1) **Background and introduction (quality of coverage & context)** - most scientific aims identified; some confusion relating to prioritisation and relevance.
2) **Understanding and analysis (scientific awareness, justification)** - some comprehension of scientific issues; attempts to apply reason-based analysis.
3) **Quality of experimental (volume and accuracy)** - some useful data; format and presentation non-ideal.
4) **Presentation (structure, clarity, written style, quality of English)** - apparent structure into sections; English acceptable; some text to scheme links.

Pass/Merit Borderline (60%):

Research Performance:
1) **Skill (technical competence)** - able to carry out most techniques; receptive to ideas which were then implemented.
2) **Originality (independence, initiative)** - contributed most ideas to advance the project.
3) **Productivity and achievement (output, time management)** - effective use of time and good number of reliable results.
4) **Commitment (diligence, motivation)** - diligent work pattern; keen to achieve progress.
5) **Record keeping (clarity, accuracy)** - sufficient details recorded to allow repetition; some non-optimal formatting.

Dissertation:
1) **Background and introduction (quality of coverage & context)** - coherent narrative; style slightly derivative; almost all aims adumbrated.
2) **Understanding and analysis (scientific awareness, justification)** - appreciation of scientific challenges; reasoned justification of strategic decisions taken.
3) **Quality of experimental (volume and accuracy)** - useful data collected; most important details documented; some inconsistencies.
4) **Presentation (structure, clarity, written style, quality of English)** - English good; clear organisation of material into logical section; Good, clear style.
Merit/Distinction Borderline (70%):

Research Performance:
1) Skill (technical competence) - very good skills from outset.
2) Originality (independence, initiative) - required minimal assistance; high level of critical judgement
3) Productivity and achievement (output, time management) - a substantial volume of results generated.
4) Commitment (diligence, motivation) - excellent motivation; voluntarily exceeded expectations.
5) Record keeping (clarity, accuracy) - precise and clear records with all details noted.

Dissertation:
1) Background and introduction (quality of coverage & context) - scientific aims clearly identified; clear comprehension of background; all key refs. cited.
2) Understanding and analysis (scientific awareness, justification) - clear awareness of scientific challenges; logical approach to problem solving.
3) Quality of experimental (volume and accuracy) - good volume of high quality, publishable results; format largely adheres to convention.
4) Presentation (structure, clarity, written style, quality of English) - essentially error free; clear logical construction; balanced presentation of message.

Clear Distinction (~85%):

Research Performance:
1) Skill (technical competence) - excellent technical ability; publishable quality of output.
2) Originality (independence, initiative) - excellent grasp of concepts; innovative lines of enquiry self-generated.
3) Productivity and achievement (output, time management) - excellent productivity and professional level of output.
4) Commitment (diligence, motivation) - tenacious; single minded dedication to advancing the project.
5) Record keeping (clarity, accuracy) - model record keeping including insightful observations and perceptive annotations.

Dissertation:
1) Background and introduction (quality of coverage & context) - clear display of subject mastery; precise, coherent, structured; all key refs. cited.
2) Understanding and analysis (scientific awareness, justification) - lucid presentation of nub of challenges faced; mature, reasoning-based analysis.
3) Quality of experimental (volume and accuracy) - outstanding volume of high quality, publishable results; substantial project progress made.
4) Presentation (structure, clarity, written style, quality of English) - flawless English; clear, logical structure; engaging style; clear developed message.
Imperial College London
Research Student Assessment: MRes Mid-Project Progress Report Form
MRes in Catalysis

Student name:
Project Title:
Supervisors:
Date:

**Evaluation to be completed by the Supervisor** (*please circle as appropriate, if starred response please give details/agreed action in space provided*)

- Attendance:
- Commitment:
- Awareness of Literature:
- Presentation skills (written and oral):
- Overall Progress:

**Supervisor’s comments on project progress to date. Please highlight any successes and problems and comment on the agreed targets for the second half of the project (please continue overleaf if required).**

**Student’s General Comments, including identification of any issues which need to be addressed** (please continue overleaf if required).

Student’s signature …………………………… Date …………………..
Supervisor’s signature  …………………………… Date …………………..
Imperial College London
MRes Mid-Project Progress Report Form - Student Evaluation
MRes in Catalysis

Name:
Project Title:
Supervisors:
Date:

Evaluation to be completed by the Student *(please circle as appropriate, if starred response please give details/agreed action in space provided)*

Quality of Supervision: Excellent / good / satisfactory / unsatisfactory*
Overall Project Progress to date: Excellent / good / satisfactory / unsatisfactory*

Please highlight successes/problems encountered during the project to date, and detail any changes made to the research plan in light of these. Use this opportunity to identify any issues which need to be addressed in the coming weeks/months.

Student's signature ............................................. Date .........................
Other useful links

Assessment

• Link to Academic and Examination regulations:
  http://www3.imperial.ac.uk/registry/proceduresandregulations/regulations

• Link to religious obligations in assessments:
  https://workspace.imperial.ac.uk/registry/Public/Exams/Exams%20and%20religious%20obligations.pdf

Procedures

• The College’s Regulations for Students:
  http://www3.imperial.ac.uk/registry/proceduresandregulations

• Mitigation / extenuating circumstances policy and procedures:
  http://www3.imperial.ac.uk/registry/proceduresandregulations/policiesandprocedures/examinationassessment

• Complaints and Appeals procedures:
  http://www3.imperial.ac.uk/registry/proceduresandregulations/policiesandprocedures/complaintsappeals

• Academic integrity:
  https://workspace.imperial.ac.uk/registry/Public/Procedures%20and%20Regulations/Policies%20and%20Procedures/Examination%20and%20Assessment%20Academic%20Integrity.pdf

• Cheating offences policy and procedures:
  http://www3.imperial.ac.uk/registry/proceduresandregulations/policiesandprocedures/disciplinary

Employment

• Link to the Policy on employment during studies:

Welfare and Support

• Information for students with disabilities, including the Disability Advisory Service:
  http://www3.imperial.ac.uk/disabilityadvisoryservice

• Other welfare and pastoral care /support resources both Departmental and College-wide (e.g. College Tutors, Dean of Students, Counselling Service, Health Centre, NHS Dentist, Student Hub, Chaplaincy, support for International Students inc. ELSP):
  http://www3.imperial.ac.uk/humanities/englishlanguagesupport
  http://www3.imperial.ac.uk/students/welfareandadvice
  http://www3.imperial.ac.uk/students/international

• Information about the Library:
  http://www3.imperial.ac.uk/library

• Student representation – how to become a student representative:
  https://www.imperialcollegeunion.org/representation
• Details of Departmental/College Committees, including Staff-Student Committees. (The College’s Staff-Student Committee Good Practice Guidelines are available at: http://www3.imperial.ac.uk/registry/proceduresandregulations/qualityassurance/goodpractice)

• Other support services (e.g. Registry, Careers Advisory Service): http://www3.imperial.ac.uk/registry http://www3.imperial.ac.uk/careers