先端化学専攻群

（物質エネルギー化学専攻，分子工学専攻，合成・生物化学専攻）

Ⅰ．専攻別志望区分

物質エネルギー化学：http://www.eh.t.kyoto-u.ac.jp/ja

区分	研究内容	対応する教育プログラム		
		連携教育プログラム		修士課程教育プログラム
		融合工学コース	高度工学コース	
201	エネルギー変換化学講座 無機固体化学、ユビキタス元素を用いた金属酸化物の設計と機能性開拓、環境に調和した低温反応法の開拓、次世代に繋がる超伝導材料、磁性体、誘電体などの新物質開発	物質機能・変換科学分野	物質エネルギー化学専攻の定める教育プログラムに従う	物質エネルギー化学専攻の定める教育プログラムに従う
202	基礎エネルギー化学講座、工業電気化学分野 電気化学、リチウム電池や燃料電池の反応とその材料、界面における電子・イオンの移動、イオン導電性材料、ナノ材料の合成			
203	基礎エネルギー化学講座、機能性材料化学分野 界面科学、界面現象と界面構造形成、界面の分光化学的解析、油水２相系およびイオン液体をもちいる機能性柔軟界面の構築			
204	基礎物質化学講座、基礎炭化水素化学分野 有機活性種化学、均一系触媒有機合成反応の開発、マクロサイクル化合物の新合成法開発、光機能性集積芳香族化合物創製、腫瘍イメージング	物質機能・変換科学分野、総合医療工学分野		
	基礎物質化学講座、励起物質化学分野 （今年度は募集しない）	物質機能・変換科学分野		
205	基礎物質化学講座、先端医工学分野 疾患特異的分子プローブ、および診断と治療を同時に実現するセラノスティックプローブの設計・合成・機能評価、均一系触媒を用いる機能性分子の原子効率的合成	物質機能・変換科学分野、生命・医工融合分野、総合医療工学分野		
206	触媒科学講座、触媒機能化学分野 太陽光エネルギー変換のための新規光触媒開発、環境汚染物質浄化のための光触媒・触媒開発、高効率有機資源変換のための新規触媒反応設計、新規手法による酸化物微粒子の合成と機能化	物質機能・変換科学分野		
207	触媒科学講座、触媒有機化学分野 新規遷移金属触媒の開発とその機能、環境保全に資する高効率分子触媒反応の開発とその反応機構			
208	触媒科学講座、触媒設計工学分野 燃料電池構成材料と電極反応、炭化水素からの水素製造触媒、環境浄化やエネルギー変換のための無機材料、機能性無機材料の物性評価			
209	物質変換科学講座、有機分子変換化学分野 新たな有機金属反応活性種の創出と新規機能性有機分子および超分子の創製による化学資源活用型の有機合成反応の開発			
210	物質変換科学講座、構造有機化学分野 機能性パイ共役分子の設計・合成・機能開発、開口ならびに内包フラーレンの有機合成と物性探索、有機太陽電池のための分子システムの開発、有機電子デバイスの作製と特性評価			
	物質変換科学講座、遷移金属錯体化学分野 （今年度は募集しない）			
211	同位体利用化学講座 同位元素の製造利用による寿命変換・核変換、放射性クラスターやエアロゾルの生成メカニズムの解明、原子炉中性子・加速器を用いた核反応メカニズムに関する研究、宇宙・地球物質の中性子放射化分析			
212	有機機能化学講座 新奇パイ共役分子の設計・合成法の開発および機能開拓、典型元素の特性を生かした機能性材料の創製、生命システムの解明と操作のための機能性分子ツールの創製			

分子工学：http://www.ml.t.kyoto-u.ac.jp/ja/

区分	研究内容	対応する教育プログラム		
		連携教育プログラム		修士課程教育プログラム
		融合工学コース	高度工学コース	
301	生体分子機能化学講座 細胞機能に関与するタンパク質の構造・機能、磁気共鳴法や光検出による生体・細胞における分子計測	物質機能・変換科学分野、生命・医工融合分野、総合医療工学分野	分子工学専攻の定める教育プログラムに従う	分子工学専攻の定める教育プログラムに従う
302	分子理論化学講座 量子化学・統計力学理論の開発と応用、溶液、蛋白質など凝縮系・材料における化学反応・化学過程のダイナミックスと機構の解明	物質機能・変換科学分野		
303	量子機能化学講座 本区分は，今年度，募集は行わない。			
304	応用反応化学講座　触媒反応化学分野 元素戦略に基づく触媒開発の基礎化学、光触媒化学および環境触媒化学、酸化触媒、固体酸塩基触媒、触媒反応ダイナミクス、触媒物性と機能発現			
305	応用反応化学講座　光有機化学分野 人工光合成系の構築、有機太陽電池の開発、ナノカーボン材料の創製、典型元素の特性を活かした機能性有機材料の開発			
306	応用反応化学講座　物性物理化学分野 物性物理化学全般（光機能分子設計･物性計測・反応解析・活性過渡種）、機能分子設計～合成～評価、高分子物性、分子集合体物性、ナノ構造物性、過渡分光分析、電子物性評価、電子素子形成			
307	分子材料科学講座　量子物質科学分野 無機スピン-フォトニクス材料の創製、ダイヤモンド中の発光中心、超高感度・超高分解能センサ、バイオイメージング、量子情報素子、ダイヤモンド高品質化			
308	分子材料科学講座　分子レオロジー分野 高分子の物理化学、粒子分散系の構造と物性、ゲルの物性と構造形成、複雑系のレオロジー特性と分子構造・ダイナミクス、反応系の不均質性と運動状態			
309	分子材料科学講座　有機分子材料分野 有機デバイス（特に有機エレクトロルミネッセンスと有機太陽電池）の創製と基礎科学の構築、有機デバイス応用のための有機および高分子合成、固体NMRおよびDNP-NMRによる構造－有機デバイス機能相関の解明			
310	分子材料科学講座　量子分子科学分野 振電相互作用、機能性分子の理論設計、反応性指標			
311	分子材料科学講座　細孔物理化学分野 多孔質物質の水の浄化への応用、多孔質物質のガス分離への応用			

合成・生物化学：http://www.sc.t.kyoto-u.ac.jp/ja/

区分	研究内容	対応する教育プログラム		
		連携教育プログラム		修士課程教育プログラム
		融合工学コース	高度工学コース	
５０１	有機設計学講座 機能分子の合成化学、新規有機金属反応剤のデザイン及び創製、新規精密重合反応の開拓、新しい触媒的不斉反応システムの開拓、キラルらせん高分子の機能開拓	物質機能・変換科学分野、総合医療工学分野	合成・生物化学専攻の定める教育プログラムに従う	合成・生物化学専攻の定める教育プログラムに従う
５０２	合成化学講座　有機合成化学分野 有機合成化学、有機反応設計、電子移動反応、新反応メディア、機能性有機物質の設計と合成、有機電解合成、フロー・マイクロリアクター合成、合成反応のインテグレーション			
５０３	合成化学講座　機能化学分野 分子空間化学、超分子材料化学、超分子触媒の開拓、カーボン空間材料の創製、高分子リン光物質の創製			
５０４	合成化学講座　物理有機化学分野 物理有機化学、有機機能材料化学、有機ナノテクノロジー、超分子光化学、光応答分子システム、分子エレクトロニクス材料			
５０５	合成化学講座　有機金属化学分野 有機化学および有機金属化学における新現象の発見、時代に求められる役に立つ合成反応と機能性有機化合物の開発			
５０６	生物化学講座　生物有機化学分野 生物有機化学、機能性生命分子のデザインと創製、生細胞有機化学の開拓、超分子バイオマテリアル、ケミカルバイオロジー	物質機能・変換科学分野、生命・医工融合分野、総合医療工学分野		
５０７	生物化学講座　分子生物化学分野 分子生理学、脳神経化学、分子医工学、創薬工学、ナノセンサーデバイス工学、生体イオン制御、細胞シグナリングとシミュレーション			
５０８	生物化学講座　生体認識化学分野 脂質工学、タンパク質工学、遺伝子発現の人為的操作、ゲノム情報の改変、遺伝子工学、細胞の極性形成、人工細胞膜の構築、細胞・生物工学、脂質生化学、温度適応のシステム生物工学			
５０９	生物化学講座　生物化学工学分野 微生物ゲノムを基盤とした生物化学・生物工学、極限環境微生物の代謝生理、遺伝子工学、ゲノム工学、生体機能化学、合成生物学、システムズ生物学、生物進化学			
５１０	反応生命化学講座　分子集合体化学分野 固体分子化学、分子集積化学、錯体機能化学、イオン伝導・輸送体の合成化学、無機―有機複合系非晶質材料、超分子ソフトマテリアル、生体機能制御材料			

Ⅱ．募集人員

先端化学専攻群（物質エネルギー化学、分子工学、合成・生物化学）　106 名

Ⅲ．出願資格

募集要項 4 ページ「Ⅱ－ｉ　出願資格」参照

Ⅳ．学力検査日程

（1）試験日時・試験科目

８月２０日（木）	９：００～１０：００ 英語	１０：４５～１２：１５ 化学Ⅰ	１３：３０～１６：３０ 化学Ⅱ
８月２１日（金）	９：００～ 口頭試問		

（2）試験場

試験は桂キャンパス A クラスターで行う。詳細は後日通知する。

Ⅴ．入学試験詳細

［英　語］配点　100 点

筆記試験（100 点）により評価。

［化学Ⅰ］配点　300 点

融合化学*・分析化学・生化学・高分子化学・化学工学から 2 問選択（各 150 点）。

［化学Ⅱ］配点　550 点

物理化学（200 点）、有機化学（200 点）、無機化学（150 点）、すべて必須問題。

*融合化学は、有機化学・物理化学・無機化学の範囲からの出題とする。

（1）学科試験

試験当日は開始 20 分前までに指定された試験室前に集合すること。試験開始時刻から 30 分経過した後は入室できない。また、試験開始後、当該科目の試験時間中は退出できない。なお、化学Ⅰ・化学Ⅱの試験時には、受験者全員に関数電卓を貸し出す。携帯電話等の電子機器類は、なるべく試験室に持ち込まないこと。持ち込む場合には、電源を切り、カバンにしまって所定の場所に置くこと。身につけている場合、不正行為と見なしますので注意すること。

（2）口頭試問

先端化学専攻群の受験生全員に対して口頭試問を行う。8 月 21 日（金）午前 8 時 45 分までに受験票交付時に指示する口頭試問控室に集合すること。口頭試問控室で「連絡先届」用紙を配付するので、口頭試問後の連絡先を明記して控室の担当教員に提出すること。同届を提出しなかった場合、受験者の不利益になることがある。

（3）有資格者及び合格者決定法

筆記試験および口頭試問の結果に基づいて合否判定を行う。

Ⅵ．出願要領

志望区分の申請

合格者の研究室配属は、「志望区分申告票」（様式は工学研究科ホームページからダウンロードすること）により申告した志望区分番号に基づいて行う。下の記入方法(1)～(3)に留意して「志望区分申告票」に記入し、6 月 17 日（水）午後 5 時までに下記の提出先に提出または送付（必着・書留便（簡易））すること。願書とは提出先が異なるので注意すること。

提出先

〒615-8510　京都市西京区京都大学桂
京都大学大学院工学研究科 A クラスター事務区教務掛
電話：075-383-2077
E-Mail：090kakyomu@mail2.adm.kyoto-u.ac.jp
ホームページ：http://www.s-ic.t.kyoto-u.ac.jp/fro/ja/admission/top

記入方法

(1) 「Ⅰ.専攻別志望区分」を参照して、「志望区分申告票」の志望区分番号欄に志望順位 1 位から志望順位 32 位までの区分番号を記入すること。なお、「Ⅰ.専攻別志望区分」に記載の各専攻ホームページは、さらに各講座・分野（研究室）のホームページにリンクされており、これから研究内容の詳細を参照できる。
(2) 「志望区分申告票」には氏名を記入し、押印すること。
(3) 区分番号の重複や空欄などの不備がないように注意すること。不備のある場合には、受験者の不利益になることがある。

Ⅶ．入学後の教育プログラムの選択

修士課程入学後には 9 種類の教育プログラムが準備されている。入試区分「先端化学専攻群」の入試に合格することにより履修できる教育プログラムは下記の通りである。

(1)博士課程前後期連携教育プログラム　融合工学コース（物質機能・変換科学分野）
(2)博士課程前後期連携教育プログラム　融合工学コース（生命・医工融合分野）
(3)博士課程前後期連携教育プログラム　融合工学コース（総合医療工学分野）
(4)博士課程前後期連携教育プログラム　高度工学コース（物質エネルギー化学専攻）
(5)博士課程前後期連携教育プログラム　高度工学コース（分子工学専攻）
(6)博士課程前後期連携教育プログラム　高度工学コース（合成・生物化学専攻）
(7)修士課程教育プログラム　物質エネルギー化学専攻
(8)修士課程教育プログラム　分子工学専攻
(9)修士課程教育プログラム　合成・生物化学専攻

いずれのプログラムを履修するかは、受験者の志望と入試成績に応じて決定する。合格決定後の適切な時期に志望を調査するので、合格決定後の指示に従うこと。

詳細については、「Ⅰ．専攻別志望区分」を参照のこと。また、教育プログラムの内容については、学生募集要項 12 ページ以降記載の「Ⅺ　教育プログラムの内容（融合工学コース）」及び、次項の「Ⅷ．教育プログラムの内容について」をそれぞれ参照すること。

Ⅷ．教育プログラムの内容について（高度工学コース・修士課程教育プログラム）

【高度工学コース】

(a)物質エネルギー化学専攻

21 世紀における人類の持続的発展を可能とするためには、科学技術の質的発展、とりわけ、最少の資源と最少のエネルギーを用い、環境への負荷を最小にして、高い付加価値を有する物質と質の良いエネルギーを得てこれを貯蔵する技術、資源の循環およびエネルギーの高効率利

用をはかる技術の創成が必要とされています。このためには、物質とエネルギーに関する新しい先端科学技術の開拓が不可欠であり、物質変換およびエネルギー変換を支える化学は、その中心に位置する学術領域です。物質エネルギー化学専攻では、この要請に応えるために、高度な学術研究の実践による学知の豊かな発展を通して人類の福祉に貢献すること、社会が求める人類と自然の共生のための新しい科学技術を創造し、それを担う人材を育成します。

このために、第一に、基礎化学の系統的な継承と学理の深化、第二にそれに基づいた創造性の高い応用化学の展開を通じて、上記の学術活動を行います。また、創造的で当該分野を質的に発展させる契機をもたらすスケールの大きな先端的研究、世界をリードする研究を目指すと共に、問題発見、課題設定、問題解決を自律的に行うことができ、かつ社会的倫理性の高い人材を継続的に育成することを目標としています。

(b)分子工学専攻

分子工学専攻では物理化学的な見地に基づき、生体物質から、有機物質、高分子物質、さらに無機物質に至るまでの広範な物質群を対象として、分子科学、分子工学に関する基礎科学を追及すると共に、時代が必要とする先端技術の開拓をする事を目的として、研究・教育を行っています。博士課程では、豊かな総合性と国際性を有し、分子に対する本質的理解と広範な知識に基づいて独創的な研究・技術開発を推進する能力を有する化学者の育成を目的としています。また主体的に実験を計画、立案し、実験を行い、国際的に発信できるような高度な研究者・技術者を育成します。

(c)合成・生物化学専攻

① 専攻における研究・教育の必要性

合成化学と生物化学は独自の発展を遂げてきましたが、近年両者のバリアは急速に狭まる状況にあります。合成化学と生物化学を基軸にした学際領域の研究と教育の推進は、現代社会における資源枯渇・環境負荷への対応、人類の幸福と自然との調和を目的とした中核的学問分野の開拓とそれを担う創造性豊かな人材の育成に必要です。

② 教育の目的

合成・生物化学専攻の高度工学コースにおいては、合成化学と生物化学を基軸とした総合精密科学の次代を担う人材を育成するとともに、健全な自然観・生命観の醸成と持続可能な社会の実現のための新産業基盤技術の創出に貢献する創造性豊かな人材を輩出することを目的としています。

③ 教育の到達目標

電子レベル／分子レベル／ナノレベル／マイクロレベル／バイオレベルでの電子状態／分子構造／反応／物性／機能／システムの発現と制御をそれぞれのレベルにおける最先端の方法論と理論を修得し、修士課程では十分な基礎専門学力に基づいた柔軟な思考力と高い問題解決能力を身につけ、博士課程では幅広い視野と豊かな創造力に基づいたリーダーとして社会に貢献できる研究者・技術者となることを目標としています。

【修士課程教育プログラム】

(a)物質エネルギー化学専攻

21 世紀における人類の持続的発展のためには、最少の資源と最少のエネルギーを用い、環境への負荷を最小にして、高い付加価値を有する物質と質の良いエネルギーを得てこれを貯蔵する技術、資源の循環およびエネルギーの高効率利用をはかる技術の創成が必要とされています。このためには、物質とエネルギーに関する新しい先端科学技術の開拓が不可欠であり、物質変換およびエネルギー変換を支える化学は、その中心に位置する学術領域です。物質エネルギー化学専攻では、この要請に応えるために、高度な学術研究による学知の豊かな発展を通じて人類の福祉に貢献すること、社会が求める人類と自然の共生のための新しい科学技術を創造し、それを担う人材を育成することを目指しています。第一に学理の深化、第二にそれに基づいた創造性の高い応用化学の展開によって、課題設定、問題解決を自律的に行うことができ、かつ

社会的倫理性の高い人材を育成します。

(b)分子工学専攻

化学は物質の変換を扱う学問であるとともに、物性を電子構造・分子の配列と相互作用などとの関連で論じ、新しい機能をもつ分子や材料の設計を行う学問としてますますその分野を広げつつあります。分子工学は、原子・分子・高分子などがかかわる微視的現象を対象とする基礎学問を支柱として、原子・分子・高分子の相互作用を理論的、実験的に解明し、その成果を分子レベルで直接工学に応用する新しい学問領域であり、その重要性は化学の新しい展開の中で、強く認識されています。特にわが国では、分子工学による先端的技術の発展に大きな期待が寄せられています。新しい電子材料、分子生物工学における機能性物質、高性能の有機・無機・高分子材料、高選択性触媒、エネルギー・情報関連材料などの開発などは、現在分子工学で対象とすべき重要な研究テーマです。

分子工学専攻は、分子論的視野に立ち、斬新な発想で基礎から応用への展開ができる研究者・技術者を育成します。

(c)合成・生物化学専攻

① 専攻における研究・教育の必要性

21 世紀の科学と技術のあらゆる分野において、物質合成、変換とその制御の重要性が認識され、特に「環境」「エネルギー」「材料」「情報」「食品」「医療」などの分野において「化学」を基盤とした学際領域の開拓とそれを担う創造性豊かな人材の養成が必要とされています。

② 教育の目的

合成・生物化学専攻の修士課程教育プログラムにおいては、物質の構造・物性・反応を理解することにより、多彩な物質と機能を創りだす力および生命現象の物質的基盤を化学からのアプローチにより理解する力を培い、人類の繁栄と幸福、持続可能な社会の実現に貢献できる人材を育成することを目的とします。

③ 教育の到達目標

合成化学、生物化学及びそれらの融合分野の基礎から最先端にわたる教育と研究を通じ、有機化学・物理化学・錯体化学・生物化学の幅広い学術分野の知識と技術を修得し、柔軟な思考力と十分な専門基礎学力に基づいた斬新な視点からの課題設定・解決能力を身につけることを目標とします。

IX．その他

試験当日、受験票を忘れた受験生は速やかにAクラスター事務区教務掛にその旨を申し出ること。

問合せ先･連絡先
〒615-8510　京都市西京区京都大学桂
京都大学大学院工学研究科 A クラスター事務区教務掛
電　話：075-383-2077
E-Mail：090kakyomu@mail2.adm.kyoto-u.ac.jp
参　照：http://www.s-ic.t.kyoto-u.ac.jp/fun/ja/admission/top

※The Japanese language version of the information provides here is to be given precedence.

Division of Advanced Chemistry

(Department of Energy and Hydrocarbon Chemistry, Department of Molecular Engineering, Department of Synthetic Chemistry and Biological Chemistry)

I. Preferred Research Areas by Department

Department of Energy and Hydrocarbon Chemistry: http://www.eh.t.kyoto-u.ac.jp/ja

Area number	Research descriptions	Applicable courses		
		Integrated Program		Master's Course Program
		Interdisciplinary Engineering Course	Advanced Engineering Course	
201	Energy Conversion Chemistry Inorganic solid-state chemistry, Design of metallic oxide using ubiquitous elements and development of its functionality, Development of low temperature reaction methods in harmony with environments, Development of new materials such as superconducting materials, magnetic materials, and dielectrics leading to the next generation	Materials Engineering and Chemistry	According to the course program established by the Department of Energy and Hydrocarbon Chemistry.	According to the course program established by the Department of Energy and Hydrocarbon Chemistry.
202	Energy Chemistry: Applied Electrochemistry Electrochemistry, Reaction of lithium battery and fuel cell and their materials, Movement of electron and ion on an interface, Ionic conductive materials, and Synthesis of nanomaterials			
203	Energy Chemistry: Functional Materials Interface science, Interface phenomenon and interface structure formation, Spectrochemical analysis of interface, Construction of functional flexible interface using oil-water two-phase system and ion liquid			
204	Hydrocarbon Chemistry: Hydrocarbon Chemistry Fundamentals Organic active species science, Development of homogeneous catalyst organic synthesis reaction, Development of a new synthetic method for macrocycle compound, Creation of optical functional integrated aromatic compound, Tumor imaging	Materials Engineering and Chemistry, Integrated Medical Engineering		
	Hydrocarbon Chemistry: Excited-State Hydrocarbon Chemistry (This will not be open for applications this year.)	Materials Engineering and Chemistry		
205	Hydrocarbon Chemistry: Advanced Biomedical Engineering Design, synthesis, and functional evaluation of disease-specific molecular probe and theranostic probe which realizes diagnosis and treatment simultaneously, Atomic efficient synthesis of functional molecules using homogeneous catalyst	Materials Engineering and Chemistry, Engineering for Life Science and Medicine, Integrated Medical Engineering		
206	Catalyst Science: Catalyst Materials Development of new photocatalysts for solar energy conversion, Development of photocatalysts and catalysts for cleaning environmental pollutant, Design of new catalyst reaction for highly efficient conversion of organic resources, Synthesis and functionalization of oxide fine particles with a new method	Materials Engineering and Chemistry		
207	Catalyst Science: Catalytic Organic Chemistry Development of a new transition metal catalyst and its functions, Development of highly efficient polymer catalyst reaction which contributes to environmental preservation and its reaction mechanism			
208	Catalyst Science: Catalyst Design Engineering Fuel battery constituent materials and electrode reaction, Catalysts producing hydrogen from hydrocarbon, Inorganic materials for environmental cleaning and energy conversion, Evaluation for physical properties of functional inorganic materials			
209	Material Transform Science: Synthetic Organotransformation Development of organic synthetic reaction which utilizes chemical resources by creation of new organometallic reaction active species and invention of new functional organic molecules and supermolecules			
210	Material Transform Science: Structural Organic Chemistry Design, synthesis, and functional development of functional π-conjugated molecule, Organic synthesis and physical properties investigation for opening fullerene and inclusion fullerene, Development of molecular system for organic solar battery, Creation and characteristic evaluation of organic electronic devices			
	Material Transform Science: Organotransition Metal Chemistry (This will not be open for applications this year.)			
211	Isotope Chemistry Life conversion and nuclear transmutation by utilizing an isotope in production, Clarification of generating mechanism for radioactive cluster and aerosol, Research on nuclear reaction mechanism using reactor neutrons and accelerators, Neutron activation analysis of cosmic and terrestrial matters			
212	Organic Functional Materials Design, synthesis, and exploration of function of novel π-conjugated systems, Development of functional materials based on the main group elements, Development of molecular tools for understanding and manipulation of living systems			

Department of Molecular Engineering: http://www.ml.t.kyoto-u.ac.jp/ja/

Area number	Research descriptions	Applicable courses		
		Integrated Program		Master's Course Program
		Interdisciplinary Engineering Course	Advanced Engineering Course	
301	Biomolecular Function Chemistry Structures and functions of proteins concerning cell functions, Molecule measurement for organism and cell by magnetic resonance method and photodetection	Materials Engineering and Chemistry, Engineering for Life Science and Medicine, Integrated Medical Engineering	According to the course program established by the Department of Molecular Engineering.	According to the course program established by the Department of Molecular Engineering.
302	Theoretical Chemistry Development and application of theories for quantum chemistry and statistical mechanics to clarify molecular mechanisms and dynamics of chemical processes, including reactions in condensed-phases such as solutions, proteins, and materials	Materials Engineering and Chemistry		
303	Quantum Function Chemistry This area will not accept any students in this season.			
304	Applied Reaction Chemistry: Catalysis Chemistry Basic chemistry for development of solid and complex catalysts based on element strategy, Aerobic oxidation, Photocatalyst chemistry and environmental catalyst chemistry, Solid acid‐base catalyst, Catalyst reaction dynamics, Physical properties of catalysts and functional expression			
305	Applied Reaction Chemistry: Photoorganic Chemistry Construction of artificial photosynthesis system, Development of organic solar cells, Creation of nanocarbon materials, Development of functional organic materials utilizing characteristics of typical elements			
306	Applied Reaction Chemistry: Condensed Matter Physical Chemistry Condensed Matter Physical Chemistry in general (design of optical function molecules, measurement of physical properties, reaction analysis, active transient species), Design, synthesis, and evaluation of functional molecules, Polymer physical properties, Physical properties of molecular assemblies, Physical properties of nanostructures, Analysis of transient spectral diffraction, Evaluation of electronic physical properties, Electronic element formation			
307	Molecular Materials Science: Quantum Materials Science Invention of inorganic spin-photonics materials, Luminescent center in diamond, Ultra-sensitive and ultra-high resolved sensor, Bioimaging, Quantum information devices, Quality improvement of diamond			
308	Molecular Materials Science: Molecular Rheology Polymer physical chemistry, Structure and physical properties of particle dispersion system, Physical properties and structure formation of gel, Rheological properties, and molecular structure and dynamics of complex systems, Heterogeneity and motion state of reaction system			
309	Molecular Materials Science: Organic Materials Science Invention of organic devices (specifically organic electroluminescence and organic solar power cells) and construction of the fundamental science, Organic and polymer synthesis for organic devices application, Clarification of correlation between structures and organic device functions by solid NMR and DNP-NMR			
310	Molecular Materials Science: Quantum Molecular Science Molecular design for functional materials based on vibronic interaction, Chemical reactivity indices			
311	Molecular Materials Science: Porous Physical Chemistry Application of porous materials to water purification, Application of porous materials to gas separation			

Department of Synthetic Chemistry and Biological Chemistry: http://www.sc.t.kyoto-u.ac.jp/ja/

Area number	Research descriptions	Applicable courses		
		Integrated Program		Master's Course Program
		Interdisciplinary Engineering Course	Advanced Engineering Course	
501	Organic System Design Synthetic chemistry of functional molecules, Design and creation of new organometallic reagents, Development of new precise polymerization reaction, Development of new catalytic asymmetric reaction system, New development of chiral helical polymers	Materials Engineering and Chemistry, Integrated Medical Engineering	According to the course program established by the Department of Synthetic Chemistry and Biological Chemistry.	According to the course program established by the Department of Synthetic Chemistry and Biological Chemistry.
502	Synthetic Chemistry: Synthetic Organic Chemistry Synthetic organic chemistry, Organic reaction design, Electron transfer reaction, New reaction media, Design and synthesis of functional organic substances, Organic electrolytic synthesis, Flow microreactor synthesis, and Integration of synthetic reaction			
503	Synthetic Chemistry: Functional Coordination Chemistry Coordination chemistry, Polymer science, Supermolecular functional materials, Nano-reaction field and space design, Fine synthetic chemistry utilizing molecular template, Unique properties of nano-confined polymer, and Organic-inorganic composite materials			
504	Synthetic Chemistry: Physical Organic Chemistry Physical organic chemistry, Chemistry of organic functional materials, Organic nanotechnology, Super molecular photochemistry, Photoresponsive molecular system, and Molecular electronics materials			
505	Synthetic Chemistry: Organometallic Chemistry Discovery of new phenomenon in organic chemistry and metalorganic chemistry, Development of synthesis reactions and functional organic compounds useful and demanded in this era			
506	Biological Chemistry: Bioorganic Chemistry Bioorganic chemistry, Design and creation of functional biomolecules, Development of living cell organic chemistry, Supermolecule biomaterials, and Chemical biology	Materials Engineering and Chemistry, Engineering for Life Science and Medicine, Integrated Medical Engineering		
507	Biological Chemistry: Molecular Biology Molecular physiology, Brain neurochemistry, Molecular medical engineering, Drug development engineering, Nanosensor device engineering, Biological ion control, Cell signaling and simulation			
508	Biological Chemistry: Biorecognition Chemistry Lipid engineering, Protein engineering, Artificial manipulation of gene expression, Modification of genome information, Genetic engineering, Polar formation of cells, Formulation of artificial cell wall, Cell and biological technologies, Lipid biochemistry, System biotechnology for temperature adaptation			
509	Biological Chemistry: Biochemical Engineering Biochemistry and biotechnology based on microbial genome, Metabolic physiology of extremophile, Genetic engineering, Genome engineering, Biological function chemistry, Synthetic biology, Systems biology, Evolutionary biology			
510	Reaction Biological Chemistry: Molecular Assembly Chemistry Molecular solid-state chemistry, chemistry of molecular assemblies, functional coordination chemistry, synthesis of ion conductors and transporters, hybrid amorphous materials, supramolecular soft materials, and materials for controlling biological functions			

II. Enrollment Capacity

Division of Advanced Chemistry (Department of Energy and Hydrocarbon Chemistry, Department of Molecular Engineering, Department of Synthetic Chemistry and Biological Chemistry): 106

III. Eligibility requirements for applicants

Refer to "II-i. Eligibility" on page 19 of the Guidelines for Applicants.

IV. Examination Schedule

(1) Date and time, and examination subjects:

August 20th (Thu)	9:00 - 10:00 English	10:45 - 12:15 Chemistry I	13:30 - 16:30 Chemistry II
August 21th (Fri)	From 9:00 Oral Exam		

(2) Examination venue

The examination will be conducted in the A cluster in Katsura Campus. Details will be notified later.

V. Details of Entrance Examinations

[English] Distribution of points: 100points

Evaluation by the written examination (100 points).

[Chemistry I] Distribution of points: 300 points

Select two questions among Interdisciplinary Chemistry*, Analytical Chemistry, Biochemistry, Polymer Chemistry, and Chemical Engineering (150 points each).

[Chemistry II] Distribution of points: 550 points

All questions in Physical Chemistry (200 points), Organic Chemistry (200 points), and Inorganic Chemistry (150 points) are required to be answered.

*Question of the Interdisciplinary Chemistry is from the range of Organic Chemistry, Physical Chemistry, and Inorganic Chemistry.

(1) Academic examinations:

On the day of the examination, applicants shall be present in front of the designated room no later than 20 minutes before the examination starts. 30 minutes after the start of the examination, applicants may no longer enter the room. Furthermore, after the start of the examination, applicants are not allowed to leave the room after for the duration of examination. For the examinations of Chemistry I and Chemistry II, a scientific calculators can be lent to the applicant for the examination. As far as possible, applicants should not to bring electronic devices, including mobile phones into the examination room. If an applicant must take an electronic device into the room, the power must be turned off, it must be placed in the applicant's bag and placed in a designated area. If applicants carry such a device with them, it may be regarded as cheating.

(2) Oral examination:

Oral examination will be given to all applicants of the Division of Advanced Chemistry. Applicants shall be present in the waiting room for oral examination, which will be specified on the received examination voucher, by 8:45 a.m. on Friday, August 21. At the waiting room for oral examination, applicants will receive the "Notification of Contact Information" form. Write down your contact information after the oral examination and submit it to the academic staff in charge of the waiting room. Failing to submit the form may cause disadvantage for the applicants.

(3) Screening method of qualified applicants and successful applicants:

Passing or failing is decided upon based on the results of written examination and oral examination.

VI. Instructions on Application for Admission

Application of preferred research areas:

Assignment to a laboratory for successful applicants will be decided based on the preferred research area numbers declared on the "Declaration of Preferred Research Area." (Download the form from the home page of the Graduate School of Engineering.) Fill out the "Declaration of Preferred Research Area" with close attention to the following procedures (1) to (3) and submit or send it to the following sections by 5:00 p.m. on Wednesday, June 17, 2020 (without fail specifying recorded delivery). Please be aware that the address for submitting these documents is different from that for your Application Form.

Submit or send the declaration form to:
Kyoto University Katsura, Nishikyo-ku, Kyoto 615-8510
A Cluster Office, Graduate Student Section, Graduate School of Engineering, Kyoto University
Phone: +81-75-383-2077
E-Mail: 090kakyomu@mail2.adm.kyoto-u.ac.jp
Home page: http://www.s-ic.t.kyoto-u.ac.jp/fro/ja/admission/top

How to fill out the form:

(1) By referring to "I. Preferred Research Areas by Department," enter the research area numbers of your 1st to 32nd choices in the Preferred Research Area Number field on the "Declaration of Preferred Research Area." The home pages of each department indicated in "I. Preferred Research Areas by Department" have further links to the home pages of each chair and laboratory for your reference of details on research topics.
(2) Enter your name and sign/stamp on the "Declaration of Preferred Research Area."
(3) Make sure there is no overlapping or blanks for preferred research area numbers. If the form is incomplete, it may cause disadvantage for the applicants.

VII. Selecting your course after enrollment

Nine courses are provided for successful applicants after the enrollment in Master's program. Successful applicants for the "Division of Advanced Chemistry" can take the following courses.

(1) Interdisciplinary Engineering Course of the Postgraduate Integrated Master's-Doctoral Course Program (Materials Engineering and Chemistry)
(2) Interdisciplinary Engineering Course of the Postgraduate Integrated Master's-Doctoral Course Program (Engineering for Life Science and Medicine)
(3) Interdisciplinary Engineering Course of the Postgraduate Integrated Master's-Doctoral Course Program (Integrated Medical Engineering)
(4) Advanced Engineering Course of the Postgraduate Integrated Master's-Doctoral Course Program (Department of Energy and Hydrocarbon Chemistry)
(5) Advanced Engineering Course of the Postgraduate Integrated Master's-Doctoral Course Program (Department of Molecular Engineering)
(6) Advanced Engineering Course of the Postgraduate Integrated Master's-Doctoral Course Program (Department of Synthetic Chemistry and Biological Chemistry)
(7) Department of Energy and Hydrocarbon Chemistry of the Master's Course Program
(8) Department of Molecular Engineering of the Master's Course Program
(9) Department of Synthetic Chemistry and Biological Chemistry of the Master's Course Program

Successful applicants' course assignment is determined based on their preference and entrance examination results. Applicants' preferred courses will be considered in an appropriate amount of time after determining that the examination has been successfully passed. Upon receiving notification of passing the exam, please follow the instructions given.
For the details, refer to "I. Preferred Research Areas by Department." For course details, refer to "XI. Educational Program (Interdisciplinary Engineering Course)" written on and after page 26 of the Guidelines for Applicants and "VIII. Course Details (Advanced Engineering Course, Master's Course Program)" in the next section.

VIII. Course Details (Advanced Engineering Course, Master's Course Program)

[Advanced Engineering Course]

(a) Department of Energy and Hydrocarbon Chemistry

In order to realize the sustainable development of humanity in the 21st century, the qualitative development in science and technology is essential. Especially, creation of technologies to obtain and storage highly value-added substances and efficient energy with minimum impact on environment using minimum resources and energy as well as technologies to circulate resources and drive high efficiency use of energy is required. For this purpose, the development of advanced science and technology with respect to substance and energy is necessary. Chemistries to support substance transformation and energy conversion are academic fields that sit in the center of this development. To meet these requirements, the Department of Energy and Hydrocarbon Chemistry aims at contributing to human welfare by utilizing the well-developed knowledge acquired through high-level academic researches and nurturing people who will create and drive new science and technology which the society demands for the co-existence of human and nature.

With these objectives, we will practice the above academic activities, firstly through systematic succession and deepening of theories in the basic chemistries and secondly through development of highly creative applied chemistries based on them. We also aim at conducting the world-leading studies as well as creative and large-scale advanced researches which can bring the opportunity for qualitative development to this field while setting our continuous objective to develop human resources who can autonomously find issues, set tasks, and solve problems and have highly developed social morality.

(b) Department of Molecular Engineering

From the physical and chemical viewpoint, the Department of Molecular Engineering is conducting researches and providing education with the aims to pursue the fundamental science concerning molecular science and molecular engineering and to develop the advanced technologies that the era needs, focusing on a wide range of substances such as biological, organic, inorganic, and polymer substances. The doctoral program aims at developing chemists who have fertile comprehensiveness and internationality with the abilities to drive creative researches and technological development based on their essential understanding and broad knowledge regarding molecules. The Department aims at fostering high-level researchers and engineers with self-initiative who can plan and design a research, conduct experiments, and inform the ideas internationally.

(c) Department of Synthetic Chemistry and Biological Chemistry

(i) Required teaching/research in this Department

Synthetic chemistry and biological chemistry had been developed independently. However, the distance between those two fields has narrowed rapidly in recent years. Promotion of research and education in the interdisciplinary fields on the basis of synthetic chemistry and biological chemistry is essential in dealing with the depletion of resources and the environmental burden in the modern society. It is also important in cultivating creative talents who can develop and lead the core academic fields to achieve harmony between human welfare and nature.

(ii) Teaching objective

The Advanced Engineering Course in the Department of Synthetic Chemistry and Biological Chemistry aims at cultivating talents who will lead the next generation in comprehensive precision science centered around the disciplines of synthetic chemistry and biological chemistry. It will also nurture human resources affluent with creativity who are capable of contributing to creation of a new industrial platform technology for fostering healthy views on nature and life and realizing a sustainable society.

(iii) Goals to be achieved

The goals are to learn the state-of-the-art methodologies and theories for appearance and control of electronic states/molecular structures/reactions/physical properties/functions/systems in each of electronic/molecular /nano/micro/biological levels. In the Master's program, students learn to think flexibly and acquire high problem-solving ability based on adequate basic and professional academic skills. In the Doctoral programs, students strive to become leading researchers and engineers who can contribute to the society with a broader viewpoint and full of creativity.

[Master's Course Program]

(a) Department of Energy and Hydrocarbon Chemistry

For the sustainable development of humanity in the 21st century, it is essential to develop technologies to obtain and storage highly value-added substances and efficient energy with minimum impact on environment using minimum resources and energy as well as technologies to circulate resources and drive high efficiency use of energy. For this purpose, the development of advanced science and technology with respect to substance and energy is necessary. Chemistries to support substance transformation and energy conversion are academic fields that sit in the center of this development. To meet these requirements, the Department of Energy and Hydrocarbon Chemistry aims at contributing to human welfare through the enhancement of students' knowledge attained from the high-level academic researches and nurturing talents who will create and drive new science and technology which the society demands for the co-existence of human and nature. Firstly through deepening the study of scientific principles and secondly through developing the highly original applied chemistry based on the deepened knowledge, we will nurture human resources who can identify and solve issues independently and have high social ethics.

(b) Department of Molecular Engineering

While chemistry is an academic study which deals with conversion of materials, its field has been increasingly expanding as a study to discuss physical properties in relation to electronic structure, molecular sequence, and their interactions and to design molecules and materials with new functions. Molecular Engineering is a new academic field, with the basic studies of microscopic phenomenon that involves atom, molecule, and polymer as a pillar, which elucidates the interaction among atom, molecule and polymer with theoretical thinking and experiments and applies the findings to engineering directly in a molecular level. Its importance is strongly recognized under the new development of chemistry. Especially in our country, development of advanced technologies by Molecular Engineering has been highly expected. Development of new electronic materials; functional substances in molecular-biological engineering; high-performance organic, inorganic, and polymeric materials; highly selective catalysts; and energy and information-related materials is one of important research themes that Molecular Engineering should deal with today.

The Department of Molecular Engineering will nurture researchers and engineers who are capable of applying novel concepts to the development of useful applications from fundamental science in the standpoint of molecular theory.

(c) Department of Synthetic Chemistry and Biological Chemistry

(i) Required teaching/research in this department

In every field of science and technology for the 21st century, the importance of synthesis, transformation, and control of substances is recognized. Especially in the fields such as environment, energy, materials, information, food, and health care, the exploitation of interdisciplinary frontier with the foundation of "chemistry" and the cultivation of creative talents who will take on such field are required.

(ii) Teaching objective

The Master's Course Program by the Department of Synthetic Chemistry and Biological Chemistry aims to cultivate the capability to create various substances and functions and grasp the physical foundation of life through approaches based on chemistry by understanding structures, physical properties, and reactions of substances as well as to develop talents who can contribute to the realization of human prosperity and happiness and sustainable society.

(iii) Goals to be achieved

Through the basic to most-advanced education and research of synthetic chemistry, biological chemistry, and their interdisciplinary areas, students aim at acquiring knowledge and skills in a wide range of academic fields, including organic chemistry, physical chemistry, complex chemistry, and biological chemistry, and abilities to identify and solve problems from an innovative viewpoint based on flexible thinking and basic and professional academic skills.

IX. Other

An applicant who forgotten to bring their examination voucher on the examination day shall report it to Graduate Student Section, A Cluster Office as soon as possible.

Contact for general inquires:
Kyoto University Katsura, Nishiko-ku, Kyoto 615-8510
A Cluster Office, Graduate Student Section, Graduate School of Engineering, Kyoto University
Phone: +81-75-383-2077
E-Mail: 090kakyomu@mail2.adm.kyoto-u.ac.jp
Home page: http://www.s-ic.t.kyoto-u.ac.jp/fun/ja/admission/top