

A)C\*!1+!: \*A&, )AT, ) - A. ' I.ST) /MO.TA\*  
S1I\*\*S I. A)C2A0, \*, 3ICA\* SCIO.CO

Module - and" ook for 202\*.202,

Core Module for the MSc Archaeological Science: Technology and Materials  
Term I, 15 Credits

Term I: Thursdays 9-11 ( 1!" # la\$ %racticals (T& '")

Co-ordinator: Mike Charlton

m.charlton@ucl.ac.uk

loA rm 210, Office hours: Frida s !-10 or " a##ointment



Assessment e\$ams and deadlines for this module:

1. %cientific &e#ort, ' erm I, 21 (o)em"er 202\*
2. %tandard +ssa , ' erm II, 22 A#ril 202,



M, ' / \* 0 , : 0 ) : 1 0 ;

Module description

Module Aims

!

" #

- 
- 
- 

\*earning , utcomes

\$ #

- %
- + " ) " & " & ' ( ) \* ( ) ' + , - . "
- %
- 
- %

!

Methods of Assessment

Formal assessment is "ased on the follo5in/:

- %cientific in)esti/ation re#ort :Assessment 1;: 'erm I, <1 . o8em\$er. <ord limit: 1=00. <ei/htin/: 2=> of the final mark.

- 7a"--"ased anal tical re#ort :Assessment 2;: 'erm II, << A%ril. <ord limit: 2000. <ei/htin/: ?=> of the final mark.

All work must be full referenced. Our attention is drawn to methods of referencing and to the statements on plagiarism and self-plagiarism available on the site. The topics and deadlines for each assessment are specified below, and further details are given in the last few pages of this handbook. If students are unclear about the nature of an assignment, please contact the Module Co-ordinator. If you wish to discuss these topics or represent a brief outline of how you intend to approach your assignment, we will be happy to discuss this.

## Communications

- Moodle is the main hub for this course.
- Important information will be posted by staff in the Announcements section of the Moodle page and you will automatically receive an email notification for these.
- Please post any general queries relating to module content, assessments and administration in the [A&C701?02](#) general channel part of the Moodle Technology and Materials 2020.21 team;
- For personal queries, please contact the co-ordinator via Moodle teams or email.

; ee7-\$y-6ee7 summary

| ; 001 | Thurs | *OCT / ) OS<br>9(!! = 11(!! in 1! | *A&, ) AT, ) -<br>&y grou% |
|-------|-------|-----------------------------------|----------------------------|
| 1     | =     |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |
|       |       |                                   |                            |

lectures and practicals that are designed to improve our analytical and critical thinking skills while directly applying them with the lessons.

The second term of the module will focus on individualised training in the oralator techniques appropriate to the material chosen for dissertations. Training will be provided and relies on close coordination with the oralator staff. This will provide the crucial first step in helping students acquire the skills and confidence to carry out individual analytical work with scaffolded support.

Hours: 1.00-1H.0: 7) e lecture/seminar/ Mon evening/: 7 lectures for the following week available 1 practical sessions: 8 hours: deadline to complete formative exercises

; or load

This is a 1-credit module which equates to 10 hours of learning time including session preparation, background reading, and research and writing our assignments. It is important that in mind you should expect to organise your time in relation to this as follows:

|          |   |     |   |   |   |   |   |
|----------|---|-----|---|---|---|---|---|
| 10       | 1 | 31  | 2 | 1 | 1 | 1 | 1 |
| 10       | 1 |     | 1 |   |   |   |   |
| 10 hours |   | 4/3 | 2 |   |   |   |   |
| 56       | 1 | )   |   |   |   | 1 |   |
| 10       | 1 | .   |   |   |   |   |   |
| 76       | 1 | )   | 1 | 1 |   |   |   |

This assessment requires you to:

- Demonstrate an understanding of a range of different types of analytical information.
- Use the information to make an argument about the history of an object.
- Explain your methods and results in terms that can be understood by an informed lay person.
- Present your data and arguments in the form of an official scientific report and in an appropriate, structured and formal manner, suitable for presentation to the Board of Trustees of a Museum.

The word length for your report is 1000 words, plus diagrams and tables. This assessment amounts to 20% of your final module mark.

You are a scientist in the laboratory of the (National) Museum of (Greece) Athens. You have a small laboratory, equipped with a range of equipment for the investigation of archaeological and museum artefacts.

The head curator of the Department of European Art and Archaeology is very excited. The Museum has been offered a rare Renaissance enamelled vessel, believed to have been made in Limoges, France and dating to the sixteenth century. The item has been in a private collection for many decades and hence purchasing it would be legal and bring the artefact to public view. This will fill an important gap in the collections. The curator wishes to buy the object at the price being offered by the dealer, which is slightly below the market value for such an object.

The Director of the Museum, while sympathetic to the enthusiasm of the curator, is more cautious. The cost of the vessel will consume the total funds available for acquisitions in the current financial year. He will have to justify the expenditure to the Museum's Trustees and is ultimately responsible to the Culture Department of the Government. If the object is purchased and later turns out to be problematic, his position will be on the line. Therefore he has told the European Department to refer it to the scientific laboratory for careful evaluation.

Your job is to examine the object and to produce a report on its condition and authenticity. Your report needs to present the details of your findings, in an appropriate way. You are not required to comment upon value or cost, and should not do so. Remember that examinations of this type often do not resolve something, the results are inconsistent with a process or characteristic. This report, particularly if unfavourable in some way to the object, might well be used by the Museum in negotiations with the owner. Therefore in the 1990s

- A #a/e from a la" "ook 5ith a sketch of the a##earance of the artefact in ultra)iolet li/ht
- 'he results of an J-&a Fluorescence e\$amination of the o"pect
- J&F results for a standard
- A radio/ra##h sho5in/ the a##earance of the central Poin in a t #ical 1Hth centur enamelled e5er from 7imo/es
- A re#ort on somethin/ com#etel different :/lass from Clun ;, 5hich sho5s ho5 a re#ort of this t #e mi/ht "e or/anised.

Mour re#ort should include the follo5in/ : ou should use su"-headin/s as a##ro#riate;. &efer to the e\$am#le of a re#ort #ro)ided )ia Moodle "ut use a st le and la out that ou think looks a##ro#riate :t #eface, #ara/ra##h s#acin/, etc.; - , / M/ST /S0 ' , /&\*0 \*l . 0 S4ACl . 3S l . - , / ) )04 , )T.

- 'itle of our Institution and Ke#artment : ' o# of #a/e;
- 'itle of the &e#ort :0&e#ort on .....3;
- Ke#artment reCuestin/ the re#ort :in "rackets: 0:&eCuested " Ke#artment of.....;3.;
- At the "e/innin/ a short summar or a"stract :u# to , sentences; of 5hat ou ha)e done and 5hat ou ha)e found.
- An introduction indicatin/ 5hat ou are lookin/ at and 5h
- A descri#tion of the methods used F indicate the methods used and the reasons for usin/ them. Mou should indicate an limitations that im#act the meanin/ of the results.
- A section outlinin/ the results F 5hat ou found.o"ser)ed. &efer to fi/ures :as fi/ . 1, 2 etc; and an ta"les.
- A discussion section F 5hat do the results mean in li/ht of the startin/ Cuestion and methods usedQ &efer "ack to #re)ious sections as ou de)elo# our ar/ument.
- A concise conclusion F Concise statement on 5hat ou ha)e concluded a"out the o"pect.
- On the left hand side at the "ottom of the re#ort, ou should si/n it, t #e our name, the date and a file num"er for this stud
- Mour re#ort 5ill ha)e referred to #re)ious 5ork in the literature, and references should "e #ro)ided in the standard 5a .
- Fi/ures and also ta"les, if an , should "e num"ered seCquentiall and referred to in the te\$t. 'he should "e em"edded in the re#ort and al5a s accom#anied " ca#tions.

&Rhrs, %, and %te/e, - ., :200, ;. @Anal sin/ 7imo/es #ainted enamels from the 1Hth to 1G<sup>th</sup> centuries " usin/ a #orta"le micro J-ra fluorescence s#ectrometerA. J-ra %##ectrom. \*\*, \*GH-, 01.

&Rhrs, %, Eiron, I. and %te/e, - . :200H; A"out 7imo/es 1ainted +namels F Chronolo/ical +)olution of the 2lass Chemical Com#osition, Association International #our l'histoire du Derre, Annales du 1?e con/res, =00-=0G.

## Assessment <: 4ractical essay: analytical re#ort

Keadline: 'erm II, 22 A#ril





1 re#are a neat #resentation and #roofread our te\$t8 if ou as the author do not think it is 5orth this effort, then readers 5ill assume the 5ork descri"ed is eCual #oor.

' he final re#ort should "e su"mitted to/ether 5ith a link to a data re#ositor that includes a di/ital )ersion of the essa as #resented, as 5ell as an further documentation /enerated :i.e. files and ra5 data from %+M-+K%, additional micro/ra#hs, and other rele)ant details;.

' he sam#le studied and the s#ecimens #roduced for anal ses should all "e la"elled and returned 5ith the essa .

' his essa counts as ?=> of our assessed course5ork for this course.

)esources and 4re%aration for Class

4re%aration for class

Mou are e\$#ected to read the4essential readings listed \$elo 6, 6atch la\$oratory 8ideos, and com%lete any online acti8ities on Moodle each 5eek. Com#letin/ the readin/s is necessar for our effecti)e #artici#ation in the acti)ities and discussions that



Martin Yonkers, M. and Ehren, 'h. :eds; 200!. Archaeology, -istor and %cience:  
International Approaches to Ancient Materials. :6C7 Institute of Archaeology Publications;.   
Sausalito, CA: West Coast Press  
I (%' A&C - AT MA&, I%%6+ K+%V IOA MA& G

(ational Academy of %ciences, 200=. Scientific examination of art: modern techniques in  
conservation and analysis :Arthur M. Mackler Colloquia of the (ational Academy of  
%ciences;. Washington, KC: (ational Academies Press.  
I (%' A&C - V( 1 (A'

Hollard, A. M., -eron, C., Armitage, & A. 201?. Archaeological Chemistry. Cambridge:  
& Oxford Society of Chemistry .  
I (%' A&C - TK 107

Martin Yonkers, M., Villick, K., 2015. Archaeological Theories and Archaeological Sciences. Oxford - and". Archaeol. Theor 1F1?  
doi:10.1080/10439862.2015.1001001,  
<https://doi.org/10.1080/10439862.2015.1001001>.

; ee7 <( Fundamentals of ) is7 Assessment(

: ic \*ucas and ) ussell &ailey

In this session, Dic and &ussell 5ill take ou throu/h the fundamentals of risk assessment.

---

## ; ee7 ( The structure of matter

Mi7e Charlton

---

< e 5ill "e lookin/ at the fundamental structures of materials, usin/ sim#le, descri#ti)e models. ' his 5ill include a look at indi)idual atoms and their )arious com#onents, isoto#es, the #eriodic ta"le of elements, different "ondin/ models to form molecules, )alencies and stoichiometr , allo s and solid solutions, from molecules to cr stal structures, and ho5 )arious as#ects of these are "ein/ e\$#loited for anal tical #ur#oses.

7earnin/ o"p#ecti)es:

' he amount of #h sics and chemistr that ou need for this module and de/ree is limited. -o5e)er, it is crucial that ou understand these )er "asics so that 5e ha)e a solid foundation to "uild on. If an of the a"o)e terms is unclear, #lease seek clarification.

)eadings:

An "asic te\$t"ook on inor/anic chemistr can #ro)ided ou 5ith a sound kno5led/e-"ase for this de/ree. And ou can also tr the Internet's

Mor/enstein, M., 200H. 2eochemical and #etro/ra#hic a##roaches to chert tool #ro)enance studies: +)idence from t5o 5estern 6%A -olocene archaeolo/ical sites. 2eol. %oc. %#ec. 1u"l. 2=?, \*0?F\*21. doi:10.11 , ,.2%7.%1.200H.2=? .01.2\* [https://s#.l ellcollection.or/.content.2=? .1.\\*0?.short](https://s#.l ellcollection.or/.content.2=? .1.*0?.short)

---

## ; ee7 5( \*ight and the analysis of materials(

Mi7e Charlton

---

Almost e)er anal tical techniCue 5e use in)ol)es the electroma/netic s#ectrum, or li/ht. ' his session 5ill #ro)ide ou 5ith a "asic introduction to the role li/ht #la s in characterisin/ materials at macroscop#ic and microscop#ic scales.

J-ra s #la an es#eciall im#ortant role in materials characterisation. ' his session 5ill em#hasise the most common a##lications of J-ra s in materials science. It 5ill "e im#ortant to /ain a /ood understandin/ of J-ra "eha)iour in order to understand the results ou o"tain from the )arious instruments in our la" that make use of these ener/etic #hotons, includin/ our J-ra ca"inet, %+M-+K%, J&K, #J&F, and the +1MA :incor#oratin/ \* < K% detectors;

)eadings: .

Eerran/er, M., Eau)ais, %, EoukeNNoula, M., 7ero , %, Kissler, A., De/a, +., Au"ert, M., Killmann, 1., FluNin, 1., 201?. Anal se technolo/iCue, \tude de #ro)enance et datation #ar le radiocar"one du d\#]t de demi-#roduits ferreus de KurrententNen : - aut-&hin, France; :

une vision renouvelée de l'économie du fer au premier âge du Fer. *Archeosciences*, 1, 2010, p. 1-10. [https://doi.org/10.1000.archeosciences.101](https://doi.org/10.1000/archeosciences.101)

Winkler, V., Kersch, L., Muche, N., 2010. The isotopic investigation of smithite from the Hellenistic to Roman period of the Eastern Taurus. *Am. Mineral.* 101, 1022-1030. <https://doi.org/10.2113/am-2010-1022>

McCrone, K.C., 1960. The identification of iron: a method. *Acc. Chem. Res.* 3, 27-31. <https://doi.org/10.1021/ar00171a001>, [https://www.mccroneinstitute.org/loads/the-microscope-uses-small-1-22-HOG\\*\\*#df](https://www.mccroneinstitute.org/loads/the-microscope-uses-small-1-22-HOG**#df)

Winkler, C., Kersch, T., 2010. The technology and craft organization of Roman technical ceramic production at Meroe and Khartoum, Sudan. *T. Archaeol. Sci.* 35, 1-10. <https://www.sciencedirect.com/science/article/pii/S0305426310000600>

Winkler, V., Yamamoto, T., Ando, M., Matsuoka, V., Arimatsu, M., Oshima, T., 2010. (Non-destructive) analysis of ancient metal swords from Eastern Asia using X-ray fluorescence. *J. Instrum. Methods Phys. Sci. Eng. Technol. Interact. 5th Mater. Atoms*, 2, 1-10. doi:10.1018/jim.2010.02.01, <https://www.sciencedirect.com/journal/instrumentation-methods-in-physics-science-and-technology/article/pii/S1546171710000010>

Winkler, V., 2010. The analysis of old swords from Iran. *Er. Museum J. Arch. Res.* 1, 1-10. <https://www.britishmuseum.org/df/EMJ&E,2010-winkler#df>

; ee7 ?( ) eading 6 ee7

Independent study = Scientific report due Thursday

; ee7 +: &u17 and Trace element analysis: an introduction to spectrometry

Mi7e Charlton

Microanalysis is a ~~critical~~ ~~normal~~ ~~book~~





## ; ee7 1!: 'ata Buality, re%orting, and %rocessing

Mi7e Charlton

Trust "ecause a machine /oes @#in/A and /enerates some num"ers does not /uarantee that the measurement 5as a success or that the num"ers ha)e an meanin/ at all. <e ha)e to assess data Cualit e)er time 5e make a measurement. And if the data are acce#ta"le, then 5hatQ First, 5e ha)e to re#ort the data in 5a that effecti)el communicates our results :#ro)idin/ neither too little nor too much detail. 'hen 5e still ha)e the task of "rid/in/ the the data 5ith our startin/ Cuestions )ia /ra#hs and statistics. 'his lecture 5ill descri"e some of the 5a s 5e ensure our data are )alid, ho5 5e re#ort them :includin/ accurac , #recision, and transformation;;, and then 5hat 5e do 5ith them.

It is im#ossi"le to learn statistics and data )isualisation from a sin/le lecture. -o5e)er, after this session ou should "e familiar 5ith the #otential a##lications of a ran/e of data #rocessin/ and #resentation techniCues, so that ou can assess 5hether the are useful for our #articlar dataset. If ou choose to use them, "e #re#ared to in)est a lot more time`

### )eadings:

8 , " - " 9

[http://555.rsc.org/.Mem"ershi#. \(et5orkin/.Interest2rou#s.Anal tical.AMC. 'echnicalEriefs.as#](http://555.rsc.org/.Mem)

Charlton, M., -um#hris, T., 201G. +\$#lorin/ ironmakin/ #ractices at Meroe, %udan a a com#arati)e anal sis of archaeolo/ical and e\$#erimental data. Archaeol. Anthro#ol. %ci. 11. doi:10.100?.s12=20-01?-0=?!-2  
<http:s://link.s#rin/er.com.article.10.100?.s12=20-01?-0=?!-2>

## ; ee7 11: )e8ie6 and concluding discussion

Mi7e Charlton

Makin/ our data and inter#retation a)aila"le to others to use, discuss and enpo is an ethical res#onsi"ilit . After all, 5e often 5ork 5ith #u"lic herita/e and funded " #u"lic resources. <hat is the "est 5a of doin/ soQ <e 5ill use this session to discuss /eneral #ractical as#ects of research desi/n, as 5ell as an other rele)ant su"pect that ou ma 5ish to talk a"out. In addition, 5e 5ill also "e handin/ out our materials for assessment 2.

### Student acti8ity &05 , )0 the class:

) , )0 , )0 %b %A

Charlton, M. F., Cre5, 1., &ehren, 'h. W %hennan, %. T. 2010. +\$#lainin/ the e)olution of ironmakin/ reci#es - an e\$am#le from north5est <ales.4< , 42G: \*=2-\*H?.

[https://555-sciencedirect-com.li"#ro\\$.ucl.ac.uk.science.article.#ii.%02?! , 1H=10000\\*0G](https://555-sciencedirect-com.li)

&adi)o#e)ib, M. W &ehren, 'h. 201H. 1aint It Elack: 'he &ise of Metallur/ in the Ealkans.4< , " 42\*: 200-2\*?.

[https://link-s#rin/er-com.li"#ro\\$.ucl.ac.uk.article.10.100?.s10!1H-01 , -G2\\*! -\\*](https://link-s#rin/er-com.li)