A plan of a course of lectures on arts and manufactures, more particularly such as relate to chemistry / [William Farish].

A PLAN OF A COURSE OF LECTURES ON ARTS AND MANUFACTURES, MORE PARTICULARLY SUCH AS RELATE TO CHEMISTRY.

By WILLIAM FARISH, M.A.

FELLOW OF MAGDALEN COLLEGE, AND PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF CAMBRIDGE.

CAMBRIDGE,

PRINTED BY J. BURGES PRINTER TO THE UNIVERSITY.

MDCCXCVI.

PART I.

METALS AND MINERALS.

1. MINING in general.
2. The ſtructure of the earth.
3. Strata.
   Hading.
   Underlie.
   Diſlocation of the ſtrata.
   Diſappearance of the upper ſtrata.
4. Veins.
   Strings.
5. Sinking ſhafts.
6. Driving levels.
   Levelling.
   Dialling.

7. Airing mines.

By bellows,

By fire,

By water,

By a horſe-head.

8. Draining mines.

By ſoughs,

By water wheels,

By ſteam engines.

9. *Iron.*

10. Manner in which the ore is found.

Near the ſurface of the earth.

In bell-pits.

In mines.

11. Appearances of the ore.

12. Smelting iron.

13. Structure of the furnace.

14. Urging the fire by a combination of forcing cylinders.

15. The blaſt regulated by a weight,

Or by water.

16. The

16. The flux uſed.
17. The ſcoriæ.
18. Tapping the furnace.
19. The metal run into pigs.
    Into various forms.
    The model.
    The flaſk.
    The mold.
20. Cannon caſt,
    Centered,
    Bored,
    And turned.
21. Shells caſt.
22. Caſting large cylinders.
23. The model made by a ſweep.
24. The cylinder bored.
25. Caſting from a wind-furnace.
    The crane.
26. Caſt iron rendered malleable.
    Puddling.
    Shingling and ſtamping

The forge hammer.

Rolling.

27. Malleable iron manufactured.

28. Bars rolled,

And ſlit.

29. The making nails.

30. Wire drawn.

Various wire-drawing machines.

31. Cleaning wire,

By friction,

By acids.

32. Iron converted into ſteel.

The converting furnace.

33. Bliſtered ſteel.

34. Propoſed method of making ſteel immediately from the ore.

35. Caſt ſteel.

The caſting furnace.

36. The tilting mill.

37. Grinding and poliſhing ſteel.

Emery.

Crocus

Crocus martis.

38. Cut ſteel.

39. Caſe-hardening.

40. Tempering ſteel.

Edge tools.

The cold chiſel.

Patent ſcythe.

Files.

Steel maundrels.

41. The re-converſion of ſteel into iron by cementation.

42. Modern diſcoveries in chemiſtry relative to ſteel and iron.

43. *Lead.*

44. Manner in which the ore is found.

Pipe veins.

Rake veins.

Slikenſide.

45. Mines in Derbyſhire,

Alſton Moor,

Durham, &c.

46. Ap-

46. Appearance of the ore.

Bing.

Peaſey.

Smitham.

Belland.

47. Treatment of the ore.

Buddling.

48. Smelting lead.

49. Smelting furnace or cupola.

Horizontal chimneys.

Slaghearth.

50. Caſting or ſheeting.

51. Leaden pipes.

52. Rolling lead.

Mill for that purpoſe.

53. Glazier's vice.

54. Shot.

55. Combination of lead with oxygen.

Litharge.

Red lead.

56. The furnace.

57. Methods

57. Methods of ſifting and grinding.

58. Combination of lead with the acetous acid.

White lead.

59. Patent yellow.

60. *Tin.*

61. Mines in Cornwall.

The Wherry mine.

62. The ſhelf.

63. Ores of tin.

Stream tin.

64. Method of extracting the metal.

65. Grain tin.

66. Tin foil.

67. Block tin.

68. Sheet tin.

69. Tinning of copper veſſels.

70. *Copper.*

71. Various mines in Angleſea,

Ecton,

&c.

72. Copper ores.

73. Copper mud.

74. The metal extracted,

And purified.

75. Copper rolled into plates.

Coppering the bottoms of ſhips.

76. Copper drawn into bolts,

And nails for ſhipping.

77. The art of engraving copper-plates.

Gravers and other inſtruments employed.

78. Mezzotinto.

Forming the ground.

Scraping.

79. Etching.

The varniſh.

Biting with aqua fortis.

Stopping out.

Producing a variety of ſhade.

80. Aquatinta.

Etched outline.

Method of laying the ground.

The operation continued by ſtopping out the lights,

Or by ſtopping out the ſhades.

81. Etching in ſoft ground.

82. Stippling.

83. The dry needle.

84. Proofs.

85. The rolling preſs.

86. Modelling.

87. *Silver.*

88. Separation of ſilver from lead.

89. Silver and copper ſweated together.

90. The art of plating.

91. Stamping machine.

92. *Gold.*

Refining.

Alloying.

Coining.

Milling.

93. Gold beaten into leaves.

94. Gilding.

95. *Mixed Metals.*

96. The ſpecific gravity,
Hardneſs,
And fuſibility of the mixtures.

97. Art of ſoldering.

98. Pewter.

99. Printer's types.

100. Cock metal.

101. Bell metal.

102. Specula.

103. *Braſs.*

104. Copper ſtratified with the ores of zinc.
Calamine.
Blende or black jack.

105. Caſt braſs.
Hardened by hammering.
Annealed.

106. Braſs manufactured into various articles.
Battering Mills.

107. *Coal.*

108. Boring for coal.

The ſweep or break.

Boring rods or bits.

The ſludging bit.

Keys.

109. Examination of the ſtrata.

110. The ſtrata thrown up or down.

Dykes.

The dip.

111. Coal mines.

Methods of ſupporting the roof.

Shafts.

Levels.

Canals.

Working the forefield.

112. The nature of choke damp,

And fire damp.

113. Steel mills for giving light.

114. The coal gin.

115. The ſteam wimſey,

Water wimſey,

And other machines for raiſing coal.

116. Corfs.

117. Coal waggons.

118. Waggon ways.

119. Contrivances for loading veſſels with coal.

120. Works at Whitehaven,
Newcaſtle,
Worſley,
Coalbrook Dale,
In Staffordſhire, &c.

121. Bitumen.

122. Mineral tar.

123. Lord Dundonald's tar works.

124. *Marble.*

125. The different ſtrata.

126. Works at Aſhford in Derbyſhire.

127. Mills for ſawing,
Sweeping,
And poliſhing marble.

128. Stone quarries.
Methods of working them.

129. Machines uſed in Maſonry.

130. Architecture.

131. Slate quarries.

Slitting the ſlate.

132. The nature of *Calcareous Stones.*

133. Burning lime.

134. The making mortar.

135. Tarras or puzzolana.

136. Water lime.

137. Alabaſter.

138. Plaiſter of Paris.

139. Stucco.

140. *Clay.*

141. Stourbridge and other clays.

Pipe clay.

142. Clay mixed with flints.

Chirt.

Kaolin and petunce.

143. *Flints,*

Burned,

Stamped,

And ground.

144. Pottery.

144. Pottery.

Preparation of the materials.

145. Potter's wheel.

146. Potter's lathe.

147. Molding and modelling.

148. The ſqueezing box.

149. Burning in the kiln.

150. Painting,

Printing,

And glazing porcelain.

151. The uſe of flints in the manufacture of glaſs.

The frit.

Green glaſs.

Crown glaſs.

Flint glaſs.

152. Structure of the pots,

And of the furnace for making glaſs.

153. Glaſs blown,

And formed.

154. Of annealing glaſs.

155. The

155. The manufacture of plate glaſs.

The plates ſilvered.

156. Cut glaſs.

157. Glaſs made for optical purpoſes.

158. Grinding optical glaſſes.

The mill for d°.

159. Centering optical glaſſes.

160. Of painting and ſtaining glaſs.

161. *Of Saline Minerals.*

162. Pyrites.

Method of extracting green vitriol from them.

163. Common ſalt.

164. Mineral ſalt.

The works at Northwich in Cheſhire.

Blaſting the ſalt rock.

Upper and lower ſtrata.

165. Brine ſprings.

166. Sea ſalt.

Works at Lymington.

Brine obtained by evaporation.

The brine boiled.

167. Different kinds of ſalt,

Fiſhery,

Store-houſe,

Middle grain,

And ſugar-loaf ſalts.

168. The bittern or mother water.

169. Extraction of glauber,

And Epſom ſalts from the bittern.

170. Magneſia.

171. Nitre,

Procured from the Eaſt Indies.

Obtained from decayed buildings.

172. Modern diſcoveries relative to its formation.

173. Purification of nitre.

174. Gunpowder.

175. The mill for mixing the ingredients.

176. The corning mill.

177. The glazing tackle or ſhamping mill.

178. On the ſtrength of various kinds of gunpowder.

The eprouvette.

179. Gunnery.

180. Sulphur.

Whence obtained.

181. The ſulphuric or vitriolic acid.

Method of obtaining it by the combuſtion of ſulphur.

182. Concentration of the acid.

183. Acids from nitre and ſea ſalt.

184. The manufacture of alum.

185. The preparation of alkaline ſalts.

PART II.

ANIMAL AND VEGETABLE SUBSTANCES.

186. THEIR culture and growth.

187. *Agriculture.*

188. On draining land.

189. Marles and manures.

190. The breed of cattle.

191. The growth of corn.

192. Planting and rearing timber.

193. Felling timber.

194. Making charcoal.

195. The timber ſawed into planks.

Saw mills.

196. Wood wrought into various articles.

197. The

197. The growth of ſeeds,

Rape ſeed, &c.

198. *Oil* procured from ſeeds by expreſſion.

The oil mill.

199. Oils hot or cold drawn.

Purification of oil.

200. Oil from animal ſubſtances.

201. The nature of fat,

And tallow.

202. Soap hard and ſoft.

203. Mold and dip candles.

204. The manufacture of wax candles.

Bleaching of wax.

205. Of ſpermaceti.

The ſpermaceti whale.

206. Train oil.

207. The whale *fiſhery* in the North Seas.

Southern fiſhery.

Harpooning.

The blubber.

The bone.

208. The cod fiſhery.

Newfoundland Bank.

Curing the fiſh.

209. The herring fiſhery.

210. Salmon fiſhery.

Coops.

Salmon leap.

Raiſe nets, &c.

211. *Leather.*

Liming,

Curing,

And tanning leather.

212. The uſe of bark.

213. Modern improvements in tanning.

214. *Saccharine juices* expreſſed from vegetables.

215. Manufacture of Muſcovado ſugars in the Weſt Indies.

216. Refining ſugar.

Molaſſes.

217. Rum.

218. Other ſaccharine juices fermented.

219. Diſtilleries.

220. *Arts relative to clothing.*

221. Flax and hemp.

Methods of preparing,

And dreſſing them.

Heckling.

222. *Cotton.*

Its various kinds from the Eaſt Indies.

Iſle de Bourbon.

From Panambaca,

Demerary,

And the Weſt Indies.

223. Yellow and white cotton.

224. Beating cotton on a flake.

225. Carding, by hand,

By the carding mill.

226. The drawing or roving mill.

227. Spinning,

By the diſtaff,

By various hand-wheels,

By machinery.

228. Sir

228. Sir Richard Arkwright's machine.
The mule.
229. Fabric of calicoes,
Muſlins,
Fuſtians,
Velvets.
230. Cutting, burning and bruſhing.
231. *Silk.*
232. Treatment of ſilk worms.
233. Winding ſilk from the cocons.
Raw ſilk.
White and yellow.
234. Throwing and twiſting ſilk.
235. Fabrics of ſilk.
236. Crape.
237. *Wool.*
238. Different breeds of ſheep.
239. Shearing.
240. Sorting wool.
241. Long wool.

Scour-

Scouring,

Combing,

Spinning,

Twiſting,

And weaving long wool.

242. Stuffs, ſhalloons, tammies, &c.

243. Preſſing and cylindering.

244. Worſted,

The manufacture of hoſiery.

245. Short wool,

Swinging wool.

Willies.

246. Scribbling and carding.

247. Slobing and ſpinning.

248. Warping.

249. Weaving.

Carpet-weaving.

Fancy-work.

250. Dreſſing cloth.

Tentering.

Milling or fulling.

Crop-

Cropping.

Preſſing.

Frizing.

251. Felting wood.

Rabbit's wool.

Beaver.

Bowing.

Hardening.

Planking.

252. Hats.

253. Woolens whitened by the fume of ſulphur.

254. Linen and cotton goods bleached.

255. Modern improvements in the art.

256. *Printing* linens and cottons.

Cutting the prints and blocks.

The pitch points and holes.

257. Preparation of the colours.

Subſtantive colours.

Adjective colours.

Mordants.

258. Variety of colours ſtruck by the ſame dye.

259. *Dying.*

259. *Dying*,

Silk,

Wool.

260. Scarlet dye,

Blue,

And other colours.

261. Chipping and raſping woods for dying.

262. The manufacture of *Paper*,

Rags,

Old ropes, &c.

263. Cutting.

264. Waſhing.

265. The mill for grinding.

266. The uſe of ſmalts.

267. Molding.

268. Preſſing.

269. Sizing.

270. The glazing and rolling mill.

PART III.

ON THE CONSTRUCTION OF MACHINES.

271. ENGINES moved by animal ſtrength,
By wind,
By water,
By ſteam.

272. Methods of applying the ſtrength of animals to the greateſt advantage.

273. The different forms of windmills.
The horizontal mill.
The vertical mill.

274. Experiments to determine the force of the wind.
Anemometers.

275. The

275. The beſt poſition of the ſail.

276. Various water-wheels.

277. Overſhot or bucket-wheel.

Experiments to determine its greateſt effect.

278. Float-wheel.

The greateſt effect of it.

279. Breſt-wheel.

280. Obſervations on the eſtimate of the force.

281. Its variation as the velocity or ſquare of the velocity.

Newtonian opinion.

Contrary opinions.

282. The force meaſured by the effect produced.

Various reſults.

283. On the nature of ſteam.

284. Its application as a moving force.

285. The principle of the common ſteam engine.

Bolton and Watts',

Heſlop's,

&c.

 286. Con-

286. Conſtruction of particular parts of mills and ſteam engines.

287. Methods of turning the ſails of a mill to the wind.

288. Stopping the wind mill.

The break.

289. Regulators.

290. Modes of regulating the ſupply of water to the wheel.

291. The boiler of the ſteam engine ſupplied.

292. The force of the ſteam regulated.

Gages.

The choke valve.

The ſafety valve.

293. The jet.

294. Regulation of the ſteam and jet valves.

295. The condenſing cylinder and air-pump.

296. The connexion of the piſton-rod and the beam.

297. Circular motion produced,

By a crank,

Or by ſun and planet wheel.

298. The

298. The uſe of fly-wheels.

299. Of cog-wheels.

Face or ſpur-wheels.

Bevil,

And crown-wheels.

Nuts or pinions.

Trundles or wallers.

300. The action of cogs on one another.

301. The ſhape of the cog.

302. The proportion of the ſize of the cog to that of the wheel.

303. Of ſtriking in and out of geer.

304. Friction.

Variation of d°.

Effect of velocity on it.

305. Methods of diminiſhing friction.

Gudgeons and braſſes.

Friction wheels.

Patent rollers.

306. The converſion of linear into circular motion,

And vice versâ,

By

By cranks,

Screws,

Racks,

And cams.

307. On the converſion of quick motions into very ſlow ones.

By a ſingle cog,

By the worm ſcrew,

By ratchet wheels.

308. On the conſtruction of wooden wheels,

309. Caſt iron wheels.

310. Braſs wheels.

311. Machines for the formation of ſmall wheels.

312. Lathes,

Turned by hand,

By foot-wheels,

By the bow or ſpring,

By water or ſteam engines.

313. The different parts,

The bar,

The heads,

The mandrell,

The reſt,

The dividing plate.

314. Manner of cutting teeth in wheels.

315. Screws cut,

Upon the lathe,

By ſtocks and dies,

By ſcrew plates.

316. Of preſſes,

The ſcrew,

Rolling,

And Printing preſs.

317. Of cranes.

The walk-wheel.

The jigger.

Triangle.

Shears.

318. Lifting jacks.

319. Other machines.

320. On the application of models to large works.

321. The

321. The danger of error in eſtimating the moving force,

The effect produced,

Friction and tenacity,

The ſtrength of the machine.

PART IV.

WATER-WORKS AND NAVIGATION.

322. AQUEDUCTS.

The ſupply of water.

Methods of regulating it.

The balance engine.

Gages.

323. Water-works.

324. Forcing pumps.

The air veſſel.

Reſervoir.

Pipes.

The ball-cock.

325. Canals.

Machines uſed in cutting canals.

Puddling.

326. Tunnels.

327. Aqueduct bridges.

328. The ſupply of water.

Reſervoir.

Waſte water.

329. Locks,

Their general principle,

And conſtruction.

330. Veſſels conveyed from one level to another,

Upon inclined planes,

By ſteam engines,

By counterpoiſes.

331. The caſſoon.

332. The veſſels uſed in navigating canals.

333. Canal and river navigation compared.

334. Of clearing the beds of rivers.

335. Docks.

336. Graving docks,

Their conſtruction.

337. Driving piles.

338. Flood-gates.

339. Clear-

339. Clearing the ſilt,

By a head of water,

By machines,

The mud machine.

340. Harbours.

Natural,

And artificial.

Ramſgate harbour.

341. Piers.

342. Quays.

343. On the mooring of veſſels.

Mooring chains.

344. Anchorage.

345. On the conſtruction of veſſels.

Launching of ſhips.

346. Experiments on the ſtability of floating bodies.

The metacenter,

Flare-ſided veſſels.

Wall-ſided.

Tumble home.

347. Experiments on the reſiſtance of water.
The proper form of ſhips.
The rake.

348. The form and uſe of the rudder.

349. The uſe of the keel,
Of falſe keels,
Of lee-boards.

350. Of caulking,
And paying the bottoms and ſides of veſſels.

351. The maſts of ſhips,
Yards,
Sails,
And cordage.

352. Of ſquare-rigged,
And ſloop-rigged veſſels.

353. Trimming the ſails.

354. Tacking and wearing.

355. The interior ſtructure,
And furniture of ſhips.