

Comparison of wooden and iron carriages.

Wooden field gun carriage and limber.

Mark II, carriage for 9 pr. R. M. L.

Special characteristics of larger natures.

The overbank attachment.

Howitzer beds.

Modes of checking recoil.

Garrison wooden carriages : (1) standing ; (2) sliding.

Wooden platforms.

Wrought iron single and double plate sliding carriages.

Wrought iron standing carriage.

Cast iron do (old pattern.)

Wrought iron platforms ; Elswick compressor ; hydraulic buffer.

The Moncrieff system.

**GUNNERY.**—General principles and result ; further investigations being reserved for the Voluntary Course.

Objects of rifling, angle of spiral, twist of rifling, relative advantages of "uniform" and "increasing" twist.

Velocity of rotation, how measured ; the considerations on which the amount of rotation to be given depends.

Derivation or drift ; how counteracted in the sighting.

Systems of rifling in common use, their advantages and defects. Various forms of grooves ; disadvantages of grooves, studs and ribs.

Care and preservation of ordnance and stores.

#### VOLUNTARY COURSE.

##### 2ND CLASS—Total Marks, 1,000.

**SECTION A.**—Construction and action of the service time and percussion fuzes.

The principal metals used in the construction of ordnance and stores. Their most important physical properties with reference to their employment. Special attention to the distinctive characteristics of wrought iron, steel, and the various descriptions of cast iron. Puddling and other metallurgic processes carried on in the Royal Arsenal or elsewhere, with special reference to military purposes.

History and construction of ordnance, including cast iron, bronze and Woolwich guns. Detailed account of all the processes of modern manufacture as carried on in the Royal Arsenal.

Proofs and tests for wrought iron ; steel tubes, before boring, with special reference to tempering in oil ; the finished tube after tempering ; and, finally, the finished gun.

Manufacture of carriages and physical properties of the more important woods employed ; without paying much attention to detail.

Manufacture of ammunition and stores connected with artillery. *Marks, 400.*

*Section B. (Sladen's Principles of Gunnery.)*

*Chapter I.*—Definition of terms used in gunnery.

*Chapter II.*—Relation between and problems upon the "angle of spiral" and "twist of rifling." Velocity of rotation determined from that of translation. "Energy" due both to translation and to rotation, omitting the note to pages 15, 16. Velocity of recoil without noticing the weight of the cartridge and without the considerations in pages 18, 19, which should however be read over, the causes of inaccuracy being noticed. Energy of recoil omitting the cartridge as before. Omit Major Kemmis' table.

*Chapter III.*—Pressure in the bore of a gun.

*Chapter IV.*—Work done by a charge of powder, omitting the table of work and its applications. "Factor of Effect." Velocity in the bore and muzzle. Velocity omitting details in pages 31, 32.