## ARTS DEPARTMENT.

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# UNIVERSITY OF LONDON.

### MATRICULATION EXAMINATION, JANUARY, 1881.

## NATURAL PHILOSOPHY-PART A.

Solutions by J. A. BALDERSON, B.A., Mathematical Master, High School, Mount Forest.

I. A body resting on a smooth horizontal table is acted on by a horizontal force equal to the weight of 2 ounces, and moves on the table over a distance of 10 feet in 2 seconds. Find the mass of the body.

Let  $m = \text{mass of body and let } f = \text{accelera$  $tion per second, then } mf = 2 \text{ ounces or } f = \frac{2}{m} \text{ and } s = \frac{1}{2} f t^2 \text{ or } \frac{2s}{t^2} = f \text{ or } \frac{20}{4} = f = 5 \text{ feet } \text{per second.}$ 

... 5m=2 or  $m=\frac{2}{5}$  or  $mg=\frac{2g}{5}=\frac{2\cdot32}{5}=\frac{4}{5}$ ... mass=mass of a body whose weight is  $\frac{4}{5}$  of a pound.

2. Three forces act along three of the sides of a parallelogram ABDC, one from A to B, one from A to C, and the third from B to D; each force being proportional to the side along which it acts; the parallelogram is such that the diagonal AD is perpendicular to the side BD. Find the line of action of the resultant force, and shew that its magnitude is equal to one of the given forces.

Let ABDC be a parallelogram having the diagonal AD perpendicular to BD and having forces represented in magnitude and direction by AC, AB, and BD, acting along

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AC, AB, and BD; now resultant of AB and AC is represented in magnitude and direction by AD and the resultant of AD and BD is represented in magnitude and direction by KD, where KD is the diagonal of parallelogram, having AD and BD as adjacent sides and this is equal to AB, the other diagonal, since the parallelogram is rectangular, that is the resultant of the three forces is equal to the force represented by AB.

3. A body appears to weigh 24 lbs. when placed in one scale-pan, and 25 lbs. when placed in the other. Find its real weight to three places of decimals.

Let w represent the true weight of the body; let x and y represent the lengths of balance arms. First, let body be weighed in the pan having the x arm and let it weigh 24 lbs., then 24y=wx; similarly by weighing body in the other we have wy=25x; by eliminating x and y we obtain

 $w = \sqrt{24.25} = \text{true weight.}$ 

4. ABC is an equilateral triangle of 6 inches side, of which O is the centre. If the triangle OBC be removed, find the distance from A to the centre of gravity of the remainder.

Let ABC be an equilateral triangle resting in a horizontal position and having O as centre, and instead of removing the triangle OBC let a force equal to weight of triangle OBC act upwards through its centre of gravity; then the problem resolves itself into finding centre of parallel forces, weight of triangle acting downwards through O, and of