Dissertation Lab Notebook

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Need to calculate the diameter of a $1/2\ lb$ hemispherical charge of TNT.

[1]
```
from pint import UnitRegistry
import numpy as np
u = UnitRegistry()
u.auto_reduce_dimensions = True
```

The density of cast TNT ranges between $1.5\ g/cc$ and $1.6\ g/cc$ [1] The weight of explosives to be used in the tests is $1/2\ lb$. Therefore, the the volume of explosives required is,

[11]
```
density_TNT = 1.5*u.gram / u.cubic_centimeter
weight_TNT = 0.5*u.pound
volume_TNT = weight_TNT / density_TNT
print(volume_TNT.to_compact())
```

```
151.19745666666668 cubic_centimeter
```

The density of bulk PETN ranges between $800\ kg/m^3$ and $900\ kg/m^3$ [2] The weight of explosives to be used in the tests is $1/2\ lb$. Therefore, the the volume of explosives required is,

[19]
```
density_PETN = 850*u.kilogram / u.meter**3
weight_PETN = 0.5*u.pound
volume_PETN = (weight_PETN /
density_PETN).to('cubic_centimeters')
print(volume_PETN)
```

```
266.8190411764706 cubic_centimeter
```

The density of Dyno AP is $1.5\ g/cc$ [3] The weight of explosives to be used in the tests is $1/2\ lb$. Therefore, the the volume of explosives required is,

[20]
```
density_dynoap = 1.5*u.gram / u.cubic_centimeter
weight_dynoap = 0.5*u.pound
volume_dynoap = weight_dynoap / density_dynoap
print(volume_dynoap.to_compact())
```

```
151.19745666666668 cubic_centimeter
```

The formula for a hemisphere is $V = \frac{2}{3}\pi r^3$. Therefore, the $r = \sqrt[3]{\frac{3}{2\pi}V}$.

[27]
```
r_TNT = (3/(2*np.pi)*volume_TNT)**(1/3)
r_PETN = (3/(2*np.pi)*volume_PETN)**(1/3)
r_dynoap = (3/(2*np.pi)*volume_dynoap)**(1/3)
print('The radius of the mold for TNT is {:.3f}'.format(r_TNT.to(
u.millimeter )))
print('The radius of the mold for PETN is
{:.3f}'.format(r_PETN.to( u.millimeter )))
print('The radius of the mold for DynoAP is
{:.3f}'.format(r_dynoap.to( u.millimeter )))
```

```
The radius of the mold for TNT is 41.639 millimeter
The radius of the mold for PETN is 50.318 millimeter
The radius of the mold for DynoAP is 41.639 millimeter
```

Bibliography

1. LLNL Explosives Handbook - Properties of Chemical Explosives and Explosive Stimulants, June 1985, Page 19-134
2. Eurenco. (2020). Pentrite (PETN). Retrieved March 25, 2020, from http://www.eurenco.com/wp-content/uploads/2013/07/PETN.pdf
3. Dyno Nobel. (2020). Technical Information Properties DYNO ® AP Small Diameter Detonator Sensitive Emulsion. Salt Lake City, UT. Retrieved from www.dynonobel.com

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