Assignment 1

Screen analysis of the fragmentation of a small scale experiment shows the size distribution of the following table:

Screen Sizes, mm	Mass Retained, g
93	716.8
63-93	1064.8
53-63	2374.9
45-53	1127.5
37.5-45	2133.5
31.5-37.5	2226.3
26.5-31.5	1198.4
18.85-26.5	3590.3
13.33-18.85	2516.9
6.73-13.33	2126.7
4.76-6.73	444.2
3.36-4.76	315
2.38-3.36	164.7
1.7-2.38	167.4
1.18-1.7	161.4
0.84-1.18	120.7
0.425-0.84	297.2
<0.425	246

The block was made of grout with UCS of 50 MPa, density of 2.3 t/m3, P-wave velocity of 4000 m/s and the pattern consisted of 5 holes with diameter of 12mm in which PETN with linear distribution of charge of 21.2 g/m was detonated. The holes were 23 cm long without stemming and the length of the charge was equal to the length of the hole; the space between the PETN detonating cord and the rock was filled with water. The burden was 7.5 cm and the spacing 10.5 cm. The height of the block was 25 cm.

A. What fraction of the total energy released by the PETN appears to be used in fragmentation?
B. What fraction of the shock energy (brisance) appears to be used in fragmentation?
C. Where does the rest of the energy go? Provide suggestions.
D. How does this compare to the values published by Spathis (Spathis, A.T.: “On the energy efficiency of blasting”, Fragblast 1999, Johannesburgh, South Africa, pp. 81-90).Total energy yield of PETN is 6.28 MJ/kg.

The JWL parameters for PETN at the density of 1.25 g/cm^3 are given in the following Table:

R[1] = 4.424 GPa, R[2] = 1.014 GPa, omega = 0.348

A = 293.012, B = 4.668, C = 1.535

Item 2

Review literature on the topic of energy efficiency of the various rock breakage (comminution) operations (blasting, crushers, rod and ball mills, sag mills). Discuss your findings in a short (three to five page) essay where you identify current efficiencies and identify trends.

Comminution typically uses Bond's laws to estimate energy consumption while in our discussion we used surface area.