6) Routine calculation

7) Let $x = \gcd(a,b) = ua + vb$ with $u, v \in \mathbb{Z}$

Then $g^x \equiv g^{ua+vb} \equiv (g^a)^u (g^b)^v$

$\equiv 1^u \cdot 1^v \equiv 1 \pmod{m}$

8) No, because we don't know that 16 is the smallest such number. (In fact

$4^4 \equiv 1 \pmod{17}$.)

9) $2^{1643} \equiv 1558 \pmod{1643}$.

↑ Routine calc

If 1643 was prime, by Fermats Little Thm. this would have to be $\equiv 2$, so 1643 cannot be prime.

b) Calculations are routine.
This does not imply that 561 is prime, because
Fermat's Little Theorem is necessary, but not
sufficient. (Numbers (such as 561) that
fulfill the condition of the theorem but are
not prime are called Carmichael-Numbers)
10) Calculate $g = ggT(m_1, m_2)$. The messages
are m_1/g and m_2/g.
11) See solution Link on web pages.