The sliding filament theory, in detail:

1. Ca2+ is released from SR
   1. Ca2+ binds to troponin and moves troposmyosin
   2. Tropomyosin movement reveals binding site on actin filament
2. Myosin head has ATP bound to it
3. ATPase (activated by Ca2+ ions) hydrolyses ATP to ADP + Pi (ADP remains bound to myosin head) – this primes the myosin head to bind to actin
4. Myosin (ADP+Pi still bound) attaches to actin
5. Pi is released, and allows the ‘power stroke’ to take place – this involves the neck of myosin filament bending and moves the actin filament
6. ADP is then released and a new ATP binds to myosin
7. New ATP molecule binds – only then does myosin dissociated from actin
8. Final stage is ATP to be hydrolysed – the chemical energy liberated is stored as potential energy through the straightening of the myosin neck region
9. The myosin head is now primed ready to attach, but further to the right

*There is, as we discussed a lot of discrepancy in the way that they books describe the process – what they fail to point out is that the energy released by hydrolysis of ATP is used to ‘recock’ but that energy is stored to allow the ‘power stroke’ only when the Pi is released from the myosin.*

I have included a couple of questions and mark schemes on the matter to ensure that you are aware of what the examiners are looking for:

*What is the role of ATP in muscular contraction?*

Allows myosin to detach from actin / to break cross bridge;  
*[allow attach and detach]*   
Releases energy to recock/swivel/activate myosin head / drive  
power stroke;

*OR*

*Describe how calcium ions cause the myofibril to start contracting.*

Ca2+ binds to [part of] the actin / troponin;  
this causes tropomyosin to be displaced;  
uncovers [myosin] binding sites [on actin] / allows actin to bind;

*Describe the events that occur within a myofibril which enable it to contract.*

myosin heads bind to actin / cross bridge formation /  
actomyosin formed;  
myosin heads / crossbridges swivel / ratchet mechanism; (Mr Gale says – remember this is, technically, only when the Pi is released)  
causing actin to slide relative to myosin;  
energy (Mr Gale says - for the ‘power stroke) provided by hydrolysis of ATP;

Hope this clears it up…

Mr Gale