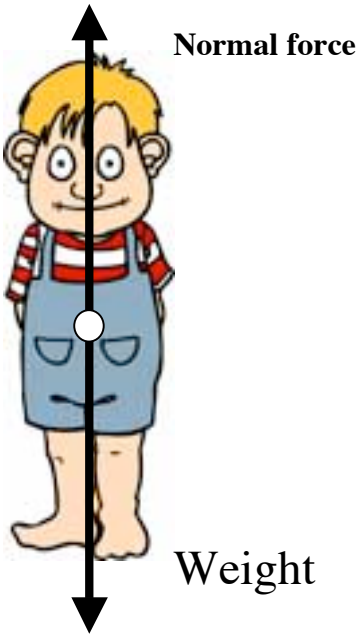
Question 4 ***(Common Question with Reg Q1 & Adv1)***

a)



(Drawing – 1 mark)

No, they are not an action-reaction pair since
(i) they act on the same object
(ii) different kinds (weight is gravitational while normal is electromagnetic)

(1 mark)

b) When Jack is simply standing on the table, the normal reaction force from the table need only be strong enough to balance his weight.

When he jumps, Jack is moving and so has momentum mv. The table must apply a sufficient force over a time to balance his weight *and* provide enough impulse to bring Jack to rest. Through Newton's third law, Jack applies the same force on the table. As the interaction time will be short, the required force can be large, overcoming the structural forces in the table and breaking it.

(2 marks)

c) While the required impulse is the same, the mattress extends the time of the interaction and hence reduces the required force. This reduces the force on the table and it does not break.

(1 mark)

(Total 5 marks)