Day 69

1. force; distance; energy
2.
   a) While there is a force, the force does not cause a displacement of any object; No
   b) There is a force applied to the barbell and the force causes a displacement of the barbell. Yes
   c) There is an upward force applied to the tray but the tray moves horizontally. Upward forces do not cause horizontal displacement. No
   d) The marble applies a force to the note card to move it across the table. This is work. Yes
   e) The shot-putter applies a force to displace the shot from a compressed arm position to an outstretched arm position. Yes
3. D
4. A, B, C, F
5.

W=(100N)(5m)cos(0˚) W=500J	W=(100N)(5m)cos(30˚) W=433J	The F value is equal to mg since the speed is constant. W=(147N)(5m)cos(0˚) W=735J

6.
   a) -
   b) +
   c) +
   d) -
   e) -

   Note: Work is negative when the force and the displacement are in opposite directions.

7. All angles result in the same work.

   This conclusion is supported by the calculations below. In each case, the angle Θ in the work equation is 0˚; this is the angle between the F vector and the displacement (not the incline angle); since these two directions are parallel to each other, the angle is 0˚. The work value is just force●distance●cosine(0˚). There is little to no difference between the three resulting values. The difference falls outside the level of precision to which the given F and d values have been expressed.

Work
$1.21*10^6$ J
$1.20*10^6$ J
$1.20*10^6$ J

8.
   a) norm 20N●5.0m●cosine(90˚) = 0J
      app 10N●5.0m●cosine(0˚) = 50J
      grav 20N●5.0m●cosine(90˚) = 0J
      total = 50J
   b) norm 20N●5.0m●cosine(90˚) = 0J
      grav 10N●5.0m●cosine(90˚) = 0J
      frict 10N●5.0m●cosine(180˚) = -50J

total = -50J

c) norm 20N●5.0m●cosine(90˚) = 0J
app 10N●5.0m●cosine(0˚) = 50J
grav 20N●5.0m●cosine(90˚) = 0J
frict 10N●5.0m●cosine(180˚) = -50J
total = 0J

d) norm 20N●5.0m●cosine(90˚) = 0J
grav 20N●5.0m●cosine(90˚) = 0J
total = 0J

e) tens 20N●5.0m●cosine(0˚) = 50J
grav 20N●5.0m●cosine(180˚) = -50J
total = 0J

f) app 20N●5.0m●cosine(90˚) = 0J
grav 20N●5.0m●cosine(90˚) = 0J
total = 0J

9. No. Consider some of the examples above – for instance, part c or part e. In both of these examples there is a force doing work. Yet there is an opposite force to balance it and prevent the acceleration. The opposing force also does work so that the net work is zero.

10.

a) Work = force●distance●cosine(Θ) = 21.6N●6.28 m●cosine(57.2˚) = 73.5 J

b) The applied force value is equal to the force of gravity; this value is m●g or 1264.2 N.
Work = force●distance●cosine(Θ) = 1264.2 N●1.98 m●cosine(0˚) = $2.50 \bullet 10^3$ J

c) The force that must be applied to lift 12 occupants at a constant speed is equivalent to the weight (m●g) of the occupants; this value is 12•(62.8 kg)•(9.8 N/kg) or 73 N.
Work = force●distance●cosine(Θ) = 7385.28 N●76.8 m●cosine(0˚) = $5.67 \bullet 10^5$ J