Work, Power and Energy Practice Problems

Work and Power Problems

1) How much work will you do if you push a block of concrete $4.3\ m$ along a floor with a steady force of $25\ N$?

2) If your mass is $70.0\ kg$, how much work will you do climbing a flight of stairs $25.0\ m$ high, moving at a steady pace?

3) Your car is stuck in the mud. You push on it with a force of $300.0\ N$ for $10.0\ s$, but it will not budge. How much work have you done in $10.0\ s$?

4) A girl uses a $3.0\ m$ long ramp to push her $110\ kg$ motorbike up to a trailer, which is $1.2\ m$ above the ground. How much work is done on the motorbike?

5) A force was used to push a box along the floor for a distance of $8.0\ m$. If $160.0\ J$ of work was done, what force was applied?

6) A force of $50.0\ N$ is used to do $480.0\ J$ of work to move an object. What distance was the object moved?

7) A bulldozer pushed a large rock with a force of $5000\ N$ at a constant speed of $2.0\ m/s$ for $20\ s$. How much work was done? (hint: $v_{avg} = \frac{d}{t}$)

8) A $50\ kg$ box is pulled $11.0\ m$ along a level surface by a rope. If the rope makes an angel of 35° with the ground, and the force exerted through the rope is $90.0\ N$, how much work is done on the box?

9) How much power does a crane develop doing $60,000\ J$ of work in 5.00 minutes?

10) How long does it take a $2.5\ kW$ electric motor to do $75,000\ J$ of work?

11) How much work can a $500\ W$ electric mixer do in 2.5 minutes?

Kinetic and Potential Energy Problems

12) A crane lifts a $1500\ kg$ car $20\ m$ straight up.

a) How much potential energy does the car gain?
b) How much work does the crane do?

13) A $4.00\ kg$ rubber ball drops from a height of $5.00\ m$ to the ground and bounces back to a height of $3.00\ m$.

a) How much potential energy does the ball lose on the trip down to the ground?
b) How much potential energy does the ball regain on the trip back up?
c) What is the net loss of potential energy during the bounce?

14) What is the kinetic energy of a $0.500\ kg$ ball thrown at $30.0\ m/s$?

15) What is the mass of an object travelling $20\ m/s$ with kinetic energy of $4000\ J$

16) A $0.50\ kg$ rubber ball is thrown into the air. At a height of $20\ m$ above the ground, it is traveling $15\ m/s$.

a) What is the ball's kinetic energy?
b) What is its potential energy at that height?

17) A force of $30.0\ N$ pushes a $1.5\ kg$ cart, initially at rest, a distance of $2.8\ m$ along a frictionless surface.

a) Find the work done on the cart.
b) What is its change in kinetic energy?
c) What is the cart's final velocity?

18) A bike and rider, $82.0\ kg$ combines mass, are traveling at $4.2\ m/s$. A constant force of $-140\ N$ is applied by the brakes to stop the bike. What braking distance is needed?

19) A $712\ kg$ car is traveling at $5.6\ m/s$ when a force acts on it for $8.4\ s$, changing its velocity to $10.2\ m/s$.

a) What is the change in kinetic energy of the car?
b) If the car moved a distance of $66.4\ m$, how large was the force?
c) How much power was developed during this time?

20) A $0.25\ kg$ ball is dropped from a height of $3.2\ m$ and bounces to a height of $2.4\ m$. What is its loss in potential energy?

21) A $15.0\ kg$ model plane flies horizontally at a constant speed of $12.5\ m/s$.

a) Calculate its kinetic energy.
b) The plane goes into a dive and levels off $20.4\ m$ closer to Earth. How much potential energy does it lose during the dive? Assume no additional drag.
c) How much kinetic energy does the plane gain during the dive?
d) What is its new kinetic energy at the lower elevation?
e) What is its new horizontal velocity at the lower elevation?

22) A $1200\ kg$ car starts from rest and accelerates to $72\ km/hr$ in $20.0\ s$. Friction exerts an average force of $450\ N$ on the car during this time. What is the net work done on the car?

Answers:

1) $108\ J$ 2) $1.72\times10^4\ J$ 3) $0\ J$ 4) $1300\ J$ 5) $20\ N$ 6) $9.6\ m$ 7) $2.0\times10^5\ J$
8) $811\ J$ 9) $200\ W$ 10) $30\ s$ 11) $7.5\times10^4\ J$ 12) a) $2.94\times10^5\ J$ b) $2.94\times10^5\ J$ 13) a) $-196\ J$
b) $118\ J$ c) $-78\ J$ 14) $225\ J$ 15) $20\ kg$ 16) a) $56.3\ J$ b) $98\ J$ 17) a) $84\ J$
b) $84\ J$ c) $10.6\ m/s$ 18) $5.2\ m$ 19) a) $2.59\times10^4\ J$ b) $390\ N$ c) $46\ W$
20) $-1.96\ J$ 21) a) $1170\ J$ b) $-3000\ J$ c) $3000\ J$ d) $4170\ J$ e) $23.6\ m/s$ 22) $2.4\times10^5\ J$