Problems chapter two

1. Which work mode is a nonequilibrium work mode?

(A) Compressing a spring

(B) Transmitting torque with a rotating shaft

(C) Energizing an electrical resistor

(D) Compressing gas in a cylinder

2. Which of the following statements about work for a quasiequilibrium process is incorrect?

(A) The differential of work is inexact

(B) Work is the area under a *P-T* diagram

(C) Work is a path function

(D) Work is always zero for a constant volume process

3. Air is compressed in a cylinder such that the volume changes from 0.2 to 0.02 m3. The initial pressure is 200 kPa. If the pressure is constant, the work is nearest

(A**)** −36 kJ

(B**)** −40 kJ

(C**)** −46 kJ

(D) −52 kJ

4. Estimate the work necessary to compress the air in a cylinder from a pressure of 100 kPa to that of 2000 kPa. The initial volume is 1000 cm3. An isothermal process is to be assumed.

(A**)** 0.51 kJ

(B**)** 0.42 kJ

(C**)** 0.30 kJ

(D**)** 0.26 kJ

5. Estimate the work done by a gas during an unknown equilibrium process. The pressure and volume are measured as follows:

P 200 250 300 350 400 450 500 kPa

V 800 650 550 475 415 365 360 cm3

(A) 350 J

(B) 260 J

(C) 220 J

(D) 130 J

6. The force needed to compress a nonlinear spring is given by $F = 10x^2$ N, where x is the distance the spring is compressed, measured in meters. Calculate the work needed to compress the spring from 0.2 to 0.8 m.

(A) 0.54 J

(B) 0.72 J

(C) 0.84 J

(D) 0.96 J

7. A paddle wheel and an electric heater supply energy to a system. If the torque is 20 N. m, the rotational speed is 400 rpm, the voltage is 20 V, and the amperage is 10 A, the work rate is nearest

(A) −820 W

(B) −920 W

(C) −1040 W

(D) −2340 W

8. A gasoline engine drives a small generator that is to supply sufficient electrical energy for a motor home. What is the minimum horsepower engine that would be necessary if a maximum of 200 A is anticipated from the 12-V system?

(A) 2.4 hp

(B) 2.6 hp

(C) 3.0 hp

(D) 3.2 hp

9. Which of the following does not transfer work to or from a system?

(A) A moving piston

(B) The expanding membrane of a balloon

(C) An electrical resistance heater

(D) A membrane that bursts

10. Ten kilograms of air at 800 kPa are heated at constant pressure from 170 to 400°C. The work required is nearest

(A) 1150 kJ

(B) 960 kJ

(C) 660 kJ

(D) 115 kJ

11. Air is compressed in a cylinder such that the volume changes from 0.2 to 0.02 m3. The pressure at the beginning of the process is 200 kPa. If the temperature is constant at 50°C, the work is nearest

(A) −133 kJ

(B) −126 kJ

(C) −114 kJ

(D) −92 kJ

12. Air is expanded in a piston-cylinder arrangement at a constant pressure of 200 kPa from a volume of 0.1 m3 to a volume of 0.3 m3. Then the temperature is held constant during an expansion of 0.5 m3. Determine the total work done by the air.

(A) 98.6 kJ

(B) 88.2 kJ

(C) 70.6 kJ

(D) 64.2 kJ

13. Air undergoes a three-process cycle. Find the net work done for 2 kg of air if the processes are

1 → 2: constant-pressure expansion

2 → 3: constant volume

3 → 1: constant-temperature compression

The necessary information is $T1 = 100°C$, $T2 = 600°C$, and $P1 = 200$ kPa.

(A) 105 kJ

(B) 96 kJ

(C) 66 kJ

(D) 11.5 kJ

12. A 200-mm-diameter piston is lowered by increasing the pressure from 100 to 800 kPa such that the $P\text{-}V$ relationship is $PV2 = $ const.

If $V1 = 0.1$ m3, the work done on the system is nearest

(A) −18.3 kJ

(B) −24.2 kJ

(C) −31.6 kJ

(D) −42.9 kJ

13. A 120-V electric resistance heater draws 10 A. It operates for 10 min in a rigid volume. Calculate the work done on the air in the volume.

(A) 720 000 kJ

(B) 720 kJ

(C) 12 000 J

(D) 12 kJ

14. An electrical voltage of 110 V is applied across a resistor providing a current of 12 A through the resistor. The work done during a period of 10 min is nearest

(A) 792 000 kJ

(B) 792 kJ

(C) 792 MJ

(D) 792 mJ