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Continuing Education Course #516
Basics of Energy, Momentum, and Power
Part 2 - Basics of Mechanical Power and Momentum

1. A car engine provides a constant forward force of 1000 N. If the car is travelling at 72 km/h, what power is developed by the engine?

- a. 2000 W
- b. 72 kW
- c. 20 kW
- d. 60 kW

2. The correct official name for what we usually call the "Metric System" is:

- a. MKS system (Meter, Kilogram, Second System)
- b. International System of Units
- c. Metric System
- d. CGS (Centimeter, Gram, Second System)

3. The correct official term for the measurement system now in use in the United States is:

- a. Imperial System
- b. United States Customary System
- c. English System
- d. Foot-Pound-Second system

4. Power can be defined as:

- a. Force of one newton acting for one meter distance during time of one second.
- b. Force of one pound force acting for one foot distance during time of one second
- c. Energy of any kind that is either produced or used in one second.
- d. All of the above

5. James Watt coined the term "horsepower". What can be said about James Watt?

- a. His work helped start the industrial revolution.
- b. Watt invented improvements to the steam engine.
- c. James Watt worked with the coal mining industry.
- d. All the above

6. Horsepower can be described as:

- a. 550 ft-lb/second
- b. 3300 ft-lb/minute
- c. Energy required to raise 550 pounds one foot in one second
- d. All the above

7. A drive shaft is turned to hoist a freight elevator. The shaft turns at 6 RPM for a total of two minutes, and it is known that torque on the shaft is 2500 lbf-ft. What is the power (in HP) required to hoist the elevator?

- a. 2.84 HP
- b. 12.5 HP
- c. 1.8 HP
- d. 3.95 HP

8. Is there any practical reason to include the suffix "e", as in "ge" when referring to gravitational acceleration on Earth?

- a. No, gravitation is the same everywhere
- b. No, it is not necessary
- c. No, everyone will know we are referring to Earth's gravity.
- d. Yes, we are in the 21st century and our project may be somewhere other than Earth.

9. What is the power output if a constant force of 20 lbf is applied on an object to slide it 30 ft horizontally in 3 seconds? The force is applied at an angle of 45° . $\text{Cosine } 45^\circ = 0.707$

- a. 141.4 ft-lbf/s
- b. 200 ft-lbf/s
- c. 182 ft-lbf/s
- d. 424.2 ft-lbf/s

10. A steel ball of mass 20 kg is dropped from a height of 50 m. What is its kinetic energy just before it hits the ground? Ignore air resistance.

- a. 5,000 J
- b. 6420 J
- c. 9800 J
- d. 3680 J

11. The world record 0-100 km/hr speed record was set at 1.86 seconds. The mass of the vehicle is 2063 kg. What was the average power output of the car?

- a. 361 kW
- b. 527 kW
- c. 429 kW
- d. 287 kW

12. Give the answer for question 11 in US units.

- a. 320 HP
- b. 575 HP
- c. 624 HP
- d. 437 HP

13. A flywheel with angular moment of inertia $25 \text{ kg}\cdot\text{m}^2$ is rotating at 1800 RPM. What is the angular kinetic energy of the flywheel?

- a. 334,000 J
- b. 446,500 J
- c. 725,000 J
- d. 535,400 J

14. Using the calculated angular kinetic energy of the flywheel from question 13, calculate average power output, in kW, of a motor that brings the flywheel up to speed (1800 RPM) in 6 seconds.

- a. 87 kW
- b. 120 kW

- c. 74 kW
- d. 94
15. A railroad engine has a mass of 40,000 kg and is moving at 10 m/s. What is its linear kinetic energy? $1000 \text{ J} = 1 \text{ kJ}$.
- a. 1200 kJ
- b. 2000 kJ
- c. 2500 kJ
- d. 3000 kJ
16. Using the linear kinetic energy of the railroad engine calculated in question 15, what is the braking power, in kW, required to bring the engine to a full stop in 20 seconds?
- a. 150 kW
- b. 200 kW
- c. 100 kW
- d. 250 kW
17. Using the linear kinetic energy of the engine calculated in question 16, what is the energy converted to?
- a. Potential energy
- b. Electrical energy
- c. Angular kinetic energy
- d. Heat energy
18. An automobile engine has a torque of 200 lbf-ft at 4500 RPM. What is the engine's power output under these conditions?
- a. 120 HP
- b. 250 HP
- c. 171 HP
- d. 197 HP
19. A truck engine can produce 175 kW at 3500 RPM. What is the engine's torque under these conditions?
- a. 355 N-m
- b. 478 N-m
- c. 421 N-m
- d. 715 N-m
20. One reason that Diesel engines are more fuel efficient than gasoline engines is:
- a. Diesel engines are more expensive
- b. Diesel engines have a higher compression ratio
- c. Diesel engines usually run at lower RPM
- d. Diesel engines are heavier and have closer tolerances
21. A power-torque curve displays the relationship between:
- a. engine torque, power, and RPM
- b. engine efficiency and RPM
- c. engine efficiency and torque
- d. engine efficiency and power
22. Horsepower can be calculated directly from RPM and torque using the following equation:
- a. You can not calculate HP using RPM and torque
- b. $\text{HP} = (\text{torque} \times \text{RPM})/5252$

- c. $HP = (\text{torque} \times 5252)/RPM$
- d. $HP = (\text{torque} \times RPM)/1000$

23. Hydraulic power machinery is also called:

- a. Fluid flow equipment
- b. Water power machinery
- c. Turbomachinery
- d. Pump and turbine machinery

24. Using equation 16, calculate horsepower to pump water at these condition: Flow rate = 1.5 cubic feet/second; weight of water = 62.4 lb/cubic foot; head = 120 ft; efficiency = 72%

- a. 21.5 HP
- b. 28.4 HP
- c. 52.3 HP
- d. 37.4 HP

25. What type of turbines are used to generate electrical power at Grand Coulee and Hoover Dam?

- a. Impulse turbine
- b. Full flow turbine
- c. Reaction turbine
- d. Hydraulic turbine

26. A wheeled, 1500 kg cannon fires a 10 kg cannonball horizontally from a ship. The ball leaves the cannon traveling at 200 m/s. At what speed (v_1) does the cannon recoil as a result?

- a. 0.8 m/s
- b. 1.0 m/s
- c. 1.33 m/s
- d. 2.0 m/s

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