Of course. Here is a more challenging numerical question paper with 15 questions, designed to make you think and apply concepts in multi-step or non-obvious ways. The questions are jumbled from all four chapters as requested.

Advanced Numerical Question Paper

Instructions:

- Answer all questions, showing your working clearly.
- For calculations, take the gravitational field strength, g, to be $9.8\ N/kg$.
- Atmospheric pressure, where needed, can be taken as 1.0×10^5 Pa.

1. A person with a mass of 70 kg stands inside a lift. Calculate the force exerted by the person on the floor of the lift if the lift is accelerating upwards at $2.0\ m/s^2$. [3]
2. A pump, powered by a 2000 W motor, is 75% efficient. Calculate the mass of water it can lift to a height of 15 m in one minute (60 s). [4]
3. A block of mass 5 kg is pulled along a rough horizontal surface. A pulling force of 30 N causes it to accelerate at $2\ m/s^2$. A larger pulling force of 40 N causes it to accelerate at $4\ m/s^2$. Calculate the constant frictional force acting on the block. [4]
4. A sealed syringe contains $50\ cm^3$ of air at atmospheric pressure (1.0×10^5 Pa). The plunger is pushed in until the air volume is $20\ cm^3$, and the temperature rises from $20°C$ to $35°C$. Calculate the new pressure of the air inside the syringe. [4]
5. A cube-shaped box of mass 20 kg and side length 0.5 m is placed on the floor. It is then filled with a liquid that has a density of $800\ kg/m^3$. Calculate the total pressure exerted by the filled box on the floor. [4]
6. A car of mass 1200 kg accelerates uniformly from 10 m/s to 25 m/s over a distance of 175 m. Calculate the resultant force required to produce this acceleration. [4]
7. A child runs up a staircase that has 20 steps. Each step is 15 cm high and 25 cm deep. If the child has a mass of 40 kg and takes 8 seconds to run up the stairs, what is their average power output? [4]
8. A hydraulic press has a small piston of area $5.0\ cm^2$ and a large piston of area $200\ cm^2$. To lift a heavy load, the large piston must move upwards by 2 cm. What distance must the small piston be pushed down? [3]
9. A mountaineer of mass 75 kg is standing at the peak of a 3000 m high mountain. They dislodge a 10 kg boulder, which rolls down the mountain. Neglecting air resistance and friction, calculate the speed of the boulder as it reaches a point 1800 m lower than the peak. [3]

10. A spring with a spring constant of 400 N/m is hung vertically. A second spring, with a constant of 600 N/m, is attached to the bottom of the first spring. A mass of 12 kg is then hung from the bottom of the second spring. Calculate the total extension of the combined spring system. [4]
11. An air bubble with a volume of $5\ cm^3$ is released by a diver at the bottom of a lake where the depth is 40 m. Assuming the temperature is constant, calculate the volume of the bubble just as it reaches the surface. (Density of water = $1000\ kg/m^3$) [4]
12. A car engine does 8×10^5 J of work to move a car along a level road. During this time, 3×10^5 J of energy is transferred to thermal energy due to air resistance and friction. What is the increase in the car's kinetic energy? [2]
13. A 60 kg person puts all their weight on the heel of a stiletto shoe while walking. If the heel has a circular area with a radius of 5 mm, calculate the pressure exerted on the ground in Pascals (Pa). [4]
14. A rollercoaster car of mass 800 kg starts from rest at the top of a hill 45 m high. It travels down and then up a second hill. Assuming no friction, what is the kinetic energy of the car when it is at the top of the second hill, which is 20 m high? [3]
15. The pressure inside a lorry tyre is 3.0×10^5 Pa when the temperature is $17^\circ C$. After a long journey, the temperature of the air inside the tyre rises to $57^\circ C$. Calculate the new pressure inside the tyre, assuming its volume has not changed. [3]