P4 Explaining motion revision questions

Equations given on the exam paper

- **Average speed (velocity) = distance moved**
  time taken
- **Acceleration = change of speed (velocity)**
  time taken
- **momentum = mass × velocity**
- **change of momentum = resultant force x time for which it acts**
- **Work done = resultant force x distance moved**
- **Weight = mass x gravitational field strength   (g = 10N/kg on earth)**
- **change in gravitational PE = weight   x   vertical height difference**
- **kinetic energy = ½ x mass x   [velocity]^2**

If you are taking the Foundation Tier paper, only complete the first two questions in each category. If you are taking the Higher Tier paper, you must complete all questions.

Velocity

1. A cyclist pedals for a distance of 5000m in 300s. What is the average velocity?
2. A small child runs for a distance of 50m in 25s. What is the average velocity?
3. A sloth climbs along a tree for a distance of 20 metres in 500 s. What is the average velocity?
4. A man runs 100m at a speed 10 m/s. How long does he take to complete the race?
5. A ball rolls down a hill at a speed of 20 m/s for 4 seconds. How far does it travel?

Acceleration

6. A rather large child waddles from a standing start to 10 m/s in 5 seconds. What is the acceleration of the child?
7. A hungry dog sitting on the floor chases the postman down the street reaching 20 m/s in 2 seconds. What is the acceleration of the worrisome canine?
8. A postman running away from a hungry dog accelerates at a speed of 10 m/s^2 for 5 seconds. What is the change in velocity?
9. The postman increases his velocity by accelerating at 20 m/s^2 for a change of velocity of 10 m/s. How long does this take?

Momentum

10. A large train is moving at 100 m/s with a mass of 5000 kg. What is the momentum of the train?

11. A particularly large elephant of mass 4500 kg is running at a speed of 9 m/s. What is the momentum of the troublesome pachyderm?

12. A runaway cow has a momentum of 2000 kg m/s and a speed of 15 m/s. What is the mass of the cow?

13. A sledge of 50 kg is sliding down a snow covered slope with momentum of 2500 kg m/s. How fast is it moving?

Change of momentum

14. A large moving box is stopped by a force of 300N over a period of 10 seconds. What is the change of momentum?

15. An angry badger of mass 30 kg moving at 10 m/s slams into a concrete wall with a force of 3000 N. How long does it take the badger to stop?

16. A man has a mass of 110 kg and he runs (very quickly) at 50 m/s. The man stops in 20 s. What force is required to stop the man?

17. A cat has a mass of 7 kg and runs at 100 m/s. The cat stops in 6 s. What force is required to stop the cat?

18. A car travels at 300 m/s and has a mass of 600 kg. The car comes to a halt in 3 seconds at traffic lights. What force is required to stop the car?

Gravitational potential energy

19. A cat weighing 200N manages to get stuck in a tree at a height of 4m. What is the gravitational potential energy of the cat?

20. A large brick weighing 500N is poised on the edge of a roof some 25 metres in the air. What is the gravitational potential energy of the dangerous piece of masonry?

21. A large box weighing 1500N is pointlessly hoisted into the air for a change in gravitational potential energy of 4500J. To what height is it raised?

22. An even larger box weighing is raised to a height of 10 metres for a change in GPE of 25000J. What is the weight of the box?

23. A truly enormous box of 1700kg is raised for a change of GPE of 3400J. How high is it raised?

Kinetic energy

24. A furious sheep of mass 30kg is running at a scarcely creditable velocity of 20 m/s. What is the kinetic energy of the animal?

25. A sports car of mass 750kg is moving at a speed of 90 m/s. What is the kinetic energy of the vehicle?

26. A small model bus of mass 2 kg has kinetic energy of 64J. What is the velocity of the bus?

27. A reality TV star of mass 80 kg is dropped out of an aeroplane at a height of 2000m. Disregarding terminal velocity, at what speed will they be travelling just before they impact the ground?