3.15 Physics: Forces, Motion and Energy Resources: 1-hour Pack

Total Marks

ISEB CE 13+ Science (Physics) · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A ferry moves at a steady 50 km/h for 4 hours. Calculate the distance it travels in km.

- ☐ A) 12.5 km
- ☐ B) 0.08 km
- ☐ C) 200 km
- ☐ D) 54 km
- ☐ E) 2000 km

---

2 Which of these is the best conductor of heat?

- ☐ A) plastic
- ☐ B) copper
- ☐ C) rubber
- ☐ D) wood
- ☐ E) glass

---

3 A balanced seesaw is pivoted at its centre. One child with weight 350 N sits 2.0 m from the pivot. Another child sits on the opposite side with weight 700 N. At what distance from the pivot must the second child sit?

(1)

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4 A lorry travels 90 km in 2 hours, then a further 135 km in 2 hours, with a rest stop of 30 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 56.25 km/h
- [ ] B) 1012.5 km/h
- [ ] C) 67.5 km/h
- [ ] D) 50 km/h
- [ ] E) 112.5 km/h

---

5 A lamp transfers 100 J of energy and 85 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 8.5%
- [ ] B) 850%
- [ ] C) 15%
- [ ] D) 170%
- [ ] E) 85%

---

6 A drone travels 280 m in 10 s at a steady speed. Calculate its speed in m/s.

- [ ] A) 2.8 m/s
- [ ] B) 2800 m/s
- [ ] C) 290 m/s
- [ ] D) 280 m/s
- [ ] E) 28 m/s

---

7 How does heat travel through a liquid or a gas?

- [ ] A) conduction
- [ ] B) reflection
- [ ] C) convection
- [ ] D) radiation
- [ ] E) evaporation

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8 A runner's distance from the start line is recorded every 60 seconds.
Time (s): 0, 60, 120, 180, 240, 300
Distance (m): 0, 360, 720, 720, 720, 1080
Calculate the runner's speed between 0 s and 120 s.

(1)

---

9 A coach travels 40 km in 1.5 hours, then a further 60 km in 0.5 hours, with a rest stop of 30 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 250 km/h
- [ ] B) 40 km/h
- [ ] C) 120 km/h
- [ ] D) 50 km/h
- [ ] E) 400 km/h

---

10 A kettle transfers 400 J of energy and 340 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 85%
- [ ] B) 850%
- [ ] C) 340%
- [ ] D) 15%
- [ ] E) 8.5%

---

11 A resultant force of 8 N acts on a go-kart of mass 8 kg. Calculate its acceleration in m/s2.

- [ ] A) 64 m/s2
- [ ] B) 10 m/s2
- [ ] C) 0.1 m/s2
- [ ] D) 1 m/s2
- [ ] E) 16 m/s2

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12 A coach travels 37.5 km in 50 minutes at a steady speed. Calculate its speed in km/h.

- ☐ A) 75 km/h
- ☐ B) 45 km/h
- ☐ C) 1875 km/h
- ☐ D) 87.5 km/h
- ☐ E) 0.75 km/h

---

13 A car's distance from a fixed point is recorded every 10 seconds during a journey.
Time (s): 0, 10, 20, 30, 40, 50
Distance (m): 0, 80, 160, 160, 160, 240
Calculate the car's speed between 40 s and 50 s.

(1)

---

14 A minibus travels 27 km in 1 hours, then a further 63 km in 2 hours. Calculate its average speed for the whole journey in km/h.

- ☐ A) 270 km/h
- ☐ B) 29.25 km/h
- ☐ C) 58.5 km/h
- ☐ D) 30 km/h
- ☐ E) 31.5 km/h

---

15 A kettle is 60% efficient and is supplied with 100 J. Calculate the useful energy output in J.

- ☐ A) 60 J
- ☐ B) 6 J
- ☐ C) 6000 J
- ☐ D) 40 J
- ☐ E) 600 J

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16 A resultant force of 75 N acts on a trolley of mass 50 kg. Calculate its acceleration in m/s2.

- [ ] A) 3750 m/s2
- [ ] B) 125 m/s2
- [ ] C) 15 m/s2
- [ ] D) 25 m/s2
- [ ] E) 1.5 m/s2

---

17 A lorry travels 180 km at a steady 60 km/h. Calculate the time taken in hours.

- [ ] A) 0.3 hours
- [ ] B) 3 hours
- [ ] C) 10800 hours
- [ ] D) 30 hours
- [ ] E) 120 hours

---

18 What happens when a north pole is brought near a south pole?

- [ ] A) nothing happens
- [ ] B) they become demagnetised
- [ ] C) they attract
- [ ] D) they repel
- [ ] E) they spin round

---

19 A train travels 126 km in 2 hours, then a further 84 km in 3 hours, with a rest stop of 15 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 1102.5 km/h
- [ ] B) 28 km/h
- [ ] C) 45.5 km/h
- [ ] D) 40 km/h
- [ ] E) 91 km/h

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20 A lamp transfers 100 J of energy and 70 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 70%
- [ ] B) 7%
- [ ] C) 30%
- [ ] D) 140%
- [ ] E) 700%

---

21 A go-kart of mass 50 kg accelerates at 2 m/s2. Calculate the resultant force on it in N.

- [ ] A) 0.04 N
- [ ] B) 25 N
- [ ] C) 52 N
- [ ] D) 1000 N
- [ ] E) 100 N

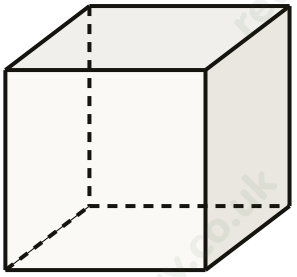
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22 A toy car travels 54 m at a steady 18 m/s. Calculate the time taken in s.

- [ ] A) 3 s
- [ ] B) 30 s
- [ ] C) 36 s
- [ ] D) 0.3 s
- [ ] E) 972 s

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23 A metal cube has sides of length 3 cm and a mass of 121.5 g. The table below shows the density of four metals.
Metal: aluminium - 2.7 g/cm^3; titanium - 4.5 g/cm^3; zinc - 7.1 g/cm^3; iron - 7.9 g/cm^3.



3 cm

Metal	Density (g/cm³)
aluminium	2.7
titanium	4.5
zinc	7.1
iron	7.9

(a) Calculate the volume of the cube. **(2)**

.....

(b) Calculate the density of the metal, giving your answer with the correct unit. Use the equation: density = mass / volume. **(2)**

.....

(c) Using the table, identify which metal the cube is most likely to be made from. **(1)**

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24 How does heat reach the Earth from the Sun?

- [ ] A) conduction
- [ ] B) convection
- [ ] C) dissolving
- [ ] D) evaporation
- [ ] E) radiation

---

25 A swimmer's distance from the diving board is measured every 60 seconds.
Time (s): 0, 60, 120, 180, 240, 300
Distance (m): 0, 480, 960, 960, 960, 1440
Calculate the swimmer's speed between 0 s and 120 s.

(1)

---

26 A engine is supplied with 120 J and wastes 60 J as heat and sound. Calculate its efficiency as a percentage.

- [ ] A) 500%
- [ ] B) 100%
- [ ] C) 60%
- [ ] D) 50%
- [ ] E) 200%

---

27 A van of mass 1000 kg accelerates at 2 m/s2. Calculate the resultant force on it in N.

- [ ] A) 0.002 N
- [ ] B) 2000 N
- [ ] C) 500 N
- [ ] D) 20000 N
- [ ] E) 1002 N

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28 A toy car moves at a steady 16 m/s for 18 s. Calculate the distance it travels in m.

- ☐ A) 2880 m
- ☐ B) 288 m
- ☐ C) 34 m
- ☐ D) 28.8 m
- ☐ E) 1.125 m

---

29 If the resultant force on a moving object is zero, its speed will

- ☐ A) increase
- ☐ B) decrease
- ☐ C) double
- ☐ D) reverse
- ☐ E) stay the same

---

30 The density of sea water is 1025 kg/m^3. A shipping container has a mass of 1800 kg and a volume of 2.0 m^3. Calculate the density of the container, in kg/m^3. Use the equation: density = mass / volume.

(1)

---

31 A lorry travels 81 km in 2.5 hours, then a further 189 km in 1.5 hours, with a rest stop of 30 minutes in between. Calculate its average speed for the whole journey in km/h.

- ☐ A) 79.2 km/h
- ☐ B) 126 km/h
- ☐ C) 60 km/h
- ☐ D) 67.5 km/h
- ☐ E) 158.4 km/h

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32 A turbine transfers 250 J of energy and 175 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 175%
- [ ] B) 700%
- [ ] C) 30%
- [ ] D) 70%
- [ ] E) 7%

---

33 A sledge of mass 100 kg is pushed forwards with a force of 200 N. Friction opposes the motion with a force of 50 N. Calculate its acceleration in m/s2.

- [ ] A) 1.5 m/s2
- [ ] B) 2.5 m/s2
- [ ] C) 15 m/s2
- [ ] D) 15000 m/s2
- [ ] E) 2 m/s2

---

34 A lorry travels 75 km at a steady 50 km/h. Calculate the time taken in hours.

- [ ] A) 1.5 hours
- [ ] B) 3750 hours
- [ ] C) 15 hours
- [ ] D) 0.15 hours
- [ ] E) 25 hours

---

35 What force slows a parachutist down when the parachute opens?

- [ ] A) magnetic force
- [ ] B) friction with the ground
- [ ] C) gravity
- [ ] D) air resistance
- [ ] E) tension

---

36 A cyclist does 8 laps of a 250 m circuit. Calculate the total distance cycled.

(1)

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37 A minibus travels 87 km in 3 hours, then a further 88 km in 1.5 hours, with a rest stop of 30 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 350 km/h
- [ ] B) 3.5 km/h
- [ ] C) 35 km/h
- [ ] D) 875 km/h
- [ ] E) 70 km/h

---

38 A heater is 40% efficient and is supplied with 80 J. Calculate the useful energy output in J.

- [ ] A) 3200 J
- [ ] B) 32 J
- [ ] C) 200 J
- [ ] D) 40 J
- [ ] E) 48 J

---

39 A resultant force of 50 N acts on a crate of mass 100 kg. Calculate its acceleration in m/s2.

- [ ] A) 2 m/s2
- [ ] B) 5000 m/s2
- [ ] C) 5 m/s2
- [ ] D) 150 m/s2
- [ ] E) 0.5 m/s2

---

40 What surrounds a magnet and can attract magnetic materials?

- [ ] A) a gravitational field
- [ ] B) an electric field
- [ ] C) a magnetic field
- [ ] D) a sound field
- [ ] E) a light field

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41 A swimmer's distance is measured every 60 seconds.
Time (s): 0, 60, 120, 180, 240, 300
Distance (m): 0, 480, 960, 960, 960, 1440
Calculate the swimmer's speed between 240 s and 300 s.

(1)

---

42 The density of sea water is 1025 kg/m^3. A ship's cargo container has a mass of 2200 kg and a volume of 2.5 m^3.

(a) Calculate the density of the cargo container, in kg/m^3. Use the equation: density = mass / volume. **(2)**

.....

(b) Convert your answer to part (a) into g/cm^3. (Hint: 1000 kg/m^3 = 1 g/cm^3.) **(1)**

.....

(c) State, with a reason, whether the cargo container will float or sink in sea water. **(2)**

---

43 A kettle transfers 500 J of energy and 250 J of it is useful. Calculate its efficiency as a percentage.

- ☐ A) 250%
- ☐ B) 100%
- ☐ C) 200%
- ☐ D) 50%
- ☐ E) 500%

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44 A trolley of mass 1000 kg is pushed forwards with a force of 1200 N. Friction opposes the motion with a force of 200 N. Calculate its acceleration in m/s2.

- [ ] A) 1.2 m/s2
- [ ] B) 10 m/s2
- [ ] C) 1000000 m/s2
- [ ] D) 1.4 m/s2
- [ ] E) 1 m/s2

---

45 A bus moves at a steady 15 km/h for 24 minutes. Calculate the distance it travels in km.

- [ ] A) 360 km
- [ ] B) 1.6 km
- [ ] C) 6 km
- [ ] D) 39 km
- [ ] E) 0.625 km

---

46 A seesaw has a child of weight 400 N sitting 1.5 m from the pivot. Another child provides the effort on the other side, 2.0 m from the pivot. Calculate the minimum effort force needed to balance the seesaw.

(1)

---

47 A family car travels 90 km in 3 hours, then a further 210 km in 2 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 60 km/h
- [ ] B) 1500 km/h
- [ ] C) 30 km/h
- [ ] D) 67.5 km/h
- [ ] E) 135 km/h

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48 A turbine is 85% efficient and is supplied with 800 J. Calculate the useful energy output in J.

- [ ] A) 120 J
- [ ] B) 680 J
- [ ] C) 68000 J
- [ ] D) 6800 J
- [ ] E) 715 J

---

49 A go-kart of mass 800 kg accelerates at 1.5 m/s2. Calculate the resultant force on it in N.

- [ ] A) 12000 N
- [ ] B) 801.5 N
- [ ] C) 120 N
- [ ] D) 2400 N
- [ ] E) 1200 N

---

50 A toy car moves at a steady 18 m/s for 19 s. Calculate the distance it travels in m.

- [ ] A) 342 m
- [ ] B) 37 m
- [ ] C) 3420 m
- [ ] D) 34.2 m
- [ ] E) 684 m

---

51 Which of these is the best thermal insulator?

- [ ] A) steel
- [ ] B) aluminium
- [ ] C) iron
- [ ] D) copper
- [ ] E) air trapped in fibres

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52 A coach travels 112 km in 2 hours, then a further 168 km in 1.5 hours. Calculate its average speed for the whole journey in km/h.

- ☐ A) 112 km/h
- ☐ B) 56 km/h
- ☐ C) 84 km/h
- ☐ D) 80 km/h
- ☐ E) 980 km/h

---

53 For each situation below, state whether the main force acting is a contact force or a non-contact force.

(a) Two bar magnets pushing apart when their like poles are brought close together, without touching. **(1)**

(b) The runners of a sledge rubbing against the snow as it slides downhill. **(1)**

(c) The gravitational pull that keeps the Moon in orbit around the Earth. **(1)**

(d) A person's hand pushing open a heavy wooden door. **(1)**

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Mark scheme · 3.15 Physics: Forces, Motion and Energy Resources: 1-hour Pack

Question 1

C (200 km) **B1**

Answer: C) 200 km

Question 2

B (copper) **B1**

Answer: B) copper

Question 3

1.0 m (oe) **B1**

Answer: 1.0 m

Question 4

D (50 km/h) **B1**

Answer: D) 50 km/h

Question 5

E (85%) **B1**

Answer: E) 85%

Question 6

E (28 m/s) **B1**

Answer: E) 28 m/s

Question 7

C (convection) **B1**

Answer: C) convection

Question 8

6 m/s (oe) **B1**

Answer: 6 m/s

Question 9

B (40 km/h) **B1**

Answer: B) 40 km/h

Question 10

A (85%) **B1**

Answer: A) 85%

Question 11

D (1 m/s2) **B1**

Answer: D) 1 m/s2

Question 12

B (45 km/h) **B1**

Answer: B) 45 km/h

Question 13

8 m/s (oe) **B1**

Answer: 8 m/s

Question 14

D (30 km/h) **B1**

Answer: D) 30 km/h

Question 15

A (60 J) **B1**

Answer: A) 60 J

Question 16

E (1.5 m/s2) **B1**

Answer: E) 1.5 m/s2

Question 17

B (3 hours) **B1**

Answer: B) 3 hours

Question 18

C (they attract) **B1**

Answer: C) they attract

Question 19

D (40 km/h) **B1**

Answer: D) 40 km/h

Question 20

A (70%) **B1**

Answer: A) 70%

Question 21

E (100 N) **B1**

Answer: E) 100 N

Question 22

A (3 s) **B1**

Answer: A) 3 s

Question 23

(a) 3 x 3 x 3 (or 3^3) **M1**

(a) 27 cm^3, cao **A1**

(a) Answer: 27 cm^3

(b) 121.5 / their (a) **M1**

(b) 4.5 g/cm^3, cao, ft **A1**

(b) Answer: 4.5 g/cm^3

(c) titanium, cao, ft from (b) **B1**

(c) Answer: Titanium

Question 24

E (radiation) **B1**

Answer: E) radiation

Question 25

8 m/s (oe) **B1**

Answer: 8 m/s

Question 26

D (50%) **B1**

Answer: D) 50%

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Question 27

B (2000 N) **B1**

Answer: B) 2000 N

Question 28

B (288 m) **B1**

Answer: B) 288 m

Question 29

E (stay the same) **B1**

Answer: E) stay the same

Question 30

900 kg/m^3 (oe) **B1**

Answer: 900 kg/m^3

Question 31

C (60 km/h) **B1**

Answer: C) 60 km/h

Question 32

D (70%) **B1**

Answer: D) 70%

Question 33

A (1.5 m/s2) **B1**

Answer: A) 1.5 m/s2

Question 34

A (1.5 hours) **B1**

Answer: A) 1.5 hours

Question 35

D (air resistance) **B1**

Answer: D) air resistance

Question 36

2000 m (oe) **B1**

Answer: 2000 m

Question 37

C (35 km/h) **B1**

Answer: C) 35 km/h

Question 38

B (32 J) **B1**

Answer: B) 32 J

Question 39

E (0.5 m/s2) **B1**

Answer: E) 0.5 m/s2

Question 40

C (a magnetic field) **B1**

Answer: C) a magnetic field

Question 41

8 m/s (oe) **B1**

Answer: 8 m/s

Question 42

(a) 2200 / 2.5 **M1**

(a) 880 kg/m^3, cao **A1**

(a) Answer: 880 kg/m^3

(b) 0.88 g/cm^3, ft from (a) **B1**

(b) Answer: 0.88 g/cm^3

(c) float, cao, ft from (a) **B1**

(c) because the density of the cargo container (880 kg/m^3) is less than the density of sea water (1025 kg/m^3), oe **B1**

(c) Answer: Float, because its density (880 kg/m^3) is less than the density of sea water (1025 kg/m^3).

Question 43

D (50%) **B1**

Answer: D) 50%

Question 44

E (1 m/s2) **B1**

Answer: E) 1 m/s2

Question 45

C (6 km) **B1**

Answer: C) 6 km

Question 46

300 N (oe) **B1**

Answer: 300 N

Question 47

A (60 km/h) **B1**

Answer: A) 60 km/h

Question 48

B (680 J) **B1**

Answer: B) 680 J

Question 49

E (1200 N) **B1**

Answer: E) 1200 N

Question 50

A (342 m) **B1**

Answer: A) 342 m

Question 51

E (air trapped in fibres) **B1**

Answer: E) air trapped in fibres

Question 52

D (80 km/h) **B1**

Answer: D) 80 km/h

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Question 53

(a) non-contact (force), cao **B1**

(a) Answer: Non-contact force

(b) contact (force), cao **B1**

(b) Answer: Contact force

(c) non-contact (force), cao **B1**

(c) Answer: Non-contact force

(d) contact (force), cao **B1**

(d) Answer: Contact force

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