Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Description of danger • build-up of charge could create a spark • flammable fuel can easily catch fire • spark could ignite fuel • igniting fuel could cause a fire / explosion of the plane Description of how risk is reduced • The pipe and the airplane are connected by a metal wire • The metal wire is connected to ground/earth • Pipe and airplane at same potential • Metal is a conductor • Electrons can move through metal wire • No charge build-up • No danger of spark • Reduce charge separation by plausible method such as reduce flow rate/ wider pipe / less friction	**(6)** **AO1**

Level	Mark	Descriptor
	0	• No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1) • Presents a description which is not logically ordered and with significant gaps. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1) • Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. (AO1) • Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	**Mark**	**Additional Guidance**	**General additional guidance – the decision within levels** e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance Two statements	Possible candidate responses There could be a fire that could lead to an explosion.
Level 2	3–4	Additional guidance limited explanation **linking** facts about dangers arising from charge OR **linking** facts about how danger is reduced	Possible candidate responses A spark could cause a fire and explosion. OR Build-up of charge prevented by a wire connected to ground
Level 3	5–6	Additional guidance Detailed explanation about danger AND how danger is reduced. (one may be more detailed than the other but both should be present)	Possible candidate responses There could be a spark that could cause a fire in the fuel and explode. AND Wires between the airplane, pipe and ground prevent the build-up of charge.

Q2.

Question Number	Answer	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 6 marks** **dangers**	**(6)**
	• friction as fuel flows through pipe • build-up of (electrostatic) charge • potential difference between nozzle and plane • causes spark • explosion or fire **use of metal wire** • potential is the same on both objects • no electric field • earths excess charge • constant safe discharge • no imbalance of electrons	

Descriptor
• No rewardable material.
• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels Eg - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance Two unlinked statements	Possible candidate responses make a spark/ explosion/fire there is static electricity fuel is flammable metal wires conduct charge(electricity) could get an electric shock
Level 2	3–4	Additional guidance Limited explanation **linking** facts about dangers OR **linking** facts about why using metal wires is safer	Possible candidate responses A spark is produced because there is a build up of static charge (electricity) or build up of static charge prevented(electricity)because the metal wire takes the charge to earth(ground)
Level 3	5–6	Additional guidance Detailed explanation about dangers AND why using metal wires is safer (one may be stronger than the other but both should feature for level 3)	Possible candidate responses Spark is caused by the build up of charge (static electricity) AND the build up is prevented by the metal wire taking the charge to earth (ground)

Q3.

Question Number:	Answer	Additional guidance	Mark
(i)	An explanation linking: sphere A has an electric field (1) sphere B is in it (1)	both spheres have electric fields the electric fields interact/overlap ignore nature of force; e.g. repulsion	**(2)** AO 2 2

Question Number:	Answer	Additional guidance	Mark
(ii)	a description to include: as the distance increases the force (on the sphere B) decreases (1) the greatest change is at smallest distances (1)	 negative correlation non-linear gradient changes allow named non-linear functions such as exponential / inversely proportional in this context reference to inverse square law scores 2 marks	**(2)** AO 3 1a AO 3 1b

Q4.

Question number	Answer	Mark
i	A gained electrons Options B, C and D are incorrect explanations	(1) AO1

Question number	Answer	Additional guidance	Mark
ii	A description to include electrons / negative charges **move** (1) down the wire / to earth (1)		(2) AO1

Question number	Answer	Additional guidance	Mark
iii	A description including one row from: use / description fuelling cars / plane (1) — charge / voltage could build up causing a spark / fire: (avoided by earthing (the pump) (1) (insecticide / paint) sprayers (1) — earthed object gains (induced) charge(s) to attract paint / insecticide (1) kettle / other electrical device (1) — earthing the outside prevents shock (to user) (1)	Other examples are possible in this context also allow to prevent shock	(2) AO1